Dell™ SAS RAID Storage Manager

User's Guide

Notes, Notices, and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

NOTICE: A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

CAUTION: A CAUTION indicates a potential for property damage, personal injury, or death.

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Introduction

Dell® SAS RAID Storage Manager works in conjunction with the appropriate libraries and drivers to enable you to configure, monitor, and maintain storage configurations on Dell PERC 5/i, SAS 5/iR, PERC 6/i, and SAS 6/iR controllers. The Dell SAS RAID Storage Manager graphical user interface (GUI) makes it easy for you to create and manage storage configurations.

NOTE: iR stands for *internal RAID*.

Creating Storage Configurations

Dell SAS RAID Storage Manager enables you to easily configure the controllers, disk drives, and virtual disks on your Dell workstation or SC server. The Configuration Wizard greatly simplifies the process of creating disk groups and virtual disks.

On Dell systems with PERC 5/i, PERC 6/i, SAS 5/iR, or SAS 6/iR Controllers, you can use the Configuration Wizard *Auto Configuration* mode to automatically create the optimal configuration with the available hardware. You can use the *Guided Configuration* mode, which asks you a few brief questions about the configuration, and then creates it for you. Or you can use the *Manual Configuration* mode, which gives you complete control over all aspects of the storage configuration.

For Dell systems with PERC 5/iR , PERC 6/i, SAS 5/iR, or SAS 6/iR Controllers, the Configuration Wizard guides you through several simple steps to create your storage configurations.

Monitoring Storage Devices

Dell SAS RAID Storage Manager displays the status of controllers, virtual disks, and physical disks on your Dell workstation or SC server. System errors and events are recorded in an event log file and are displayed on the screen. Special device icons appear on the screen to notify you of disk failures and other events that require immediate attention.

Maintaining Storage Configurations

On Dell systems with the PERC 5/i, PERC 6/i, SAS 5/iR, or SAS 6/iR controller, you can use Dell SAS RAID Storage Manager to perform system maintenance tasks such as running patrol read operations, updating firmware, and running consistency checks on disk groups that support redundancy.

Comparison of Supported Features

Table 1-1 shows the Dell SAS RAID Storage Manager features that are supported by Dell systems using the PERC 5/i or the PERC 6/i controller, and by systems using the SAS 5/iR or the SAS 6/iR controller.

Table 1-1. Feature Comparison

Feature	PERC 5/i Controller PERC 6/i Controller	SAS 5/iR Controller SAS 6/iR Controller
RAID 0 Configuration	Y	Y
RAID 1 Configuration	Y	Y
RAID 5 Configuration	Y	N
RAID 6 Configuration	N for PERC 5/i Y for PERC 6/i	N
RAID 10 Configuration	Y	N
RAID 50 Configuration	Y	N
RAID 60 Configuration	N for PERC 5/i Y for PERC 6/i	N
Hotspare Disks	Y	N for SAS 5/iR Y for SAS 6/iR
Auto Configuration	Y	N
Guided Configuration	Y	Y
Manual Configuration	Y	N
Event Monitoring	Y	Y
Device Status Monitoring	Y	Y
Physical/Logical Device View	Y	Y

Table 1-1. Feature Comparison

Feature	PERC 5/i Controller PERC 6/i Controller	SAS 5/iR Controller SAS 6/iR Controller
Device Properties Information	Y	Y
Create/Delete Virtual Disk	Y	Y
Run Patrol Read	Y	N
Rebuild Disk Drive	Y	Y
Background Virtual Disk Initialization	Y	N
Remove Drive	Y	Y
Make Drive Online/Offline	Y	N
Run Consistency Check	Y	N
Scan for New Disk Drives	Y	Y
Update Firmware	Y	Y
Save/Add Storage Configuration	Y	Y
Set Adjustable Task Rates	Y	N
Change Virtual Disk Properties	Y	Y

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Installation

Dell SAS RAID Storage Manager is pre-installed on your Dell system. If you need to reinstall Dell SAS RAID Storage Manager for some reason, this section explains how to do this on the supported operating systems: Microsoft® Windows®, Red Hat® Linux, and SUSE Linux.

Installing Dell SAS RAID Storage Manager on Microsoft Windows

Follow these steps if you need to install Dell SAS RAID Storage Manager on a system running Microsoft Windows 2000, Microsoft Windows Server 2003, Microsoft Windows Server 2008, Microsoft Windows XP, or Microsoft Windows Vista:

NOTICE: If you are installing Dell SAS RAID Storage Manager on Windows XP with service pack 1 installed, you will need to obtain a hotfix for the operating system to address an issue with the scsiport module.

1. Insert the CD, which contains Dell SAS RAID Storage Manager, in the CD-ROM drive.

   If necessary, find the `setup.exe` file and double click the file name to start the installation program.

2. When the Welcome screen appears, click **Next**.
3. When the next screen appears, read and accept the user license and click **Next**.

   The Customer Information screen appears.

4. Enter your user name and organization name. In the bottom part of the screen, select an installation option:
   - If you select **All users**, any user with administrative privileges can use this version of Dell SAS RAID Storage Manager to view or change storage configurations.
   - If you select **Only for current users (Administrator)**, the Dell SAS RAID Storage Manager shortcuts and associated icons will be available only to the user with this username.

5 Click **Next** to continue.

6 On the next screen, accept the default Destination Folder, or click **Change** to select a different destination folder. Click **Next** to continue.

7 On the next screen, click **Install** to begin the installation. The InstallShield Wizard then installs the Dell SAS RAID Storage Manager. This can take several minutes.

8 Click **Finish** to complete the installation process.

Installing Dell SAS RAID Storage Manager on Linux

Follow these steps if you need to install Dell SAS RAID Storage Manager on a system running Red Hat Linux or SUSE Linux:

1 Copy the `SSM_linux_installer...tar.gz` file to a temporary folder.

2 Untar the `SSM_linux_installer...tar.gz` file using the following command:

```
tar -zxvf SSM_linux_installer...tar.gz
```

A new `disk` directory is created.

3 Go to the new `disk` directory.

4 In the `disk` directory, find and read the `readme.txt` file.

5 To start the installation, enter the following command:

```
./install.sh
```

NOTE: If you upgrade Dell SAS RAID Storage Manager, the event logs are not cleared as part of the upgrade process. Events in the event log prior to the upgrade will still appear in the log.

NOTE: You should download the latest device drivers for the RAID controllers from support.dell.com.

Linux Installation Error Messages

The following messages might appear while you are installing Dell SAS RAID Storage Manager on a Linux system:

- **More than one copy of MegaRAID Storage Manager has been installed.**
  This message indicates that you have installed more than one copy of Dell SAS RAID Storage Manager. (This can be done by using the `rpm-force` command to install the rpm file directly, which is not recommended, instead of using the `install.sh` file.) In such cases, you must uninstall all the rpms manually before installing Dell SAS RAID Storage Manager with the procedure listed above.
- **The version is already installed.**
  This message indicates that the version of Dell SAS RAID Storage Manager you are trying to install is already installed on the system.
- **The installed version is newer.**
  This message indicates that a version of Dell SAS RAID Storage Manager is already installed on the system, and it is a newer version than the version you are trying to install.
- **Exiting installation.**
  This is the message that appears when the installation is complete.
- **RPM Installation Failed**
  This message indicates that the installation failed for some reason. Additional message text explains the cause of the failure.

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Dell SAS RAID Storage Manager Windows and Menus

This chapter explains how to start Dell SAS RAID Storage Manager and describes the Dell SAS RAID Storage Manager window and menus.

Starting Dell SAS RAID Storage Manager

Follow these steps to start Dell SAS RAID Storage Manager and view the main window:

1. Start the program using the method required for your operating system environment:
   - To start Dell SAS RAID Storage Manager on a Microsoft Windows system, select **Applications-> Programs-> Dell SAS RAID Storage Manager-> StartupUI**.

     NOTE: If a warning appears stating that Windows Firewall has blocked some features of the program, click **Unblock** to allow Dell SAS RAID Storage Manager to start. (The Windows Firewall sometimes blocks the operation of programs like Dell SAS RAID Storage Manager that use Java.)
   - To start Dell SAS RAID Storage Manager on a Red Hat Linux system, select **Applications-> System Tools-> Dell SAS RAID Storage Manager-> StartupUI**.
   - To start Dell SAS RAID Storage Manager on a SUSE SLES 9 system, select **Start->System-> More Programs-> Dell SAS RAID Storage Manager-> StartupUI**.
   - To start Dell SAS RAID Storage Manager on a SUSE SLES 10 system, select **Computer-> New Application-> Dell SAS RAID Storage Manager-> StartupUI**.
2. When the Enter UserName & Password window appears, select an access mode from the drop-down menu.
   - Select **Full Access** if you need to both view the current configuration and change the configuration.
   - Select **View Only** if you only need to view and monitor the configuration.

3 Enter your user name and password and click **Login**.

NOTE: If the computer is networked, this is not the network login but the login to the computer itself. This is the local administrator/root password, not a network logon password.

You must enter the root/administrator username and password in order to use Full Access mode. If your user name and password are correct for the login mode you have chosen, the main Dell SAS RAID Storage Manager window appears.

Dell SAS RAID Storage Manager Window

This section describes the Dell SAS RAID Storage Manager window, which appears when you start Dell SAS RAID Storage Manager.

The following topics describe the panels and menu options that appear in this window:

Physical/Logical View Panel

The left panel of the Dell SAS RAID Storage Manager window displays either the *Physical view* or the *Logical view* of the system and the devices in it, depending on which tab is selected.

- The *Physical view* shows the hierarchy of physical devices in the system. At the top of the hierarchy is the system itself. One or more controllers are installed in the system. Each controller has one or more ports. Disk drives and other devices are attached to the ports.
- The *Logical view* shows the hierarchy of controllers, virtual disks, and disk groups that are defined on the system. (Physical drives also appear in the Logical view, so you can see which physical drives are used by each virtual disk.)

The following icons in the left panel represent the controllers, disk drives, and other devices:

- System (such as server) 
- Controller 
- Port 

- Disk group (array) 

- Virtual disk 
- Physical drive: SAS  and SATA 
- Hot spare 
- Enclosure 

A red circle to the right of an icon indicates that the device has failed. For example, this icon indicates that a disk drive has failed or gone offline: 

A yellow circle to the right of an icon indicates that a device is running in a degraded state. For example, this icon indicates that a virtual disk is running in a degraded state because a disk drive has failed: 

Properties/Operations/Graphical View Panel

The right panel of the Dell SAS RAID Storage Manager window has from one to three tabs, depending on the kind of device selected in the left panel.

The *Properties* tab displays information about the selected device. For example, if a controller icon is selected in the left panel the Properties tab lists information such as the controller name, NVRAM size, and device port count. If a server is selected, the host name, operating system (OS), operating system architecture, IP address, and OS version displays. For more information, see Monitoring Controllers, Monitoring Disk Drives, and Monitoring Virtual Disks.

- The *Operations* tab lists the operations that can be performed on the device that is selected in the left panel. For example, the virtual disk operations include *Locate Virtual Disk* and *Stop Locating Virtual Disk*. Some types of devices, such as disk groups, servers, and ports, do not have operations associated with them. For more information, see Maintaining and Managing Storage Configurations.
- The *Graphical* tab can be selected in the right panel if a physical drive or a virtual disk is selected in the left panel. In Graphical View, the device's storage capacity is color coded according to the legend shown on the screen. For example, on a physical drive configured space is blue, available space is white, reserved space is red, and space for the selected virtual disk is green. There is a menu on this panel where you can select a virtual disk for which to display the virtual disk space. For more information, see Monitoring Disk Drives and Monitoring Virtual Disks.

Event Log Panel

The lower part of the Dell SAS RAID Storage Manager window displays the system event log entries. New event log entries appear during the session. Each entry has an Error Level indicating the severity of the event, a timestamp and date, and a brief description of the event. For more information about the Event Log, see Monitoring System Events.

NOTE: For some events on Dell systems with a SAS 5/iR controller or a SAS 6/iR controller, the time stamp will be reported as #### because the reported time stamp is not valid.

For more information about the event log entries, see Events and Messages.

Menu Bar

Here are brief descriptions of the main selections on the Dell SAS RAID Storage Manager menu bar:

File Menu

The File menu has an Exit option for exiting from Dell SAS RAID Storage Manager. It also has a Rescan option for updating the display in the Dell SAS RAID Storage Manager window. (Rescan is seldom required; the display normally updates automatically.)

Operations Menu

The Operations menu is available when a controller, physical drive, or virtual disk is selected in the Dell SAS RAID Storage Manager window. The Operations menu options vary depending on the type of device selected in the left panel of the Dell SAS RAID Storage Manager window. For example, the **Scan for Foreign Config** option is available only when a controller is selected. The options also vary depending on the current state of the selected device. For example, if you select an offline physical drive, the **Make Drive Online** option appears in the Operations menu.

You can also view the Operations selections on the main window on the Operations tab in the right panel. If an operation requires user inputs before it can be executed, it appears in the Operations tab but not in the Operations menu. A device-specific Operations menu pops up if you right-click a device icon in the left panel.

Group Operations Menu

The Group Operations menu options include Check Consistency, Show Progress, and Initialize (on Dell PERC 5/i controllers and Dell PERC 6/i controllers only).

Log Menu

The Log menu includes options for saving and clearing the message log. For more information, see Monitoring System Events.

Help Menu

On the Help menu you can select **Help-> Help** to view the Dell SAS RAID Storage Manager online Help file. You can select **Help-> About** to view version information for the Dell SAS RAID Storage Manager.

NOTE: When you use the Dell SAS RAID Storage Manager online Help, you might see a warning message that Internet Explorer has restricted the file from showing active content. If this warning appears, click on the active content warning bar and enable the active content.

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Configuration

You use Dell SAS RAID Storage Manager to create storage configurations on Dell systems with PERC 5/i, SAS 5/iR, PERC 6/i , and SAS 6/iR controllers. The controllers support storage configurations for the following RAID levels:

- Dell SAS 5/iR controller: RAID 0 and RAID 1
- Dell SAS 6/iR controller: RAID 0 and RAID 1
- Dell PERC 5/i controller: RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50
- Dell PERC 6/i controller: RAID 0, RAID 1, RAID 5, RAID 6, RAID 10, RAID 50, and RAID 60

To learn more about RAID and RAID levels, see the Glossary.

Creating a New Configuration on a SAS 5/iR Controller or on a SAS 6/iR Controller

You can use the Dell SAS RAID Storage Manager Configuration Wizard to create new configurations on Dell systems with the SAS 5/iR controller or the the SAS 6/iR controller.

To start the Dell SAS RAID Storage Manager Configuration Wizard, select a Dell SAS 5/iR or a Dell SAS 6/iR controller in the left panel of the Dell SAS RAID Storage Manager window and then select **Operations-> Configuration-> Configuration Wizard**. The following subsections explain how to create a RAID 0 or a RAID 1 configuration on a Dell system with a SAS 5/iR controller or a SAS 6/iR controller.

NOTICE: You cannot use physical drives with bootable partitions to create a virtual drive on a SAS 5/iR controller or on a SAS 6/iR controller. This prevents you from accidentally using a drive containing an operating system as part of a virtual drive, and thereby destroying the operating system. If one or more drives have a bootable partition, they will not appear on the list of drives that are available to create a new virtual drive. If no drives are available, a warning message will be displayed.

Creating a RAID 0 Configuration on a SAS 5/iR Controller or on a SAS 6/iR Controller

Follow these steps to create a RAID 0 configuration on a Dell system with a SAS 5/iR controller or with a SAS 6/iR controller:

1. Select a Dell SAS 5/iR or a Dell SAS 6/iR controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.
2. In the Configuration Wizard, select two or more available drives in the left panel. Click the right-arrow **Add** button to move the selected drives to the right panel.

   NOTICE: Be sure you do not select the disk drive on which the operating system is installed.
3. Click **Accept** to accept these drives for the new RAID 0 disk group.

   NOTE: To remove a single drive from a proposed disk group, select the drive icon in the right panel of the Dell SAS RAID Storage Manager window and click the left-arrow button.
4. Click **Next**. The next Configuration Wizard window appears.
5. Select the disk group to use for the new virtual disk.
6. In the right panel, select RAID 0 as the RAID level.
7. Click **Accept** to accept the configuration of the new virtual disk.

   NOTE: Click the **Reclaim** button if you want to undo a virtual disk that you just defined. (For more information, see the Glossary entry for *reclaim virtual disk*.)
8. Select an available disk for another virtual disk and define its properties, or click **Next** to go to the next configuration step. (You can define up to two virtual disks.) The virtual disk summary window appears.
9. Review the configuration shown in the window. If you want to change something, click **Back** and change the configuration parameters.
10. Click **Finish** to accept the configuration and start the initialization process.

Creating a RAID 1 Configuration on a SAS 5/iR Controller or on a SAS 6/iR Controller

Follow these steps to create a RAID 1 configuration on a Dell system with a SAS 5/iR controller or a SAS 6/iR controller:

1. Select a Dell SAS 5/iR or a Dell SAS 6/iR controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.
2. In the Configuration Wizard, select two available drives in the left panel. Click the right-arrow **Add** button to move the selected drives to the right panel.

   NOTICE: Be sure you do not select the disk drive on which the operating system is installed.
3. Click **Accept** to accept these drives for the new RAID 1 disk group.

   NOTE: You can add hotspare disks to a configuration on a SAS 6/iR controller. For information about adding hotspares, see Adding Hotspare Disks.
4. Click **Next**. The next Configuration Wizard window appears.
5. Select the disk group to use for the new virtual disk.
6. In the right panel of the Dell SAS RAID Storage Manager window, select RAID 1 as the RAID level.
7. Click **Accept** to accept the configuration of the new virtual disk, which appears in the window.

   NOTE: Click the **Reclaim** button if you want to undo a virtual disk that you just defined. (For more information, see the Glossary entry for *reclaim virtual disk*.)
8. Select an available disk for another virtual disk and define its properties, or click **Next** to go to the next configuration step. (You can define up to two virtual disks.) The virtual disk summary window appears.
9. Review the configuration shown in the window. If you want to change something, click **Back** and change the configuration parameters.
10. Click **Finish** to accept the configuration and start the initialization process.

Creating a New Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller

You can use the Dell SAS RAID Storage Manager Configuration Wizard to create new storage configurations on Dell systems with the PERC 5/i controller or with the PERC 6/i controller.

To open the Dell SAS RAID Storage Manager Configuration Wizard, select a PERC 5/i controller or a PERC 6/i controller in the left panel of the Dell SAS RAID Storage Manager screen and then select **Operations-> Configuration-> Configuration Wizard**. The first Configuration Wizard window is a menu with three configuration modes:

- **Auto Configuration** automatically creates an optimal configuration from the available disk drives.
- **Guided Configuration** asks you a few simple questions about what kind of configuration you want and then automatically creates it from the available disk drives.
- **Manual Configuration** gives you the greatest level of control in creating a new virtual disk.

NOTE: You can use Auto Configuration, Guided Configuration, or Manual Configuration to create a RAID 0, RAID 1, RAID 5, or RAID 6 configuration. To create a RAID 10 configuration, you must use the Manual Configuration mode.

The following subsections explain how to create storage configurations on a Dell system with a PERC 5/i controller or a PERC 6/i controller:

- Understanding Virtual Disk Parameters
- Using Auto Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller
- Using Guided Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller
- Using Manual Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller (RAID 0, 1, 5, and 6)
- Using Manual Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller (RAID 10)

Understanding Virtual Disk Parameters

This section describes the Virtual Disk Parameters that you can set when you use the Guided Configuration or Manual Configuration modes of the Configuration Wizard. You do not necessarily need to change these parameters when you create a storage configuration; you can leave them at their default settings.

- **Stripe Size:**
  A stripe is a segment of data spread across multiple physical disks. Data segments with stripe sizes of 8, 16, 32, 64, and 128 Kbytes are supported. The default is 64 KB. For more information, see the Glossary entry for *striping*.
- **Read Policy:**
  Always Read Ahead: Read-ahead capability allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data will be needed soon. This speeds up reads for sequential data, but there is little improvement when accessing random data.
  No Read Ahead: Disables the read-ahead capability.
  Adaptive Read Ahead: When selected, the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If the read requests are random, the controller reverts to *No Read Ahead*.
- **Write Policy:**
  Write back: In this mode the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. This setting is recommended in standard mode.
  Write through: In this mode the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction.

  NOTE: If you select Write back, you need to clear the check box "Use Write through for failed or missing battery?". Otherwise, Write through is used because no battery is present.

  CAUTION: Using Write Back can result in data loss if a power failure occurs since the data is not stored in battery backed cache.
- **IO Policy:** The IO Policy applies to reads on a specific virtual disk. It does not affect the Read-ahead cache.
  Cached IO: In this mode, all reads are buffered in cache memory.

Direct IO: In this mode, reads are not buffered in cache memory. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory.

- **Access Policy:** Select the type of data access that is allowed for this logical drive: *Read/Write*, *Read Only*, or *Blocked*.
- **Disk Cache Policy:** Select a disk cache setting for this disk: *Unchanged*, *Enabled*, or *Disabled*.

  NOTE: The disk cache setting applies to the whole disk group; it cannot be set on an individual virtual disk. Changing the setting on a virtual disk causes the setting to change for the disk group.

- **Init State:**
  No Initialization: The new configuration is not initialized and the existing data on the disks is not overwritten.
  Fast Initialization: Dell SAS RAID Storage Manager quickly writes zeroes to the first and last 10 Mbyte regions of the new virtual disk and then completes the initialization in the background. This allows you to start writing data to the virtual disk immediately.
  Full Initialization: A complete initialization is done on the new configuration. You cannot write data to the new virtual disk until the initialization is complete. This can take a long time if the disks are large.

  NOTICE: If you initialize a drive on which the operating system is installed, you will overwrite the Operating System and potentially make the system non-functional.

Using Auto Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller

Auto Configuration is the quickest and simplest way to create a new storage configuration on a Dell PERC 5/i controller or on a Dell PERC 6/i controller. When you select Auto Configuration mode on the first Configuration Wizard window, the Configuration wizard creates the best configuration possible using the available physical disks.

Follow these steps to create a new storage configuration in Auto Configuration mode:

1. Select a PERC SAS 5/i or a PERC SAS 6/i controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.

2 Select **Auto Configuration** and click **Next**. The Auto Configuration window appears.

3 On the next screen, select a redundancy option from the drop-down menu at the bottom of the Auto Configuration window:

- **No Redundancy**: The new configuration will have no data redundancy (RAID 0). If a physical disk in the configuration fails, all data will be lost.
- **With Redundancy**: The new configuration will have data redundancy, either by parity data (RAID 5 or RAID 6) or mirrored data (RAID 1). If a physical disk fails, its data is still protected.

NOTE: The PERC 5/i controller supports RAID 0, 1, 5, 10, and 50, but it does not support RAID 6 or 60. The PERC 6/i controller supports RAID 0, 1, 5, 6, 10, 50, and 60.

4 Select an Initialization option from the drop-down menu at the bottom of the window:

- **No Initialization**: The new configuration is not initialized and the existing data on the disks is not overwritten.
- **Fast Initialization**: Dell SAS RAID Storage Manager quickly writes zeroes to the first and last 10 Mbyte regions of the new virtual disk and then completes the initialization in the background. This allows you to start writing data to the virtual disk immediately.
- **Full Initialization**: A complete initialization is done on the new configuration. You cannot write data to the new virtual disk until the initialization is complete. This can take a long time if the disks are large.

5 Click **Modify** if you want to make changes to the Auto Configuration. For example, you could change the size of a virtual disk. To modify the configuration, perform the following steps:

a Select a virtual disk in the New Virtual Disks panel. The Reclaim button becomes available.

b Click **Reclaim**. A warning states that this will delete the newly created virtual disk.

c Click **Yes** to accept. The array displays in the top left panel under the heading Arrays.

d If desired, reclaim the second virtual disk.

e Click the checkbox next to one or two new arrays. The Virtual Disk Properties for the selected array(s) display in the right panel.

f Select one array to create a non-spanned virtual disk (RAID 0, 1, 5, or 6), or select both arrays to create a spanned virtual disk (RAID 50 and 60).

NOTE: The PERC 5/i controller does not support RAID 6 or RAID 60.

g Click **Accept** in the right panel. The new virtual disk displays.

h Click **Next**.

6 Click **Finish**. The new storage configuration will be created and initialized (unless you selected **No Initialization**). Check the configuration you just created to make sure it is acceptable.

Using Guided Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller

Guided Configuration provides an easy way to create a new storage configuration. Based on the information that is provided, the Configuration Wizard uses the available disk drives to create an optimal storage configuration.

Follow these steps to create a new storage configuration in Guided Configuration mode on a Dell PERC 5/i controller or on a Dell PERC 6/i controller:

1 Select a PERC SAS 5/i or a PERC SAS 6/i controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.

2 Select **Guided Configuration** and click **Next**. The Guided Configuration window appears.

3 Select a redundancy option at the top of the Guided Configuration window:

- **Redundancy Only**: Create a configuration only if redundancy (RAID 1, RAID 5, or RAID 6) is possible. RAID 6 is available for the PERC 6/i controller, but not for the PERC 5/i controller.
- **Redundancy when possible**: Create a redundant configuration if possible. Otherwise, create a non-redundant configuration.
- **No Redundancy**: Create a non-redundant configuration.

4 Choose whether you want to use existing disk groups (arrays) in the new virtual disk. The options are:

- **Use Existing Arrays Only**
- **Don't Use Existing Arrays**
- **Use Existing and New Arrays**

The first and third options are disabled if there are no available existing disk groups (arrays).

5 Select the maximum number of virtual disks you want to create. The maximum number of virtual disks supported is 64.

The Configuration Wizard might not be able to create as many virtual disks as you want, depending on the current configuration and the number of virtual disks that have already been created.

6 Click **Next** to continue to the next window.

7 Change the default virtual disk parameters in this window, if needed.

In the right panel, you can specify the number of virtual disks to create. You can also choose to use less than the full capacity of this array for the virtual disk(s). (You could do this in order to leave capacity available for other virtual disks that you create later.) In the lower right panel, you can change the virtual disk parameters, such as the stripe size, read policy, and write policy. To learn about the Stripe Size and other virtual disk parameters, see Understanding Virtual Disk Parameters.

8 Click **Next** to continue to the next window.

9 Check the configuration that you have just defined. If it is acceptable, click **Finish**. If you want to change a setting for all of the virtual disks, click **Back** to return to the previous windows. If you want to change a setting for specific virtual disks, perform the following steps:

a Select a virtual disk in the New Virtual Disks panel. The Reclaim button becomes available.

b Click **Reclaim**. A warning states that this will delete the newly created virtual disk.

c Click **Yes** to accept. The array displays in the top left panel under the heading Arrays.

d If desired, reclaim the second virtual disk.

e Click the checkbox next to one or two new arrays. The Virtual Disk Properties for the selected array(s) display in the right panel.

f Select one array to create a non-spanned virtual disk (RAID 0, 1, 5, or 6), or select both arrays to create a spanned virtual disk (RAID 50 and 60).

NOTE: PERC 5/i does not support RAID 6 or RAID 60.

g Click **Accept** in the right panel. The new virtual disk displays.

h Click **Next**.

i Click **Finish**. The new storage configuration will be created and initialized (unless you selected **No Initialization**). Check the configuration you just created to make sure it is acceptable.

Using Manual Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller (RAID 0, 1, 5, and 6)

NOTE: PERC 5/i does not support RAID 6.

Follow these steps to create a RAID 0, 1, 5, or 6 storage configuration using the Manual Configuration mode of the Configuration Wizard:

1 Select a PERC SAS 5/i or a PERC SAS 6/i controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.

2 Select **Manual Configuration** and click **Next**. The Manual Configuration window appears.

3 In the first Manual Configuration window, select two or more available drives in the left panel for a RAID 0 or 1 configuration, or select three or more available drives for a RAID 5 or 6 configuration.

NOTE: For RAID 1, you must select an even number of drives.

You can select drives three ways:

- Click on an individual drive.
- Select consecutive drives by holding down <Shift>, and then clicking on the first drive and the last drive you want to include.
- Select non-consecutive drives by holding <Ctrl> and clicking multiple non-consecutive drives.

4 Click the right-arrow **Add** button to move the selected drives to the right panel.

NOTICE: Be sure you do not select the disk drive on which the operating system is installed.

NOTE: To remove a drive from a proposed new disk group, select the drive icon in the right panel and click the left-arrow **Remove** button.

5 Click **Accept** to accept these drives for the new RAID disk group.

6 To add a hotspare to an array, select an available drive in the left panel, and then select the array from the drop-down menu, and click **Add HotSpare To**.

NOTE: Hot spares are not available for RAID 0.

7 Click **Next**. The next Configuration Wizard window appears.

The *Arrays* box lists the new disk group (array) that you just defined, plus any existing disk groups with holes (free space) that you can use for a new configuration.

8 In the *Arrays* box, click the checkbox to select the disk group to use for the new virtual disk.

9 In the right panel under Virtual Disk Properties, select the desired RAID level.

10 (Optional) Set *Size (in MB)* to a lower number if you do not want to use the entire available capacity for the new virtual disk.

11 (Optional) Change the other Virtual Disk Properties, if desired. For more information, see Understanding Virtual Disk Parameters.

NOTE: You cannot change the default Volume Name if Dell SAS RAID Storage Manager is running in a language that uses the Double Byte Character Set. The default Volume Name must be kept.

12 Click **Accept** to accept the configuration of the new virtual disk. The RAID 0 virtual disk appears in the left panel under New Virtual Disk.

NOTE: If you want to undo a virtual disk that you just defined, click on the virtual disk option, and then click the **Reclaim** button . (For more information, see the Glossary entry for *reclaim virtual disk*.) The array will display under *Arrays*. You can then start at step 7 to create a new virtual disk.

13 Click **Next** to go to the next configuration step. The Virtual Disk Summary window appears.

14 Check the configuration that you have just defined. If it is acceptable, click **Finish** and start the initialization process (unless you selected **No Initialization** earlier). If you want to change a setting for all of the virtual disks, click **Back** to return to the previous windows. If you want to change a setting for specific virtual disks, perform the following steps:

a Select a virtual disk in the New Virtual Disks panel. The Reclaim button becomes available.

b Click **Reclaim**. A warning states that this will delete the newly created virtual disk.

c Click **Yes** to accept. The array displays in the top left panel under the heading Arrays.

d If desired, reclaim the second virtual disk.

e Click the checkbox next to one or two new arrays. The Virtual Disk Properties for the selected array(s) display in the right panel.

f Change the properties for the virtual disk(s), as desired.

g Click **Accept** to accept the configuration of the new virtual disk.

h Check the configuration that you have just defined. If it is acceptable, click **Finish**. The new storage configuration will be created and initialized (unless you selected **No Initialization**).

Using Manual Configuration on a Dell PERC 5/i Controller or on a Dell PERC 6/i Controller (RAID 10)

Follow these steps to create a RAID 10 storage configuration using the Manual Configuration mode of the Configuration Wizard:

1 Select a PERC 5/i or a PERC 6/i controller in the left panel of the Dell SAS RAID Storage Manager window, and then select **Operations-> Configuration-> Configuration Wizard**.

2 Select **Manual Configuration** and click **Next**. The Manual Configuration window appears.In the first Manual Configuration window, select three or more available drives in the left panel. Click the right-arrow **Add** button to move the selected drives to the right panel.

NOTICE: Be sure you do not select the disk drive on which the operating system is installed.

3 In the first Manual Configuration window, select two available drives in the left panel. Click the right-arrow **Add** button to move the selected drives to the right panel to be part of a new array.

4 Click **Accept** to accept these drives for a new RAID 1 disk group.

5 Select two more drives for a second RAID 1 disk group, click **Add**, and click **Accept**.

6 Click **Next**. The Configuration Wizard window for virtual disks appears.

The *Arrays* box lists the new disk groups that you just defined, plus any existing disk groups with holes (free space) that could be used for a new configuration.

7 In the left panel, select the two RAID 1 disk groups in the Arrays box.

8 In the right panel, select RAID 10 as the RAID level.

9 (Optional) Change the other Virtual Disk Properties, if necessary. For more information, see Understanding Virtual Disk Parameters.

NOTE: You cannot change the default Volume Name if Dell SAS RAID Storage Manager is running in a language that uses the Double Byte Character Set. The default Volume Name must be kept.

10 Click **Accept** to accept the configuration of the new virtual disk. The virtual disk appears in the left panel under New Virtual Disk.

NOTE: If you want to undo a virtual disk that you just defined, click on the virtual disk, and then click the **Reclaim** button . (For more information, see the Glossary entry for *reclaim virtual disk*.) The array will display under *Arrays*. You can then start at step 7 to create a new virtual disk.

11 Click **Next** to go to the next configuration step. The Virtual Disk Summary window appears.

12 Check the configuration that you have just defined. If it is acceptable, click **Finish** and start the initialization process (unless you selected **No Initialization** earlier). If you want to change a setting for all of the virtual disks, click **Back** to return to the previous windows. If you want to change a setting for specific virtual disks, perform the following steps:

a Select a virtual disk in the New Virtual Disks panel. The Reclaim button becomes available.

b Click **Reclaim**. A warning states that this will delete the newly created virtual disk.

c Click **Yes** to accept. The array displays in the top left panel under the heading Arrays.

d If desired, reclaim the second virtual disk.

e Click the checkbox next to one or two new arrays. The Virtual Disk Properties for the selected array(s) display in the right panel.

f Change the properties for the virtual disk(s), as desired.

g Click **Accept** to accept the configuration of the new virtual disk.

h Click **Next** to go to the next configuration step. The Virtual Disk Summary window appears.

i Check the configuration that you have just defined. If it is acceptable, click **Finish** and start the initialization process (unless you selected **No Initialization** earlier).

Adding Hotspare Disks

Hotspare disks are supported by the Dell PERC 5/i, PERC 6/i, and SAS 6/iR controllers. Hotspares are disk drives that are available to automatically replace failed drives in a RAID 1, RAID 5, or RAID 6 virtual disk. *Dedicated hotspares* are available to only one virtual disk. *Global hotspares* are available to any virtual disk on a specific controller.

NOTE: The SAS 6/iR controller supports global hotspares only.

To add a global hotspare disk, follow these steps:

1 Select the **Physical View** tab in the left panel of the Dell SAS RAID Storage Manager screen, and select the icon of an unused disk drive.

2 Select the **Operations** tab in the right panel of the Dell SAS RAID Storage Manager screen.

3 Select **Make Global Hotspare**.

You can create dedicated hot spares when you create a new configuration with the Configuration Wizard. To add dedicated hotspares after running the Configuration Wizard, follow these steps:

1 Select the **Physical View** tab in the left panel of the Dell SAS RAID Storage Manager window and select the icon of an unused disk drive.

2 In the right panel of the Dell SAS RAID Storage Manager window, select the **Operations** tab and select **Make Dedicated Hotspare**.

3 In the right panel of the Operations tab, select the disk group (array) to which the hotspare will be dedicated.

4 Click **Go** to create the dedicated hotspare.

Using the Replace Member Feature and Revertible Hot Spares

The Replace Member functionality allows a previously commissioned hot spare to be reverted back to a usable hot spare. When a drive failure occurs within a virtual disk, an assigned hot spare (dedicated or global) is commissioned and begins rebuilding until the virtual disk is optimal. Once the failed drive is replaced (in the same slot) and the rebuild to the hot spare is complete, the controller automatically starts to copy data from the commissioned hot spare to the newly-inserted drive. Once this is complete, the new drive is part of the virtual disk and the hot spare is reverted back to being a ready hot spare; this allows hot spares to remain in specific enclosure slots. While the controller is reverting the hot spare, the virtual disk remains optimal.

NOTE: The controller automatically reverts a hot spare only if the failed drive is replaced with a new drive in the same slot. If the new drive is not placed in the same slot, a manual replace member operation can be used to revert a previously commissioned hot spare.

The Replace Member function works with another fault tolerance feature, load balancing, to avoid downtime and keep data available to users. Load balancing is a method of spreading work between two or more computers, network links, CPUs, physical disk drives, or other resources. Load balancing is used to maximize resource use, throughput, or response time. In the controllers, the balancing service is performed by the firmware. Using multiple paths with load balancing, instead of a single path, can increase availability through redundancy. If there are redundant paths to different ports of a device, then access to a device is not lost if a path fails.

Automatic Replace Member with Predicted Failure

A Replace Member operation can occur when there is a SMART predictive failure reporting on a drive in a virtual disk. The automatic Replace Member is initiated when the first SMART error occurs on a physical disk that is part of a virtual disk. The target drive needs to be a hot spare that qualifies as a rebuild drive. The physical disk with the SMART error is marked as "failed" only after the successful completion of the Replace Member. This avoids putting the array in degraded status.

If an automatic Replace Member occurs using a source drive that was originally a hot spare (that was used in a rebuild), and a new drive added for the Replace Member operation as the target drive, the hot spare reverts to the hot spare state after a successful Replace Member operation.

Manual Replace Member Operation

In addition to the automatic Replace Member operation, you can perform a manual Replace Member operation. Perform the following steps to carry out a manual Replace Member operation:

1. Select a physical disk in the left panel of the main menu screen.
2. Click the **Operations** tab in the right panel.

   The utility identifies the drives you can use to replace existing drives in the virtual disk.
3. Click **Go** to carry out the Replace Member operation.

   After the controller copies data from the commissioned hot spare to the newly-inserted drive, the new drive is part of the virtual disk and the hot spare reverts back to being a ready hot spare.

Restrictions and Limitations

The following restrictions and limitations apply to the Replace Member operation:

- The Replace Member functions are restricted to one per array for RAID 0, RAID 1, and RAID 5, and two per array for RAID 6.
- The Replace Member function and rebuild cannot run simultaneously on a RAID 6 virtual disk. The rebuild operation has a higher priority, and the Replace Member operation will be aborted if a rebuild begins.

Changing Adjustable Task Rates

You can change adjustable task rates for the Dell PERC 5/i controller and the Dell PERC 6/i controller. Follow these steps if you need to change the adjustable rates for rebuilds, patrol reads, and other system tasks that run in the background:

NOTE: Dell recommends that you leave the adjustable task rates at their default settings, in order to achieve the best system performance. If you raise the task rates above the defaults, foreground tasks will run more slowly and it might seem that the system is not responding. If you lower the task rates below the defaults, rebuilds and other background tasks might run very slowly and might not complete within a reasonable time. If you decide to change the values, record the original default value here so you can restore them later, if necessary:

Rebuild Rate: _____
Patrol Rate: _____
Background Initialization Rate: _____
Check Consistency Rate: _____
Reconstruction Rate: _____

1. Select the **Physical View** tab in the left panel of the Dell SAS RAID Storage Manager window and select a controller icon.
2. In the right panel of the Dell SAS RAID Storage Manager window, select the **Operations** tab and select **Set Adjustable Task Rates**.

   The default task rates appear in the right panel.
3. Enter changes, as needed, to the task rates for Rebuild Rate, Patrol Rate (for patrol reads), Background Initialization (BGI) Rate (for fast initialization), Check Consistency Rate (for consistency checks), and Reconstruction Rate. Each task rate can be set from 0 to 100. The higher the number, the faster the activity will run in the background, possibly impacting other system tasks.

   NOTE: Patrol read does not report on its progress while it is running. The patrol read status is reported in the Event Log only.
4. Click **Go** to accept the new task rates.
5. When the warning message appears, click **OK** to confirm that you want to change the task rates.

Changing Virtual Disk Properties

NOTICE: For the SAS 5/iR controller, you can enable/disable Self-Monitoring and Reporting Technology (SMART) and Write Cache Enable on physical disks are not part of a virtual disk. For the SAS 6/iR controller, support is provided for Write Cache Enable on physical disks that are not part of a virtual disk. The parameters are different from those set for the virtual disk.

You can change the Read Policy, Write Policy, and other properties of a virtual disk at any time after the virtual disk is created. To do this, follow these steps:

1. Select the **Logical View** tab in the left panel of the Dell SAS RAID Storage Manager screen.
2. Select a virtual disk icon in the left panel of the window.
3. In the right panel, select the **Operations** tab, and then select **Set Virtual Disk Properties.**

   A list of Virtual Disk Properties appears in the right panel. The properties include the Read Policy, Default Write Policy, an option for Write Through for a failed or missing battery, IO policy, Access Policy, Disk Cache Policy, and Background Initialization.
4. Change the virtual disk properties as needed in the right panel. For information on these properties, see Understanding Virtual Disk Parameters.
5. Click **Go** to accept the changes.

Changing a Virtual Disk Configuration

You can use the Dell SAS RAID Storage Manager Reconstruction Wizard to change the configuration of virtual disks on a Dell system with a PERC 5/i controller or a PERC 6/i controller. You can change the configuration for virtual disks at the following RAID levels for these RAID controllers:

- PERC 5/i controller: RAID 0, RAID 1, and RAID 5
- PERC 6/i controller: RAID 0, RAID 1, RAID 5, and RAID 6

NOTICE: Be sure to back up the data on the virtual disk before you change its configuration.

The Reconstruction Wizard allows you to change a virtual disk configuration by adding disk drives to the virtual disk, removing disk drives from it, or changing its RAID level.

NOTE: You cannot change the configuration of a RAID 10 virtual disk. You cannot change a RAID 0, RAID 1, RAID 5, or RAID 6 configuration if two or more virtual disks are defined on a single disk group. (The Logical view tab shows which disk groups and disk drives are used by each virtual disk.)

To start the Reconstruction Wizard, select a virtual disk icon in the left panel of the Dell SAS RAID Storage Manager window and then select **Operations-> Advanced Operations-> Reconstruction Wizard** from the menu. This section has the following subsections explaining the Reconstruction Wizard options:

- Adding a Disk Drive to a Configuration on a PERC 5/i Controller or on a PERC 6/i Controller
- Changing the RAID Level of a Configuration on a PERC 5/i Controller or on a PERC 6/i Controller

Adding a Disk Drive to a Configuration on a PERC 5/i Controller or on a PERC 6/i Controller

NOTICE: Be sure to back up the data on the virtual disk before you add a drive to it.

Follow these steps to add a disk drive to a configuration with the Configuration Wizard:

1. Select a virtual disk icon in the left panel of the Dell SAS RAID Storage Manager window and then select **Operations-> Advanced Operations-> Reconstruction Wizard** from the menu to start the Reconstruction Wizard.
2. Click **Add Drive** on the Reconstruction Wizard menu screen, and then click **Next**.
3. When the next screen appears, select an available disk drive in the top panel and click the down-arrow **Add** button to move it to the Selected Drives list.
4. Click **Next** to continue. The next screen appears.
5. (Optional) Select a different RAID level for the configuration from the drop-down menu in the lower right of the window.
6. Review the information in the window. If everything is acceptable, click **Finish**.

   A Reconstruct operation begins on the virtual disk. You can monitor the progress of the reconstruction in the Group Show Progress window. To do this, select **Group Operations-> Show Progress**.

Changing the RAID Level of a Configuration on a PERC 5/i Controller or on a PERC 6/i Controller

NOTICE: Be sure to back up the data on the virtual disk before you change its RAID level.

Follow these steps to change the RAID level of a RAID 1, RAID 5, or RAID 6 (PERC 6/i only) configuration with the Configuration Wizard:

1. Select the **Logical View** tab in the left panel of the Dell SAS RAID Storage Manager screen.
2. Select a virtual disk icon in the left panel, and then select **Operations-> Advanced Operations-> Reconstruction Wizard** from the menu to start the Reconstruction Wizard.
3. Click **Change RAID Level** on the Reconstruction Wizard menu screen.

   NOTE: This option is not available for RAID 0 configurations.
4. When the next screen appears, select a RAID level from the drop-down menu in the lower right corner.
5. Review the information in the window. If everything is acceptable, click **Finish**.

   A Reconstruct operation begins on the virtual disk. You can monitor the progress of the reconstruction in the Group Show Progress window. To do this, select **Group Operations -> Show Progress**.

Deleting a Virtual Disk

NOTICE: Be sure to back up the data on the virtual disk before you delete it. Be sure that the operating system is not installed on this virtual disk.

NOTICE: If one or more drives have a bootable partition, they will not appear on the list of drives that are available to create a new virtual drive. Virtual drives that have a bootable partition cannot be deleted, in order to prevent you from accidentally deleting a drive that contains the operating system.

You can delete virtual disks in order to rearrange the storage space. To delete a virtual disk, follow these steps:

1. Back up all user data on the virtual disk you intend to delete.
2. In the left panel of the Dell SAS RAID Storage Manager window, select the **Logical** tab and click the icon of the virtual disk you want to delete.

3 In the right panel, select the **Operations** tab and select **Delete Virtual Disk**.

4 Click **Go**.

5 When the warning message appears, click the check box to confirm that you are certain that you want to delete the virtual disk, and then click **Yes** to confirm that you want to delete the virtual disk.

NOTE: You will be asked twice if you want to delete a virtual disk to avoid deleting the virtual disk by mistake.

Saving a Storage Configuration to Disk

You can save an existing controller configuration to a file so you can apply it to another controller. To save a configuration file, follow these steps:

1 Select a controller icon in the left panel of the Dell SAS RAID Storage Manager window.

2 On the menu bar, select **Operations-> Configuration-> Save Configuration to file**.

The Save dialog box appears.

3 In the Save dialog box, type a name for the configuration file, or accept the default name (*hostname*.cfg).

4 Click **Save** to save the configuration file.

Clearing a Storage Configuration from a Controller

You must clear a storage configuration from a controller before you can create a new configuration on the controller or load a previously saved configuration file.

NOTICE: Before you clear a configuration, be sure to save any data that you want to keep! Clearing a configuration deletes all data from the disks of the existing configuration.

To clear a configuration from a controller, follow these steps:

1 Select a controller icon in the left panel of the Dell SAS RAID Storage Manager window.

2 On the menu bar, select **Operations-> Configuration-> Clear Configuration**.

A warning message appears.

NOTICE: If a configuration contains an operating system drive, the configuration cannot be cleared.

3 Click **Yes** to clear the configuration or **No** to cancel the operation.

Adding a Saved Storage Configuration

When you replace a controller, or when you want to duplicate an existing storage configuration on a new controller, you can add a saved configuration to the controller.

NOTICE: When you add a saved configuration to a replacement controller, be sure that the number and size of the physical disks connected to the controller is exactly the same as it was when the configuration was saved.

To add a saved configuration, follow these steps:

1 Select a controller icon in the left panel of the Dell SAS RAID Storage Manager window.

2 On the menu bar, select **Operations-> Configuration-> Add Saved Configuration**.

A warning message appears.

3 Click **Yes**. When the Open dialog box appears, select the configuration file and click **Open**.

4 View the configuration detail, and then click **Apply**.

5 Confirm the new configuration when prompted.

5

Monitoring System Events and Storage Devices

The Dell SAS RAID Storage Manager enables you to monitor the status of disk drives, virtual disks, and other storage devices. This chapter explains how to use Dell SAS RAID Storage Manager to perform the following monitoring tasks.

Monitoring System Events

Dell SAS RAID Storage Manager monitors the activity and performance of all controllers in the system and the storage devices connected to them. When an event occurs (such as the creation of a new virtual disk or the removal of a physical drive) an event message appears in the log displayed at the bottom of the Dell SAS RAID Storage Manager window.

Each event in the log includes an error level (Info, Warning, Caution, or Fatal) a date and time stamp, and a brief description. (For a list of all events, see Appendix A, Events and Messages)

The Log menu has four options:

- **Save Log**: Saves the current log as a .log file.
- **Save Log Text**: Saves the current log as a .txt file.
- **Clear Log**: Clears the current log information.
- **Load Log**: Enables you to load a different log file.

NOTE: For some events on Dell systems with a SAS 5/iR controller or a SAS 6/iR controller, the time stamp will be reported as #### because the reported time stamp is not valid.

Monitoring Controllers

When Dell SAS RAID Storage Manager is running, you can see the status of all controllers in the left panel of the Dell SAS RAID Storage Manager window. If the controller is operating normally, the controller icon looks like this:  . If the controller has failed, a small red circle appears to the right of the icon. (See Physical/Logical View Panel for a complete list of device icons.)

To display complete controller Information, click a controller icon in the left panel of the Dell SAS RAID Storage Manager window and click the **Properties** tab in the right panel. The Properties tab lists information such as Product Name, Serial No., SubVendor ID, Host Port Count, and task rates. Controller properties are defined in the Glossary.

Monitoring Disk Drives

When Dell SAS RAID Storage Manager is running, you can see the status of all physical disk drives in the left panel of the Dell SAS RAID Storage Manager window. If the disk drive is operating normally, its icon looks like this:  . If the disk drive has failed, a small red circle appears to the right of the icon, like this  . (See Physical/Logical View Panel for a complete list of device icons.)

To display complete disk drive information, click a disk drive icon in the left panel of the Dell SAS RAID Storage Manager window and click the **Properties** tab in the right panel. The Properties tab lists information such as vendor name, device ID, drive size, and physical drive state. All disk drive properties are defined in the Glossary.

To display a graphical view of a disk drive, click on a drive icon in the left panel of the Dell SAS RAID Storage Manager and click the **Graphical View** tab. In Graphical View, the drive's storage capacity is color coded according to the legend shown on the screen: configured space is blue, available space is white, and reserved space is red. When you select a virtual disk from the drop-down menu, the disk space used by that virtual disk is displayed in green.

Running a Patrol Read

The Dell PERC 5/i controller and the Dell PERC 6/i controller supports the patrol read feature. Patrol read provides a dynamic check on the virtual disk to confirm the disk is functioning properly. Patrol read runs in the background, adjusting its performance based on the patrol read settings and the i/o load on the controller. A patrol read can be used for all RAID levels and for all hotspare drives. To start a patrol read, follow these steps:

1. Click a controller icon in the left panel of the Dell SAS RAID Storage Manager window.
2. Select **Operations -> Start Patrol Read**.
3. When prompted, click **Yes** to confirm that you want to start a patrol read.

To change the patrol read settings, follow these steps:

1. Click a controller icon in the left panel of the Dell SAS RAID Storage Manager window.
2. Select the **Operations** tab in the right panel, and select **Set Patrol Read Properties**.
3. Select an **Operation Mode** for patrol read. The options are:
   - **Auto**: Patrol read runs automatically at the time interval you specify on this screen.
   - **Manual**: Patrol read runs only when you manually start it by selecting **Start Patrol Read** from the controller Options panel.
   - **Disabled**: Patrol read does not run at all.
4. (Optional) Specify a maximum count of physical drives to include in the patrol read. The count must be between 0 and 255.
5. (Optional) Select the virtual disks on this controller that you want to **exclude** from the patrol read. The existing virtual disks are listed in the gray box. To exclude a virtual disk, check the box next to it.
6. (Optional) Change the frequency at which the patrol read runs (the execution frequency). The default frequency is 168 hours (7 days), which is suitable for most configurations.

   NOTE: Dell recommends that you leave the patrol read frequency and other patrol read settings at the default values, in order to achieve the best system performance. If you decide to change the values, record the original default value here so you can restore them later, if necessary:

Patrol Read Frequency: _____
Continuous Patrolling: Enabled/Disabled
Patrol Read Task Rate: _____

7 (Optional) Select **Continuous Patrolling** if you want patrol read to run continuously in the background instead of running at periodic intervals. If you select **Continuous Patrolling**, the time interval field is grayed out.

8 Click **Go** to enable the patrol read properties.

NOTE: Patrol read does not report on its progress while it is running. The patrol read status is reported in the Event Log only.

You have the option to change the patrol read *task rate*. The task rate determines the amount of system resources that are dedicated to a patrol read when a patrol read is running. Dell recommends, however, that you leave the patrol read task rate at its default setting. If you raise the task rate above the default, foreground tasks will run more slowly and it might seem that the system is not responding. For more information, about the patrol read task rate, see Changing Adjustable Task Rates.

Monitoring Virtual Disks

When Dell SAS RAID Storage Manager is running, you can see the status of all virtual disks. If a virtual disk is operating normally, the icon looks like this:  . If the virtual disk is running in degraded mode (for example, if a physical disk has failed) a small yellow circle appears to the right of the icon:  . (See Physical/Logical View Panel for a complete list of device icons.)

For the Dell PERC 5/i controller, and the Dell PERC 6/i controller, when you select the Logical tab, the left panel of the Dell SAS RAID Storage Manager window shows which physical disks are used by each virtual disk. The same physical disk can be used by multiple virtual disks.

To display complete information about the virtual disk , click the **Logical** tab in the left panel, click on a virtual disk icon in the left panel, and click the **Properties** tab in the right panel. All of the virtual disk properties appear. They are defined in the Glossary.

NOTE: On Dell PERC 5/i controllers and Dell PERC 6/i controllers, you can change virtual disk properties such as Read Policy, Write Policy, IO Policy, and Access Policy after the virtual disk has been created. For more information, see Changing Virtual Disk Properties.

To display a graphical view of a virtual disk, click on a virtual disk icon in the left panel of the Dell SAS RAID Storage Manager and click the **Graphical View** tab. In Graphical View, the disk group (array) used for this virtual disk is shaded blue to show how much of the disk group capacity is used by this virtual disk. If part of the disk group is shaded white, this indicates that some of the capacity is used by another virtual disk. In a RAID 10 configuration, two disk groups are used by one virtual disk.

Monitoring Rebuilds and Other Processes

Dell SAS RAID Storage Manager allows you to monitor the progress of rebuilds and other lengthy processes in the Group Show Progress window. To open this window, select **Group Operations -> Show Progress** on the menu bar.

Operations on virtual disks appear in the left panel of the Group Show Progress window, and operations on physical drives appear in the right panel. The following operations appear in this window.

- Background initialization of a virtual disk (on Dell PERC 5/i controllers and Dell PERC 6/i controllers only)
- Rebuild (see Rebuilding a Drive)
- Consistency check (on Dell PERC 5/i controllers and Dell PERC 6/i controllers only) (see Running a Consistency Check)
- Replace member (on Dell PERC 5/i controllers and Dell PERC 6/i controllers only)

To abort any ongoing process, click the **Abort** button next to the status indicator. Click **Abort All** to abort all ongoing processes. Click **Close** to close the window.

6

Maintaining and Managing Storage Configurations

This chapter explains how to use Dell SAS RAID Storage Manager to maintain and manage storage configurations.

Initializing Virtual Disks

To initialize a virtual disk after you complete the configuration process on a Dell PERC 5/i controller and on a Dell PERC 6/i controller, follow these steps:

1. Select the **Logical** tab in the left panel of the Dell SAS RAID Storage Manager window and click the icon of the virtual disk that you want to initialize.
2. Select **Group Operations-> Initialize**. The Group Initialize dialog box appears.
3. Select the virtual disk(s) to initialize, or click **Select All** to select all of the virtual disks in the list.
4. Click the **Fast Initialization** check box if you want to use this option. If you leave the box unchecked, Dell SAS RAID Storage Manager will run a Full Initialization on the virtual disk. A Full Initialization takes longer thans Fast Initialization. (For more information, see Understanding Virtual Disk Parameters.)
5. Click **Start** to start the initialization.

   You can monitor the progress of the initialization. See Monitoring Rebuilds and Other Processes for more information.

Running a Consistency Check

You should periodically run a consistency check on fault-tolerant virtual disks that are on Dell PERC 5/i controllers and Dell PERC 6/i controllers. It is especially important to do this if you suspect that the virtual disk consistency data might be corrupted. Be sure to back up the data before running a consistency check if you think the consistency data might be corrupted.

You can use the Check Consistency stop on error option to select whether Check Consistency stops when an inconsistency is detected or whether it fixes the inconsistency, logs the event, and continues.

To run a consistency check, follow these steps:

1. Select **Group Operations-> Check Consistency**.

   The Group Consistency Check window appears.

2. Select the virtual disks that you want to check, or click **Select All** to select all of the virtual disks.

3. Click **Start** to begin the operation.

You can monitor the progress of the consistency check. See Monitoring Rebuilds and Other Processes for more information.

NOTE: You can also run a consistency check by selecting the virtual disk icon in the left panel of the Dell SAS RAID Storage Manager window and selecting the option on the Operation tab in the right panel. If you select the **Automatically fix errors** check box, Dell SAS RAID Storage Manager automatically fixes any consistency data errors that it finds.

NOTE: Running consistency check impacts the system performance. Make sure to perform this maintenance task during periods of lower usage.

Scheduling a Consistency Check

You can schedule a consistency check to run at a specified time on fault-tolerant virtual disks that are on Dell PERC 5/i controllers and Dell PERC 6/i controllers. This feature makes it easier to run consistency checks on the virtual disks on a regular basis.

To run a consistency check, follow these steps:

1. Select the **Physical View** tab in the left panel of the Dell SAS RAID Storage Manager window and select a controller icon.

2 In the right panel of the Dell SAS RAID Storage Manager window, select the **Operations** tab and select **Schedule Check Consistency**.

   The schedule options appear in the right panel.

3 You can select from the following options:

   - How often to run the consistency check: run it hourly, daily, weekly, monthly, or disable it
   - Whether to run the consistency check continuously
   - The month, day, year, and time on which to start the consistency check

     The default is the month, day, year, and time when you invoke this dialog box.

4 Click **Go** to set the schedule.

Scanning for New Drives

Dell SAS RAID Storage Manager normally detects newly installed disk drives and displays icons for them in the Dell SAS RAID Storage Manager window. If for some reason the utility does not detect a new drive (or drives), you can use the Rescan command to find it. The Rescan command updates the display in the Dell SAS RAID Storage Manager window. (Rescan is seldom required; the display normally updates automatically.)

To do this, follow these steps:

1 Select a controller icon in the left panel of the Dell SAS RAID Storage Manager screen.

2 Select **File-> Rescan**.

   If Dell SAS RAID Storage Manager detects any new disk drives, it displays a list of them on the screen. If not, it notifies you that none were found.

Scanning for Foreign Configurations

You can use the Scan for Foreign Configurations option to find drives with foreign configurations. A foreign configuration is a RAID configuration that already exists on a replacement set of physical disks that you install in a computer system. Disks that are foreign are listed on the physical drives list with a special symbol in Dell SAS RAID Storage Manager. The utility allows

you to import the existing configuration to the RAID controller or clear the configuration so you can create a new configuration using these drives. You can preview the foreign configuration before you decide whether to import it.

NOTE: On the SAS 5/iR controller and the SAS 6/iR controller, when a disk set is moved from one controller to another, the disks are reported to SAS RAID Storage Manager as un-configured and good. You can import the existing volume by using the operation to import foreign configurations or you can use the Configuration Wizard to create a new volume on the disks that overwrites any existing data on the disks.

To do this, follow these steps:

1. Select a controller icon in the left panel of the Dell SAS RAID Storage Manager screen.
2. Select **Operations-> Scan for Foreign Config**.

   If Dell SAS RAID Storage Manager detects any new disk drives, it displays a list of them on the screen. If not, it notifies you that no foreign configuration is found.
3. Follow the instructions on the screen to complete the disk detection.

Clearing a Foreign Configuration

You can use the controller BIOS configuration utility to clear a foreign configuration. Refer to your SAS controller user's guide for further instructions. This is a non-recoverable operation, so be sure that you want to do this before you continue.

Rebuilding a Drive

If a single drive in a RAID 1, RAID 5, RAID 6 (PERC 6/i only), or RAID 10 virtual disk fails, the system is protected from data loss. A RAID 6 configuration can survive the failure of two physical drives. The failed drive must be replaced, and the drive's data must be rebuilt on a new drive to restore the system to fault tolerance. (You can choose to rebuild the data on the failed drive if the drive is still operational.)

On a Dell SAS 6/iR system, if a RAID 1 virtual disk fails, and if hotspare disks are available, the failed drive is rebuilt automatically without any user intervention.

On a Dell PERC 5/i system, if a RAID 1 or RAID 5 virtual disk fails, and if hotspare disks are available, the failed drive is rebuilt automatically without any user intervention.

On a Dell PERC 6/i system, if a RAID 1, RAID 5, or RAID 6 virtual disk fails, and if hotspare disks are available, the failed drive is rebuilt automatically without any user intervention. On a RAID 6 virtual disk, if there are two failed drives, the failed drives are automatically rebuilt.

NOTE: Dell SAS RAID Storage Manager uses the term *rebuild* to describe the operation that occurs when a disk is replaced in a RAID 1 array and data is copied from one disk to another. The BIOS utility uses the term *synchronization* to describe the same operation. *Rebuild* and *synchronization* in this context have the same meaning. This applies to the SAS 5/iR controller only.

If a drive has failed, a red circle appears to the right of the disk drive icon:  . A small yellow circle appears to the right of the icon of the virtual disk that uses this physical disk:  . This indicates that the virtual disk is in a degraded state; the data is still safe, but data could be lost if another drive fails.

Rebuilding a Drive on a Dell SAS 5/iR System or on a Dell SAS 6/iR System

Follow these steps if you need to replace a failed physical drive on a Dell SAS 5/iR system or on a Dell SAS 6/iR system:

1. Note the number of the failed drive in the Dell SAS RAID Storage Manager window. For example, the number --:--:<port #> identifies the enclosure, the drive, and the port, respectively.
2. Shut down the system, disconnect the power cord, and open the computer case.

CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Authorized Service Technicians: Before performing any procedure, see your Product Information Guide for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

3. Find the failed disk drive and remove it from the computer case.

   You can identify the disk drive by reading the number on the drive cable. This corresponds to the drive number displayed in the Dell SAS RAID Storage Manager window. Also, the drive 0 cable is color coded. For the integrated controller, the disk drive number is on the motherboard next to the cable connector.

4 Replace the failed disk drive with a new drive of equal or greater capacity.

5 Close the computer case, reconnect the power cord, and restart the computer.

6 Restart Dell SAS RAID Storage Manager.

When the new drive spins up, the drive icon changes back to normal status, and the rebuild process begins automatically.

Rebuilding a Drive on a Dell PERC 5/i System or on a Dell PERC 6/i System

Follow these steps if you need to rebuild a physical drive on a Dell PERC 5/i system or on a Dell PERC 6/i system:

1 Right click the icon of the failed drive and select **Rebuild**.

2 Click **Yes** when the warning message appears. If the drive is still good, a rebuild will start.

You can monitor the progress of the rebuild in the Group Show Progress window by selecting **Group Operations-> Show Progress**. If the drive cannot be rebuilt, an error message appears. Continue with the next step.

CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Authorized Service Technicians: Before performing any procedure, see your Product Information Guide for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

3 Shut down the system, disconnect the power cord, and open the computer case.

4 Replace the failed disk drive with a new drive of equal capacity.

5 Close the computer case, reconnect the power cord, and restart the computer.

6 Restart Dell SAS RAID Storage Manager.

When the new drive spins up, the drive icon changes back to normal status, and the rebuild process begins automatically. You can monitor the progress of the rebuild in the Group Show Progress window by selecting **Group Operations-> Show Progress**.

Making a Drive Offline or Missing

If a disk drive is currently part of a redundant configuration and you want to use it in another configuration, you can use Dell SAS RAID Storage Manager commands to remove the disk drive from the first configuration for this purpose. When you do this, **all data on that drive is lost**.

To remove the disk drive from the configuration without harming the data on the virtual disk, follow these steps:

1. In the left panel of the Dell SAS RAID Storage Manager window, right-click on the icon of a disk drive in a redundant virtual disk.
2. Select **Make drive offline** from the popup menu. The disk drive status changes to Offline.
3. Right-click the disk drive icon again and select **Mark physical disk as missing**.
4. Select **File-> Rescan**. The disk drive status changes to UNCONFIGURED & GOOD. At this point, the data on this disk drive is no longer valid.
5. If necessary, create a hotspare disk for the virtual disk from which you have removed the disk drive. (See Adding Hotspare Disks.)

   When a hotspare is available, the data on the virtual disk will be rebuilt. You can now use the removed disk for another configuration.

NOTE: If Dell SAS RAID Storage Manager detects that a disk drive in a virtual disk has failed, it makes the drive offline. If this happens, you must remove the disk drive and replace it. You cannot make the drive usable for another configuration by using the **Mark physical disk as missing** and **Rescan** commands.

Preserving Pinned Cache

If a virtual disk becomes offline or is deleted for any reason, the firmware preserves the dirty cache from the virtual disk. This preserved dirty cache is called pinned cache, and is preserved until you import the virtual disk, or discard the cache.

NOTE: The pinned cache information applies only to the PERC 6 controllers.

NOTE: Certain operations, such as creating a new virtual disk, cannot be performed if pinned cache exists. In addition, if you reboot your server, the operating system will not start as long as the pinned cache exists. Messages notify you that you cannot perform the procedure until you either delet the pinned cache or import the virtual disks with the pinned cache.

If there are any foreign configurations, it is strongly advised that you import the foreign configuration before you discard the preserved cache. Otherwise, you might lose data that belongs with the foreign configuration.

Perform the following steps to select whether to import the virtual disk or discard the pinned cache.

1. In the left panel of the Dell SAS RAID Storage Manager window, select the **Logical** tab and click on a controller icon.
2. In the right panel, select the **Operations** tab.
3. Select **Manage Preserved Cache**.
4. Click **Go**.

   A message displays to advise you to import any existing foreign configurations before you discard the preserved cache. Otherwise, you can lose data that belongs with the foreign configurations. Confirm whether you want to continue. Next, the **Manage Preserved Cache** screen displays the affected virtual disks.

5. On the **Manage Preserved Cache** screen, choose whether to discard the cache. You can discard the cache or press **Cancel** to display the **Preserved Cache Retained** dialog box.

   If you choose to discard the cache, you are prompted to confirm your choice. If you choose to retain the cache, a message displays to notify you that you cannot perform certain operations while the cache exists. Click **OK** to continure.

Some operations, such as creating a new virtual disk, are not allowed if preserved cache exists. A message warns you that you cannot perform the operation while preserved cache exists. If you choose to clear a configuration, and preserved cache exists, a message warns you that all data on all virtual drives will be lost and the preserved cache will be discarded.

Upgrading the Firmware

Dell SAS RAID Storage Manager enables you to easily upgrade the controller firmware. The latest firmware packages are available at support.dell.com. The images used for the update are contained in this package.

To upgrade the firmware, follow these steps:

1. In the left panel of the Dell SAS RAID Storage Manager window, click on the icon of the Dell controller you need to upgrade.
2. In the right panel, click the **Operations** tab and select **Flash Firmware**.
3. Click **Go**.
4. Browse for the firmware file.

   Dell SAS RAID Storage Manager displays the version of the existing firmware and the version of the new firmware file.
5. When you are prompted to indicate whether you want to upgrade the firmware, click **Yes**.

   The controller is updated with the new firmware code contained in the the .fw file or the .rom file.

7

Troubleshooting

To get help installing Dell SAS RAID Storage Manager on your Dell™ PERC 5/i, SAS 5/iR, PERC 6/i, or SAS 6/iR system, you can contact your Dell Technical Service representative or access the Dell Support website at **support.dell.com**.

Pinned Cache State

If a virtual disk becomes offline or is deleted for any reason, the firmware preserves the dirty cache from the virtual disk. This preserved dirty cache is called pinned cache, and is preserved until you import the virtual disk, or discard the cache.

NOTE: The pinned cache information applies only to the PERC 6 controllers.

You can use the software utility to select whether to import the virtual disk or discard the pinned cache. In the VD Mgmt menu, select Manage Preserved Cache and follow the steps on the screen.

NOTE: For the procedure used to import the virtual disk or discard the pinned cache, see "Preserving Pinned Cache" on page 55.

Certain operations, such as creating a new virtual disk, cannot be performed if pinned cache exists. In addition, if you reboot your server, the operating system will not start as long as the pinned cache exists. Messages notify you that you cannot perform the procedure until you either delete the pinned cache or import the virtual disks with the pinned cache.

If there are any foreign configurations, it is strongly advised that you import the foreign configuration before you discard the preserved cache. Otherwise, you might lose data that belongs with the foreign configuration.

NOTE: Firmware deletes a virtual disk if the virtual disk loses all of its drives, even if you did not intend to delete the virtual disk. This causes loss of data. Such unintended cases can occur to configured drives due to unexpected cable failure or power failure.

Windows Installation Error Messages

The Microsoft Installer might display error messages during the installation process when you are installing Dell SAS RAID Storage Manager on a Dell system running under the Microsoft Windows operating system. The error messages are self-explanatory. If you need more information about these messages, see the list of Installer error messages on the Microsoft Developers Network (MSDN) website at this address:

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/msi/setup/windows_installer_error_messages.asp

Linux Installation Error Messages

The messages shown in Table 7-1 might appear while you are installing Dell SAS RAID Storage Manager on a Dell system running under the Red Hat® Linux or SUSE Linux operating system:

Table 7-1. Linux Installation Error Messages

Message	Meaning
More than one copy of MegaRAID Storage Manager has been installed.	You have installed more than one copy of Dell SAS RAID Storage Manager. This can be done by using the `rpm-force` command to install the rpm file directly, which is not recommended, instead of using the `install.sh` file. In such cases, you must uninstall all the rpms manually before installing Dell SAS RAID Storage Manager as described in Installation.
The version is already installed.	The version of Dell SAS RAID Storage Manager you are trying to install is already installed on the system. Cancel out of the installation program.
The installed version is newer.	A newer version of Dell SAS RAID Storage Manager is already installed on the system. Cancel out of the installation program.
Exiting installation.	This message appears when the installation is complete. No action is necessary.
RPM Installation Failed	This message indicates that the installation failed for some reason. Additional message text explains the cause of the failure. Read this message text and take appropriate action.

Other Dell SAS RAID Storage Manager Messages

Table 7-2 lists other messages generated by Dell SAS RAID Storage Manager and explains what should be done to respond to them.

Table 7-2. Dell SAS RAID Storage Manager Messages

Message	Meaning	Action
Event ID 0X27	This means that patrol read is disabled. This message displays if you try to start patrol read when it is not enabled.	Change the patrol read mode to Auto or Manual from Disabled. See Running a Patrol Read in Chapter 5 for detailed instructio ns.
Message 4007	A Start Rebuild command was issued, but rebuild was not able to start.	See the Dell knowledgebase articles on support.dell.com.
Message 4008	A Make Drive Online command was issued.	See the Dell knowledgebase articles on support.dell.com.
Message 4009	You are attempting to create a virtual disk with a mix of SAS and SATA physical drives.	The operation is not supported. Select only SAS or only SATA drives when creating a virtual disk.
Message 4022	Required hardware, such as a battery backup unit, is missing.	No action is required; these functions are not supported.
Message 8107	You sent a Start Locate or Stop Locate command to a physical drive that is not connected to a backplane (that is, not in a disk enclosure).	Command not supported on this hardware config (informational message only).
Message 8109	File selected to upgrade firmware is invalid for that controller.	See Upgrading the Firmware for instructions on how to upgrade the firmware.
Message 800E	You sent an Undo Prepare Removal command to a physical drive that does not support this command.	The hardware configuration is not supported.

Table 7-2. Dell SAS RAID Storage Manager Messages *(continued)*

Message	Meaning	Action
Guided Configuration Failed!	Dell SAS RAID Storage Manager could not proceed with guided configuration. This might occur because the underlying hardware resources were changed during the configuration: for example, a drive was removed.	Close the Configuration Wizard and then retry.
Cannot read Foreign Config!	An error occurred while Dell SAS RAID Storage Manager was attempting to read a Foreign Configuration. Dell SAS RAID Storage Manager is unable to read the configuration.	Move the configuration back to the system where it came from and verify the configuration there.
No Foreign Configuration is found!	Dell SAS RAID Storage Manager found a data inconsistency while reading a foreign configuration. The foreign configuration is invalid.	Scan the system again to attempt to read the foreign configuration. If this fails, the configuration might be corrupted.
Operation cannot be started while reconstruction is in progress!	You tried to start another operation in Dell SAS RAID Storage Manager while a reconstruction was running.	Wait for the reconstruction operation to complete and then retry the operation.
Guided Configuration failed!	Dell SAS RAID Storage Manager could not proceed with guided configuration. This might occur because the underlying hardware resources were changed during the configuration: for example, a drive was removed.	Close the Configuration Wizard and then retry it.

Table 7-2. Dell SAS RAID Storage Manager Messages *(continued)*

Message	Meaning	Action
Storelib Initialization failed	StoreLib (the library used by Dell SAS RAID Storage Manager) could not be initialized on the system. No SAS hardware or driver is present on the system.	Check the knowledgebase articles on support.dell.com.
No Storage Controller Found!	No controller could be found on the system. No SAS hardware or driver is present on the system.	Verify that the hardware is properly connected, the SAS controller is enabled in the system BIOS (if it is an integrated controller) and the driver is installed in the system. If you have just installed the BIOS, make sure the system has been rebooted.
Clear Configuration failed: Unknown Exception	The Clear Configuration command has failed.	Verify that you want to clear the configuration (this is a non-recoverable operation). Follow the instructions in the SAS controller user's guide to perform this task using the controller BIOS utility.
Login failed: Invalid username or password!	The username or password is invalid. User authentication failed because the user entered an invalid user name of password.	The username and password are set up by your local system administrator. Contact your system administrator to verify the password. Note that the administrator/root password is for the local machine, not a domain based administrator password.
Auto Configuration failed!	Dell SAS RAID Storage Manager could not proceed with auto configuration. This might occur because the underlying hardware resources were changed during the configuration: for example, a drive was removed.	Close the Configuration Wizard and retry. If this happens repeatedly, verify that the hardware is properly connected.

Table 7-2. Dell SAS RAID Storage Manager Messages *(continued)*

Message	Meaning	Action
Cannot create Virtual Disk: Invalid input parameters for creating Virtual Disk.	You have entered some parameters that are not valid for the virtual disk.	Be sure that all the virtual disk parameters are valid, and then retry creating the virtual disk.
The drive is not in a state to perform.	The physical drive does not support this command. This might happen when you send an Undo Prepare for Removal command to the wrong physical drive.	This functionality is not supported. Check the state of the physical drive.
Save configuration failed.	The Save Configuration command failed while attempting to save the configuration to a file.	Be sure that you are saving the configuration to the correct location. Be sure there is adequate free space for the file on the disk. Be sure you have write permission on the target.
Reconstruction on this Volume is not allowed!	This virtual disk does not support the Reconstruction command. The system hardware is not allowing any kind of reconstruction.	Verify that the hardware is properly connected and retry.
Fatal Error: Cannot connect to Framework!	A software component of Dell SAS RAID Storage Manager cannot establish a connection to the MSM framework. The Dell SAS RAID Storage Manager GUI is not able to communicate with the server side software component.	Confirm that the device driver is installed and that the system has been rebooted. If the driver is present, uninstall and re-install the application.

Table 7-2. Dell SAS RAID Storage Manager Messages *(continued)*

Message	Meaning	Action
Clear Foreign Config failed!	The Clear Foreign Config operation has failed with an error.	Use the controller BIOS configuration utility to execute this task. (See the SAS controller user's guide for further instructions.) This is a non-recoverable operation, so be sure that you want to do this before continuing.
No Servers found!	Dell SAS RAID Storage Manager did not find any servers to manage.	Uninstall and reinstall the software application.
Import foreign configuration failed!	An error occurred when Dell SAS RAID Storage Manager attempted to import a foreign configuration.	Move the configuration back to the system where it came from and verify the configuration there.
Device not responding!	The device is not responding to the command you are sending it.	Re-try the command. Verify that the hardware is connected and is configured properly.
This user does not have Administrator right for this system!	Dell SAS RAID Storage Manager log-in failed because the user does not have administrator rights for this system. This happens only when the user is trying to use Dell SAS RAID Storage Manager with full access rights.	Verify that the username has administrator rights for the local system (not domain based rights). Note that you can log in with view only access if you do not need to change the configuration.
Drive not certified	This indicates that the disk drive was not obtained from Dell and has not undergone the testing that is done for disk drives that Dell provides.	No action is required. This is a notification that Dell did not certify the disk drive.

A

Events and Messages

This appendix lists the Dell SAS RAID Storage Manager events that might appear in the event log.

Dell SAS RAID Storage Manager monitors the activity and performance of all controllers in the workstation and the devices attached to them. When an event occurs, such as the start of an initialization, an event message appears in the log at the bottom of the Dell SAS RAID Storage Manager window.

Each message that appears in the event log has an Error Level that indicates the severity of the event, as shown in Table A-1.

Table A-1. Event Error Levels

Error Level	Meaning
Info	Informational message. No user action is necessary.
Warning	Some component might be close to a failure point.
Caution	A component has failed, but the system has not lost data.
Fatal	A component has failed and data loss has occurred or will occur.
Dead	A catastrophic error has occurred and the controller has died. This event is seen only after the controller has been restarted.

List of System Event Messages

Table A-2 lists all of the Dell SAS RAID Storage Manager event messages. The event message descriptions include placeholders for specific values that are determined when the event is generated. For example, in message #1 in the Event Messages table "%s" is replaced by the firmware version, which is read from the firmware when the event is generated.

Table A-2. Event Messages

Number	Type	Event Text
0x0000	Info	MegaRAID firmware initialization started (PCI ID %04x/%04x/%04x/%04x)
0x0001	Info	MegaRAID firmware version %s

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x0002	Fatal	Unable to recover cache data from TBBU
0x0003	Info	Cache data recovered from TBBU successfully
0x0004	Info	Configuration cleared
0x0005	Warning	Cluster down; communication with peer lost
0x0006	Info	Virtual disk %s ownership changed from %02x to %02x
0x0007	Info	Alarm disabled by user
0x0008	Info	Alarm enabled by user
0x0009	Info	Background initialization rate changed to %d%%
0x000a	Fatal	Controller cache discarded due to memory/battery problems
0x000b	Fatal	Unable to recover cache data due to configuration mismatch
0x000c	Info	Cache data recovered successfully
0x000d	Fatal	Controller cache discarded due to firmware version incompatibility
0x000e	Info	Consistency Check rate changed to %d%%
0x000f	Dead	Fatal firmware error: %s
0x0010	Info	Factory defaults restored
0x0011	Info	Flash downloaded image corrupt
0x0012	Caution	Flash erase error
0x0013	Caution	Flash timeout during erase
0x0014	Caution	Flash error
0x0015	Info	Flashing image: %s
0x0016	Info	Flash of new firmware image(s) complete
0x0017	Caution	Flash programming error
0x0018	Caution	Flash timeout during programming
0x0019	Caution	Flash chip type unknown
0x001a	Caution	Flash command set unknown
0x001b	Caution	Flash verify failure

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x001c	Info	Flush rate changed to %d seconds
0x001d	Info	Hibernate command received from host
0x001e	Info	Event log cleared
0x001f	Info	Event log wrapped
0x0020	Dead	Multi-bit ECC error: ECAR=%x, ELOG=%x, (%s)
0x0021	Warning	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s)
0x0022	Dead	Not enough controller memory
0x0028	Info	Rebuild rate changed to %d%%
0x0029	Info	Reconstruction rate changed to %d%%
0x002a	Info	Shutdown command received from host
0x002c	Info	Time established as %s; (%d seconds since power on)
0x002d	Info	User entered firmware debugger
0x002e	Warning	Background Initialization aborted on %s
0x002f	Warning	Background Initialization corrected medium error (%s at %lx
0x0030	Info	Background Initialization completed on %s
0x0031	Fatal	Background Initialization completed with uncorrectable errors on %s
0x0032	Fatal	Background Initialization detected uncorrectable double medium errors (%s at %lx on %s)
0x0033	Caution	Background Initialization failed on %s
0x0034	Progress	Background Initialization progress on %s is %s
0x0035	Info	Background Initialization started on %s
0x0036	Info	Policy change on %s from %s to %s
0x0038	Warning	Consistency Check aborted on %s
0x0039	Warning	Consistency Check corrected medium error (%s at %lx
0x003a	Info	Consistency Check done on %s
0x003b	Info	Consistency Check done with corrections on %s

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x003c	Fatal	Consistency Check detected uncorrectable double medium errors (%s at %lx on %s)
0x003d	Caution	Consistency Check failed on %s
0x003e	Fatal	Consistency Check failed with uncorrectable data on %s
0x003f	Warning	Consistency Check found inconsistent parity on %s at strip %lx
0x0040	Warning	Consistency Check inconsistency logging disabled on %s (too many inconsistencies)
0x0041	Progress	Consistency Check progress on %s is %s
0x0042	Info	Consistency Check started on %s
0x0043	Warning	Initialization aborted on %s
0x0044	Caution	Initialization failed on %s
0x0045	Progress	Initialization progress on %s is %s
0x0046	Info	Fast initialization started on %s
0x0047	Info	Full initialization started on %s
0x0048	Info	Initialization complete on %s
0x0049	Info	LD Properties updated to %s (form %s)
0x004a	Info	Reconstruction complete on %s
0x004b	Fatal	Reconstruction of %s stopped due to unrecoverable errors
0x004c	Fatal	Reconstruct detected uncorrectable double medium errors (%s at %lx on %s at %lx)
0x004d	Progress	Reconstruction progress on %s is %s
0x004e	Info	Reconstruction resumed on %s
0x004f	Fatal	Reconstruction resume of %s failed due to configuration mismatch
0x0050	Info	Reconstructing started on %s
0x0051	Info	State change on %s from %s to %s
0x0052	Info	PD Clear aborted on %s

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x0053	Caution	PD Clear failed on %s (Error %02x)
0x0054	Progress	PD Clear progress on %s is %s
0x0055	Info	PD Clear started on %s
0x0056	Info	PD Clear completed on %s
0x0057	Warning	Error on %s (Error %02x)
0x0058	Info	Format complete on %s
0x0059	Info	Format started on %s
0x005a	Caution	Hot Spare SMART polling failed on %s (Error %02x)
0x005b	Info	PD inserted: %s
0x005c	Warning	PD %s is not supported
0x005d	Warning	Patrol Read corrected medium error on %s at %lx
0x005e	Progress	Patrol Read progress on %s is %s
0x005f	Fatal	Patrol Read found an uncorrectable medium error on %s at %lx
0x0060	Caution	Predictive failure: CDB: %s
0x0061	Fatal	Patrol Read puncturing bad block on %s at %lx
0x0062	Info	Rebuild aborted by user on %s
0x0063	Info	Rebuild complete on %s
0x0064	Info	Rebuild complete on %s
0x0065	Caution	Rebuild failed on %s due to source drive error
0x0066	Caution	Rebuild failed on %s due to target drive error
0x0067	Progress	Rebuild progress on %s is %s
0x0068	Info	Rebuild resumed on %s
0x0069	Info	Rebuild started on %s
0x006a	Info	Rebuild automatically started on %s
0x006b	Caution	Rebuild stopped on %s due to loss of cluster ownership
0x006c	Fatal	Reassign write operation failed on %s at %lx

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x006d	Fatal	Unrecoverable medium error during rebuild on %s at %lx
0x006e	Info	Corrected medium error during recovery on %s at %lx
0x006f	Fatal	Unrecoverable medium error during recovery on %s at %lx
0x0070	Info	PD removed: %s
0x0071	Warning	Unexpected sense: %s, CDB%s, Sense: %s
0x0072	Info	State change on %s from %s to %s
0x0073	Info	State change by user on %s from %s to %s
0x0074	Warning	Redundant path to %s broken
0x0075	Info	Redundant path to %s restored
0x0076	Info	Dedicated Hot Spare PD %s no longer useful due to deleted array
0x0077	Caution	SAS topology error: Loop detected
0x0078	Caution	SAS topology error: Un-addressable device
0x0079	Caution	SAS topology error: Multiple ports to the same SAS address
0x007a	Caution	SAS topology error: Expander error
0x007b	Caution	SAS topology error: SMP timeout
0x007c	Caution	SAS topology error: Out of route entries
0x007d	Caution	SAS topology error: Index not found
0x007e	Caution	SAS topology error: SMP function failed
0x007f	Caution	SAS topology error: SMP CRC error
0x0080	Caution	SAS topology error: Multiple subtractive
0x0081	Caution	SAS topology error: Table to table
0x0082	Caution	SAS topology error: Multiple paths
0x0083	Fatal	Unable to access device %s
0x0084	Info	Dedicated Hot Spare created on %s (%s)
0x0085	Info	Dedicated Hot Spare %s disabled
0x0086	Caution	Dedicated Hot Spare %s no longer useful for all arrays

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x0087	Info	Global Hot Spare created on %s (%s)
0x0088	Info	Global Hot Spare %s disabled
0x0089	Caution	Global Hot Spare does not cover all arrays
0x008a	Info	Created %s}
0x008b	Info	Deleted %s}
0x008c	Info	Marking LD %s inconsistent due to active writes at shutdown
0x008d	Info	Battery Present
0x008e	Warning	Battery Not Present
0x008f	Info	New Battery Detected
0x0090	Info	Battery has been replaced
0x0091	Caution	Battery temperature is high
0x0092	Warning	Battery voltage low
0x0093	Info	Battery started charging
0x0094	Info	Battery is discharging
0x0095	Info	Battery temperature is normal
0x0096	Fatal	Battery needs to be replacement, SOH Bad
0x0097	Info	Battery relearn started
0x0098	Info	Battery relearn in progress
0x0099	Info	Battery relearn completed
0x009a	Caution	Battery relearn timed out
0x009b	Info	Battery relearn pending: Battery is under charge
0x009c	Info	Battery relearn postponed
0x009d	Info	Battery relearn will start in 4 days
0x009e	Info	Battery relearn will start in 2 day
0x009f	Info	Battery relearn will start in 1 day
0x00a0	Info	Battery relearn will start in 5 hours

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x00a1	Info	Battery removed
0x00a2	Info	Current capacity of the battery is below threshold
0x00a3	Info	Current capacity of the battery is above threshold
0x00a4	Info	Enclosure (SES) discovered on %s
0x00a5	Info	Enclosure (SAF-TE) discovered on %s
0x00a6	Caution	Enclosure %s communication lost
0x00a7	Info	Enclosure %s communication restored
0x00a8	Caution	Enclosure %s fan %d failed
0x00a9	Info	Enclosure %s fan %d inserted
0x00aa	Caution	Enclosure %s fan %d removed
0x00ab	Caution	Enclosure %s power supply %d failed
0x00ac	Info	Enclosure %s power supply %d inserted
0x00ad	Caution	Enclosure %s power supply %d removed
0x00ae	Caution	Enclosure %s SIM %d failed
0x00af	Info	Enclosure %s SIM %d inserted
0x00b0	Caution	Enclosure %s SIM %d removed
0x00b1	Warning	Enclosure %s temperature sensor %d below warning threshold
0x00b2	Caution	Enclosure %s temperature sensor %d below error threshold
0x00b3	Warning	Enclosure %s temperature sensor %d above warning threshold
0x00b4	Caution	Enclosure %s temperature sensor %d above error threshold
0x00b5	Caution	Enclosure %s shutdown
0x00b6	Warning	Enclosure %s not supported; too many enclosures connected to port
0x00b7	Caution	Enclosure %s firmware mismatch
0x00b8	Warning	Enclosure %s sensor %d bad
0x00b9	Caution	Enclosure %s phy %d bad

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x00ba	Caution	Enclosure %s is unstable
0x00bb	Caution	Enclosure %s hardware error
0x00bc	Caution	Enclosure %s not responding
0x00bd	Info	SAS/SATA mixing not supported in enclosure; PD %s disabled
0x00be	Info	Enclosure (SES) hotplug on %s was detected, but is not supported
0x00bf	Info	Clustering enabled
0x00c0	Info	Clustering disabled
0x00c1	Info	PD too small to be used for auto-rebuild on %s
0x00c2	Info	BBU enabled; changing WT virtual disks to WB
0x00c3	Warning	BBU disabled; changing WB virtual disks to WT
0x00c4	Warning	Bad block table on PD %s is 80% full
0x00c5	Fatal	Bad block table on PD %s is full; unable to log block %lx
0x00c6	Info	Consistency Check Aborted due to ownership loss on %s
0x00c7	Info	Background Initialization (BGI) Aborted Due to Ownership Loss on %s
0x00c8	Caution	Battery/charger problems detected; SOH Bad
0x00c9	Warning	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); warning threshold exceeded
0x00ca	Caution	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); critical threshold exceeded
0x00cb	Caution	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); further reporting disabled
0x00cc	Caution	Enclosure %s Power supply %d switched off
0x00cd	Info	Enclosure %s Power supply %d switched on
0x00ce	Caution	Enclosure %s Power supply %d cable removed
0x00cf	Info	Enclosure %s Power supply %d cable inserted
0x00d0	Info	Enclosure %s Fan %d returned to normal

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x00d1	Info	BBU Retention test was initiated on previous boot
0x00d2	Info	BBU Retention test passed
0x00d3	Caution	BBU Retention test failed!
0x00d4	Info	NVRAM Retention test was initiated on previous boot
0x00d5	Info	NVRAM Retention test passed
0x00d6	Caution	NVRAM Retention test failed!
0x00d7	Info	%s test completed %d passes successfully
0x00d8	Caution	%s test FAILED on %d pass. Fail data: errorOffset=%x goodData=%x badData=%x
0x00d9	Info	Self check diagnostics completed
0x00da	Info	Foreign Configuration Detected
0x00db	Info	Foreign Configuration Imported
0x00dc	Info	Foreign Configuration Cleared
0x00dd	Warning	NVRAM is corrupt; reinitializing
0x00de	Warning	NVRAM mismatch occurred
0x00df	Warning	SAS wide port %d lost link on PHY %d
0x00e0	Info	SAS wide port %d restored link on PHY %d
0x00e1	Warning	SAS port %d, PHY %d has exceeded the allowed error rate
0x00e2	Warning	Bad block reassigned on %s at %lx to %lx
0x00e3	Info	Controller Hot Plug detected
0x00e4	Warning	Enclosure %s temperature sensor %d differential detected
0x00e5	Info	Disk test cannot start. No qualifying disks found
0x00e6	Info	Time duration provided by host is not sufficient for self check
0x00e7	Info	Marked Missing for %s on array %d row %d
0x00e8	Info	Replaced Missing as %s on array %d row %d
0x00e9	Info	Enclosure %s Temperature %d returned to normal

Table A-2. Event Messages *(continued)*

Number	Type	Event Text
0x00ea	Info	Enclosure %s Firmware download in progress
0x00eb	Warning	Enclosure %s Firmware download failed
0x00ec	Warning	%s is not a certified drive
0x00ed	Info	Dirty cache data discarded by user
0x00ee	Info	PDs missing from configuration at boot
0x00ef	Info	VDs missing drives and will go offline at boot: %s
0x00f0	Info	VDs missing at boot: %s
0x00f1	Info	Previous configuration completely missing at boot
0x00f2	Info	Battery charge complete
0x00f3	Info	Enclosure %s fan %d speed changed
0x0128	Info	Cache discarded on offline virtual disk. When a VD with cached data goes offline or missing during runtime, the cache for the VD is discarded. Because the VD is offline, the cache cannot be saved.
0x27	Info	Patrol read disabled. This event message is returned when you try to start patrol read when patrol read is not enabled.
0x4008	Caution	An attempt to make an offline drive online on the SAS 5/iR RAID controller failed.
0x821a	Info	The maximum number of logical drives has been configured.

Glossary

Access Policy

A virtual disk property indicating what kind of access is allowed for this virtual disk. The possible values are *Read/Write*, *Read Only*, or *Blocked*.

adapter

A device that enables a computer system to access peripheral devices by converting the protocol of one bus or interface to another. An adapter can also provide specialized function. For example, a RAID controller is a type of adapter that provides RAID functions. Adapters can reside on the system board or be an add-in card. Other examples of adapters include network and SCSI adapters.

Alarm Enabled

A controller property that indicates whether the controller's onboard alarm is enabled.

Alarm Present

A controller property that indicates whether the controller has an onboard alarm. If present and enabled, the alarm is sounded for certain error conditions.

array

See *disk group*.

backplane

A hardware component that connects a primary controller board to peripheral devices, such as disk drives, and that typically provides the signal and power connections to the peripherals.

BBU Present

A controller property that indicates whether the controller has an onboard battery backup unit to provide power in case of a power failure.

BGI Rate

A controller property indicating the rate at which the background initialization of virtual disks will be carried out.

BIOS

Basic Input/Output System. The computer BIOS is stored on a flash memory chip. The BIOS controls the following: communications between the microprocessor and peripheral devices, such as the keyboard and the video adapter, and miscellaneous functions, such as system messages.

cache

Fast memory that holds recently accessed data. Use of cache memory speeds subsequent access to the same data. When data is read from or written to main memory, a copy is also saved in cache memory with the associated main memory address. The cache memory software monitors the addresses of subsequent reads to see if the required data is already stored in cache memory. If it is already in cache memory (a cache hit), it is read from cache memory immediately and the main memory read is aborted (or not started). If the data is not cached (a cache miss), it is fetched from main memory and saved in cache memory.

Cache Flush Interval

A controller property that indicates how often the data cache is flushed.

caching

The process of using a high speed memory buffer to speed up a computer system's overall read/write performance. The cache can be accessed at a higher speed than a disk subsystem. To improve read performance, the cache usually contains the most recently accessed data, as well as data from adjacent disk sectors. To improve write performance, the cache can temporarily store data in accordance with its write back policies.

Coerced Size

A physical drive property indicating the size to which a disk drive has been coerced (forced) to make it compatible with other disk drives that are nominally the same size. For example, a 4 Gbyte drive from one manufacturer might be 4,196 Mbytes, and a 4 Gbyte drive from another manufacturer might be 4,128 Mbytes. These drives could be coerced to a usable size of 4,088 Mbytes each for use in a disk group in a storage configuration.

Coercion Mode

A controller property indicating the size to which disk drives of nominally identical capacity are coerced (forced) in order to make them usable in a storage configuration.

consistency check

An operation that verifies that all stripes in a virtual disk with a redundant RAID level are consistent and that automatically fixes any errors. For RAID 1 disk groups, this operation verifies correct mirrored data for each stripe.

Consistency Check Rate

The rate at which consistency check operations are run on a computer system.

controller

A chip that controls the transfer of data between the microprocessor and memory or between the microprocessor and a peripheral device such as a physical disk. RAID controllers perform RAID functions such as striping and mirroring to provide data protection. Dell SAS RAID Storage Manager runs on the Dell PERC 5/i, PERC 6/i, SAS 5/iR, and SAS 6/iR controllers.

Current Write Policy

A virtual disk property that indicates whether the virtual disk currently supports *Write back* or *Write through* mode.

- In Write back mode the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction.
- In Write through mode the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction.

Default Write Policy

A virtual disk property indicating whether the default write policy is *Write through* or *Write back*. In Write back mode the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In Write through mode the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction.

device driver

Software that allows the operating system to control a device such as a printer. Many devices do not work properly if the correct driver is not installed in the computer.

Device ID

A controller or physical disk property indicating the manufacturer-assigned device ID.

Device Port Count

A controller property indicating the number of ports on the controller.

Disk Cache Policy

A virtual disk property indicating whether the virtual disk cache is enabled, disabled, or unchanged from its previous setting.

disk group

A logical grouping of disks attached to a RAID controller on which one or more virtual disks can be created, such that all virtual disks in the disk group use all of the physical disks in the disk group.

disk subsystem

A collection of disks and the hardware that controls them and connects them to one or more controllers. The hardware can include an intelligent controller, or the disks can attach directly to a system I/O bus controller.

fast initialization

A mode of initialization that quickly writes zeroes to the first and last sectors of the virtual disk. This allows you to start writing data to the virtual disk immediately while the initialization is running in the background.

fault tolerance

Fault tolerance is the capability of the disk subsystem to undergo a single drive failure per disk group without compromising data integrity and processing capability. RAID levels 1, 5, 6, 10, 50, and 60 are fault tolerant.

firmware

Software stored in read-only memory (ROM) or Programmable ROM (PROM). Firmware is often responsible for the behavior of a system when it is first turned on. A typical example would be a monitor program in a system that loads the full operating system from disk or from a network and then passes control to the operating system.

foreign configuration

A RAID configuration that already exists on a replacement set of physical disks that you install in a computer system. Dell SAS RAID Storage Manager allows you to import the existing configuration to the RAID controller, or you can clear the configuration so you can create a new one.

formatting

The process of writing a specific value to all data fields on a physical disk, to map out unreadable or bad sectors. Because most physical disks are formatted when manufactured, formatting is usually done only if a physical disk generates many media errors.

hole

In Dell SAS RAID Storage Manager a *hole* is a block of empty space in a disk group that can be used to define a virtual disk.

Host Interface

A controller property indicating the type of interface used by the computer host system: for example, *PCIX*.

Host Port Count

A controller property indicating the number of host data ports currently in use.

host system

Any computer system on which the controller is installed. Mainframes, workstations, and standalone desktop systems can all be considered host systems.

hotspare

A standby physical disk that can automatically replace a failed physical disk in a virtual disk and prevent data from being lost. A hotspare can be dedicated to a single redundant disk group or it can be part of the global hotspare pool for all disk groups controlled by the controller.

When a physical disk fails, Dell SAS RAID Storage Manager automatically uses a hotspare to replace it and then rebuilds the data from the failed physical disk to the hotspare. Hotspares can be used in RAID 1, RAID 5, and RAID 10 storage configurations.

initialization

The process of writing zeros to the data fields of a virtual disk and, in fault-tolerant RAID levels, generating the corresponding parity to put the virtual disk in a Ready state. Initialization erases all previous data on the physical disks. Disk groups will work without initializing, but they can fail a consistency check because the parity fields have not been generated.

library

A software component that provides a variety of related functions available to be used by other software modules.

IO Policy

A virtual disk property indicating whether Cached IO or Direct IO is being used. In Cached IO mode, all reads are buffered in cache memory. In Direct IO mode, reads are not buffered in cache memory. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. (The IO Policy applies to reads on a specific logical drive. It does not affect the Read-ahead cache.)

Media Error Count

A physical drive property indicating the number of errors that have been detected on the disk media.

migration

The process of moving virtual disks and hotspare disks from one controller to another by disconnecting the physical disks from one controller and attaching them to another one. The firmware on the new controller will detect and retain the virtual disk information on the physical disks.

mirroring

The process of providing complete data redundancy with two physical disks by maintaining an exact copy of one disk's data on the second physical disk. If one physical disk fails, the contents of the other physical disk can be used to maintain the integrity of the system and to rebuild the failed physical disk.

Name

A virtual disk property indicating the user-assigned name of the virtual disk.

non-redundant configuration

A non-redundant configuration is a RAID 0 virtual disk with data striped across two or more physical disks, but without disk mirroring or parity. This provides for high data throughput but offers no protection in case of a physical disk failure.

NVRAM

Acronym for non-volatile random access memory. A storage system that does not lose the data stored on it when power is removed. NVRAM is used to store firmware and configuration data on the RAID controller.

NVRAM Present

A controller property indicating whether an NVRAM is present on the controller.

NVRAM Size

A controller property indicating the size of the controller's NVRAM.

offline

A physical disk is offline when it is part of a virtual disk but its data is not accessible to the virtual disk.

patrol read

A process that checks the physical disks in a storage configuration for physical disk errors that could lead to drive failure and lost data. The patrol read operation can find and sometimes fix any potential problem with physical disks prior to host access. This enhances overall system performance because error recovery during a normal I/O operation might not be necessary.

patrol read rate

The user-defined rate at which patrol read operations are run on a computer system.

physical disk (PD)

A non-volatile, randomly addressable device for storing data. Physical disks are rewritable and commonly referred to as disk drives.

Physical Drive State

A physical drive property indicating the status of the drive. A physical disk can be in one of the following states:

- Un-configured Good: A disk accessible to the RAID controller but not configured as a part of a virtual disk or as a hotspare.
- Hot Spare: A physical disk that is configured as a hotspare.
- Online: A physical disk can be accessed by the RAID controller and will be part of the virtual disk.
- Rebuild: A physical disk to which data is being written to restore full redundancy for a virtual disk.
- Failed: A physical disk that was originally configured as Online or Hot Spare, but on which the firmware detects an unrecoverable error.
- Un-configured Bad: A physical disk on which the firmware detects an unrecoverable error; the physical disk was Un-configured Good or the physical disk could not be initialized.
- Missing: A physical disk that was Online, but which has been removed from its location.
- Offline: A physical disk that is part of a virtual disk but which has invalid data as far as the RAID configuration is concerned.
- None: A physical disk with the unsupported flag set. An Un-configured Good or Offline physical disk that has completed the prepare for removal operation.

Physical Drive Type

A physical drive property indicating the characteristics of the drive.

Product Info

A physical disk property indicating the vendor-assigned model number of the drive.

Product Name

A controller property indicating the manufacturing name of the controller.

RAID

A group of multiple, independent disk drives that provide high performance by increasing the number of disks used for saving and accessing data. A RAID disk group improves input/output (I/O) performance and data availability. The group of disk drives appears to the host system as a single storage unit or as multiple logical disks. Data throughput improves because several physical disks can be accessed simultaneously. RAID configurations also improve data storage availability and fault tolerance. Redundant RAID levels (RAID levels 1, 5, 6, 10, 50, and 60), provide data protection.

RAID 0

RAID 0 uses data striping on two or more disk drives to provide high data throughput, especially for large files in an environment that requires no data redundancy. The PERC 5/i, PERC 6/i, SAS 5/iR, and SAS 6/iR controllers support RAID 0.

RAID 1

RAID 1 uses data mirroring on a pair of disk drives so that data written to one physical disk is simultaneously written to the other physical disk. RAID 1 works well for small databases or other small applications that require complete data redundancy. The PERC 5/i, PERC 6/i, SAS 5/iR, and SAS 6/iR controllers support RAID 1.

RAID 5

RAID 5 uses data striping and parity data across three or more disk drivers (distributed parity) to provide high data throughput and data redundancy, especially for applications that require random access. The PERC 5/i controller and the PERC 6/i controller support RAID 5.

RAID 6

RAID 6 uses data striping and dual parity across four or more disks (distributed parity) to provide high data throughput and data redundancy especially for applications that require random access. RAID 6 can survive the failure of two disk drives. The PERC 6/i controller supports RAID 6.

RAID 10

RAID 10, a combination of RAID 0 and RAID 1, uses data striping across mirrored spans. It provides high data throughput and complete data redundancy. The PERC 5/i controller and the PERC 6/i controller support RAID 10.

RAID 50

A combination of RAID 0 and RAID 5 that uses data striping across two disk groups with parity data. It provides high data throughput and complete data redundancy. The PERC 5/i controller and the PERC 6/i controller support RAID 50.

RAID 60

A combination of RAID 0 and RAID 6 that uses data striping across two disk groups with parity data. It provides high data throughput and complete data redundancy. RAID 60 can survive the failure of two disk drives in each RAID set in the spanned array. The PERC 6/i controller supports RAID 60.

RAID Level

A set of techniques applied to disk groups to deliver higher data availability, and/or performance characteristics to host environments. Each virtual disk must have a RAID level assigned to it. A virtual disk property indicating the RAID level of the virtual disk. Dell PERC 5/i controllers support RAID levels 0, 1, 5, 10, and 50. Dell PERC 6/i controllers support RAID levels 0, 1, 5, 6, 10, 50, and 60. The Dell SAS 5/iR controller and the Dell SAS 6/iR controller support RAID levels 0 and 1.

Raw Size

A physical drive property indicating the actual full size of the drive, before any Coercion Mode is applied to reduce the size.

Read Policy

A controller attribute indicating the current read policy mode. In *Always read ahead* mode, the controller reads sequentially ahead of requested data and stores the additional data in cache memory, anticipating that the data will be needed soon. This speeds up reads for sequential data, but there is little improvement when accessing random data. In *No read ahead* mode, read-ahead capability is disabled. In A*daptive read ahead* mode, the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If the read requests are random, the controller reverts to *No read ahead* mode.

rebuild

The regeneration of all data to a replacement disk in a redundant virtual disk after a physical disk failure. A disk rebuild normally occurs without interrupting normal operations on the affected virtual disk, though some degradation of performance of the disk subsystem can occur.

rebuild rate

The percentage of central processing unit (CPU) resources devoted to rebuilding data onto a new physical disk after a disk in a storage configuration has failed.

reclaim virtual disk

A method of undoing the configuration of a new virtual disk. If you highlight the virtual disk in the Configuration Wizard and click the **Reclaim** button, the individual disk drives are removed from the virtual disk configuration.

reconstruction rate

The user-defined rate at which a reconstruct operation is carried out.

redundancy

A property of a storage configuration that prevents data from being lost when one physical disk fails in the configuration.

redundant configuration

A virtual disk that has redundant data on physical disks in the disk group that can be used to rebuild a failed physical disk. The redundant data can be parity data striped across multiple physical disks in a disk group, or it can be a complete mirrored copy of the data stored on a second physical disk. A redundant configuration protects the data in case a physical disk fails in the configuration.

Revision Level

A physical disk property that indicates the revision level of the disk's firmware.

SAS

Serial Attached SCSI. SAS is a serial, point-to-point, enterprise-level device interface that leverages the Small Computer System Interface (SCSI) protocol set. The SAS interface provides improved performance, simplified cabling, smaller connectors, lower pin count, and lower power requirements when compared to parallel SCSI.

SATA

Acronym for Serial Advanced Technology Attachment. A physical storage interface standard. SATA is a serial link that provides point-to-point connections between devices. The thinner serial cables allow for better airflow within the system and permit smaller chassis designs.

SCSI Device Type

A physical drive property indicating the type of the device, such as *Disk Drive*.

Serial No.

A controller property indicating the manufacturer-assigned serial number.

Size

A virtual disk property indicating the amount of storage space on the virtual disk.

Stripe Size

A virtual disk property indicating the data stripe size used in the virtual disk. For storage configurations on Dell PERC 5/i controllers and Dell PERC 6/i controllers, the stripe size is user-selectable.

striping

A technique used to write data across all physical disks in a virtual disk. Each stripe consists of consecutive virtual disk data addresses that are mapped in fixed-size units to each physical disk in the virtual disk using a sequential pattern. For example, if the virtual disk includes five physical disks, the stripe writes data to physical disks one through five without repeating any of the physical disks. The amount of space consumed by a stripe is the same on each physical disk. Striping by itself does not provide data redundancy. Striping in combination with parity does provide data redundancy.

SubVendor ID

A controller property that lists additional vendor ID information about the controller.

Uncorrectable Error Count

A controller property that lists the number of uncorrectable errors detected on physical disks connected to the controller. If the error count reaches a certain level, a physical disk will be marked as *Failed*.

Vendor ID

A controller property indicating the vendor-assigned ID number of the controller.

Vendor Info

A physical drive property listing the name of the vendor of the drive.

virtual disk (VD)

A storage unit created by a RAID controller from one or more physical disks. Although a virtual disk can be created from several physical disks, it is seen by the operating system as a single disk. Depending on the RAID level used, the virtual disk can retain redundant data in case of a disk failure.

Virtual Disk State

A virtual disk property indicating the condition of the virtual disk. Examples include *Optimal* and *Degraded*.

write-back

In write-back caching mode, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a disk write transaction. Data is written to the disk subsystem in accordance with policies set up by the controller. These policies include the amount of dirty/clean cache lines, the number of cache lines available, and elapsed time from the last cache flush.

Write Policy

See *Default Write Policy*.

write-through

In write-through caching mode, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data and has completed the write transaction to the disk.

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