Oracle® Storage 12 Gb/s SAS PCIe RAID HBA, Internal Installation Guide For HBA Models 7110116 and 7110117

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Contents

Using This Documentation

- **Overview** – Describes how to troubleshoot and maintain the Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal
- **Audience** – Technicians, system administrators, and authorized service providers
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware

Product Documentation Library

Documentation and resources for this product and related products are available at https://docs.oracle.com/cd/E52363_01/index.html.

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♦ ♦ ♦ CHAPTER 1

HBA Overview

This chapter provides an overview of the internal Oracle Storage 12 Gigabit per second (Gb/s) Serial Attached SCSI/SATA (SAS) PCI Express (PCIe) RAID host bus adapter (HBA), which uses Broadcom technology. The chapter also describes the various operating systems, host platforms, storage, and infrastructure configurations that support the HBA.

This chapter contains the following topics:

Ship Kit Contents

- Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal, with a standard, low-profile bracket installed
- *Accessing Documentation* document

HBA Features

The internal Oracle Storage 12 Gb/s SAS PCIe RAID HBA (7110116, 7110117) is a low-profile, PCI Express 3.0 RAID controller that supports eight internal 12 Gb/s SAS/SATA ports through two SFF-8643 x4 internal mini-SAS HD connectors.

Note - SATA II is the only type of SATA supported by this HBA.

Data that is cached on the HBA is protected, in the event of a power failure, by the CacheVault (a super capacitor and flash combination that is installed on the HBA at the factory). If the CacheVault needs to be replaced, for any reason, you can remove the faulty CacheVault from the HBA and obtain a replacement CacheVault from Oracle. For more information about the CacheVault, refer to the Broadcom document, *LSICVM02 Kit Quick Installation Guide*, located at the Broadcom web site: `https://docs.broadcom.com/docs/54063-00`

The HBA supports the following features:

- Two SAS3, x4 internal mini-SAS HD connectors
- PCI Express host interface, as defined in the *PCI Express Card Specification*, version 3.0
- SAS3 12-Gb/s target interface
- PCI Express 3.0 x8 lane width up to 8 Gt/s per lane
- High performance through the MegaRAID Firmware Interface (MFI) architecture
- High throughput and low CPU utilization to offload the host processor
- Boot support for all supported operating systems (OSs) (see "Boot Support" on page 16)

RAID Features

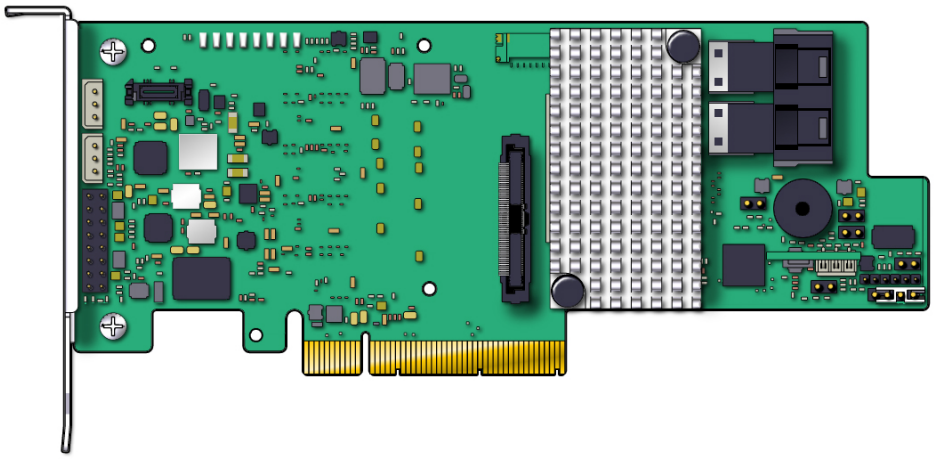
The following are the RAID features supported by the HBA:

- Full-featured, hardware-based RAID implementation
- Integration of a high-speed 1 Gbyte DDR/DDR2 800-MHz on-board SDRAM interface with a hardware RAID assist exclusive-OR (XOR) engine
- Data striping across multiple drives
- Data mirroring or parity block for backing up data
- Support for RAID levels 0, 1, 5, 6, 10, 50, and 60, with a minimum of 1 Gb data cache
- Support for, at minimum, a 72-bit DDR3 memory interface
- Built-in Flash Controller for direct Flash backup from DDR memory
- Support for T10 EEDP (and DIX)
- Dual firmware image (active/backup)
- Support for up to 32 drives in a RAID volume
- Support for several RAID stripe sizes
- Load balancing
- Path failover
- Online RAID level migration

- Drive migration and roaming
- Media scan
- No reboot necessary after expansion
- User-configurable rebuild rate
- 32-Kbyte nonvolatile random access memory (NVRAM) for storing RAID system configuration information; the MegaRAID SAS firmware is stored in flash ROM for easy upgrade

Figure 1, “Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal,” on page 13 shows the physical layout of the HBA.

FIGURE 1 Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal



Valid Drive Mix Configurations With HDDs and SSDs

This HBA supports connectivity using labeled SATA II drives, SAS drives, or both. The following are some basic rules about the types of drives you can use:

- **Within a logical volume:**
  - You can mix SAS and SATA drives [either all solid state drives (SSDs) or all hard disk drives (HDDs)].

Note - Though it is possible to mix SAS and SATA drives in a single RAID volume, Oracle does not support this configuration as it might cause performance issues with the drives.

  - You cannot mix HDDs and SSDs of any type.
- **Within an enclosure (SAS expander or direct-connect SAS cable)**, you can mix any drive types, subject to any restrictions imposed by the enclosure.

Operating System and Technology Requirements

The HBA requires the operating system (OS) and technology levels, at minimum, listed in the following table.

Note - If you need to contact Oracle Support, first verify that you have a supported OS installed on the host system, and install the latest HBA driver, utility, and firmware versions. Updating the system and HBA to the latest OS, driver, utility, and firmware versions might address the issue, preventing the need to contact Oracle Support about an issue that has already been fixed.

TABLE 1 Supported Operating System/Technology Versions

Operating System/Technology	Recommended Versions (minimum)
Oracle Solaris OS for the x86 (64-bit) platform	■ Oracle Solaris 11.3 ■ Oracle Solaris 11.2 with SRU5, if the Oracle Solaris OS is ordered To obtain the latest SRUs, go to `https://support.oracle.com` **Note -** The MegaRAID Storage Manager (MSM) software is not supported with the Oracle Solaris OS.
Linux OS (64-bit)	■ Oracle Linux 7.2 with Unbreakable Enterprise Kernel (UEK) 4 ■ Oracle Linux 6.5 with Unbreakable Enterprise Kernel (UEK) Release 3 (R3) ■ Red Hat Enterprise Linux (RHEL) 6.8 ■ SUSE Linux Enterprise Server (SLES) 11 SP3
Virtual Machine Technology	■ Oracle VM 3.4.2
Microsoft Windows OS (64-bit)	■ Windows Server 2012 R2 Enterprise and Standard Server ■ Windows Server 2012 Enterprise and Standard Server
VMware Technology	■ VMware ESXi 5.5

System Interoperability

This section provides host platform, storage, and software support information. This section contains the following topics:

Host Platform Support

The HBA is supported by the platforms listed in Table 2, "Host Platform Support," on page 15. For the latest information, refer to the product notes for your system.

For supported operating system and technology versions, see Table 1, "Supported Operating System/Technology Versions ," on page 14.

TABLE 2 Host Platform Support

Platform	Supported OS/Technology
Oracle Server X5-2 and X5-2L	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware
Oracle Server X5-4	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware
Oracle Server X5-8	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware
Oracle Server X6-2, X6-2L, and X6-2M	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware
Netra Server X5-2	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware
Netra T7	Oracle Solaris, Oracle Linux, Oracle VM, Linux, Windows, VMware

Storage System Support

Internal disk drives are the only storage supported by the HBA.

Software Support

Install, Flash, and BIOS configuration utilities are provided. The HBA uses the MegaRAID Firmware Interface (MFI) architecture for all major operating systems, which allows for thinner drivers for better performance. To obtain a device driver that supports your operating system, go to: `https://www.broadcom.com/support/oem/oracle/`

Use the MegaRAID SAS Software to manage the HBA upon installation. For more information, see the *12 Gb/s MegaRAID SAS Software User's Guide* at: `https://www.broadcom.com/support/oem/oracle/`

Boot Support

Booting through the HBA is supported in the following operating system and technology environments:

- Oracle Solaris 11.2 OS with SRU5 for the x86 platform, if the Oracle Solaris OS is ordered.
- Oracle Linux 7 OS
- Oracle Linux 6.5 OS
- Oracle VM 3.3 technology
- Red Hat Enterprise Linux (RHEL) 6.5 OS
- SUSE Linux Enterprise Server (SLES) 11 SP3 OS
- Windows Server 2012 R2 OS
- Windows Server 2012 OS

Note - Immediately after HBA installation, Windows Server 2012 and 2012 R2 drivers must be upgraded to `MegaSAS2` version 6.702.04.00 or later. For more information, see Chapter 4, “HBA Software Installation”.

- VMware ESXi 5.5 technology

Note - Immediately after HBA installation, VMware ESXi 5.5 drivers must be upgraded to `scsi-megaraid-sas` version 6.603.53.00-1OEM or later. For more information, see Chapter 4, “HBA Software Installation”.

♦ ♦ ♦ CHAPTER 2

Hardware Installation and Removal

This chapter describes how to install and remove the HBA. For detailed instructions, see your storage system installation or service guide and the installation guide for the storage devices to be connected to the HBA.

This chapter contains the following topics:

Observing ESD and Handling Precautions

Caution - Damage to the HBA can occur as the result of careless handling or electrostatic discharge (ESD). Always handle the HBA with care to avoid damage to electrostatic-sensitive components.

To minimize the possibility of ESD-related damage, use both a workstation antistatic mat and an ESD wrist strap. You can get an ESD wrist strap from any reputable electronics store or from Oracle as part number 250-1007.

Observe the following precautions to avoid ESD-related problems:

- Leave the HBA in its antistatic bag until you are ready to install it in the system.
- Always use a properly fitted and grounded wrist strap or other suitable ESD protection when handling the HBA and observe proper ESD grounding techniques.
- Always hold the HBA by the metal enclosure.
- Place the HBA on a properly grounded antistatic work surface pad when it is out of its protective antistatic bag.

Best Practices for HBA Installation

Follow these general best practices for installing and configuring the HBA:

- If more than one HBA model is present in the configuration, enable only the OptionROM (OpROM) for the first HBA seen in the boot sequence. There is a limited amount of space for OpROMs; therefore, do *not* unnecessarily enable all OpROMs, as space usage issues might occur.
- When installing the HBA, be sure to also install the latest version of the command-line utility available from the manufacturer's web site. Keep the HBA utilities, firmware, and drivers up-to-date, and update them in that order.

Installing the HBA

This section provides the following procedures:

▼ To Prepare for Hardware Installation

1. **Read and observe the safety information for this product.**
   See the *Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal Safety and Compliance Guide* at: `https://docs.oracle.com/cd/E52363_01/index.html`.

2. **Familiarize yourself with the physical features of the HBA and the RAID levels that it supports.**

3. **Ensure that you have the right quantity of initialized disk drives for the RAID level you want to use for the arrays.**
   For optimal performance, use drives of the same type, speed, and size when you create virtual drives. You can use different-sized disk drives in the array, but the array will be limited to the capacity of the smallest and slowest disk drive.
   For more information, refer to the *12 Gb/s MegaRAID SAS Software User's Guide* at: `https://www.broadcom.com/support/oem/oracle/`
   The HBA supports both SAS and SATA II disk drives.

4. **Ensure that you have the proper cables for the HBA and the internal disk drives.**

   You will need at least one, straight mini-SAS HD cable that has a SFF-8643 x4 connector on the host end that will connect to the HBA (the connector on the target end depends on the connection requirement of the hard disk drive enclosure).

   Use only Oracle-provided SAS cables (provided with your Oracle system at time of purchase). For more information or to purchase cables for your Oracle system, visit `https://shop.oracle.com/pls/ostore/f?p=dstore:2:0::NO:RIR,RP,2:PROD_HIER_ID:3687054182480918651799 76`. Cable connectors are keyed so that you cannot insert them incorrectly.

5. **Unpack the box containing the HBA in a static-free environment and inspect it for damage.**

   Note - Leave the HBA in the protective bag until you are ready to install it. If there is damage, contact Oracle customer support.

6. **Refer to your system installation guide or service manual for instructions on how to remove the system cover, disconnect the AC power cords, and turn off power from the system, if required.**

▼ To Install the HBA

1. **Attach an antistatic wrist strap and remove the HBA from its protective bag.**

   See "Observing ESD and Handling Precautions" on page 17.

2. **If a removable memory option is present, ensure that the module is seated firmly in the dual-inline memory module (DIMM) socket.**

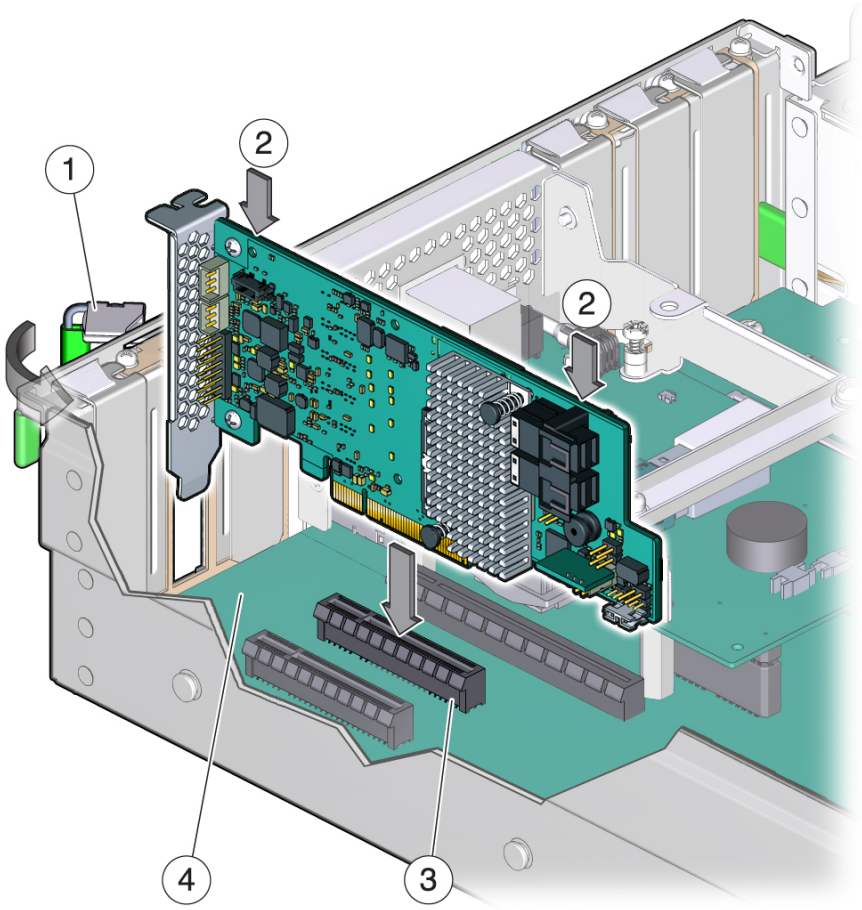
   Note - This HBA has on-board, 72-bit direct DDR-3 memory.

3. **Refer to the installation guide or service manual for your particular system for instructions on how to locate an available PCIe slot in the system.**

4. **Align the PCIe bus connector of the HBA to the PCIe slot.**

   Note - Some PCIe slots support PCIe graphics cards only; if the HBA is installed in one of those PCIe slots, the HBA will not function.

5. **Press down gently and firmly to seat the HBA in the PCIe slot, and then secure the bracket to the system chassis with the retention clip (see the following figure).**



Callout	Description
1	Retention clip
2	Press down here, on the edge by the internal ports.
3	PCIe slot
4	Motherboard

Note - The configuration of the enclosure might not be the same as shown in this illustration.

▼ To Connect the HBA to Internal Storage Devices

1. **Install and configure the SAS devices, SATA II devices, or both in the system.**

   For more information, see the documentation for the devices.

2. **Connect the SFF-8643 x4 Mini SAS HD connector on one end of the SAS cable to an internal port.**

   Use only Oracle-provided SAS cables (provided with your Oracle system at time of purchase). The cables are also available for purchase at: `https://shop.oracle.com/pls/ostore/f?p=dstore:2:0::NO:RIR,RP,2:PROD_HIER_ID:368705418248091865179976`

3. **Connect the other end of the SFF-8643 x4 Mini SAS HD cable to the connector on the SAS drive or SATA drive.**

Note - You can connect one device per SAS PHY unless you use an expander.

▼ To Complete the Installation

1. **Replace the system cover and reconnect the AC power cords, if required, as described in the system documentation.**

2. **If you needed to turn the system power off to install the HBA, power on the system.**

Note - If you do need to return power to the system, ensure that the power is turned on to the SAS devices, SATA II devices, or both before or at the same time that the power is turned on to the host system. If the system is powered up before these devices, the devices might not be recognized.

3. **If you need to install an OS on your system, complete the procedures in Chapter 3, "Creating a Bootable Drive in a Preboot Environment " and then go to the next step.**

4. **If you already have an OS installed on an x86 system, do the following:**

   a. **During the power-up process of the system, review the BIOS bootup messages to ensure that you are prompted for the BIOS Setup utility (which prompts you to press `CTRL+R`).**

      If you are prompted for this utility, the BIOS has detected the HBA card.

   b. **Go to the Oracle support area of the Broadcom web site (`https://www.broadcom.com/support/oem/oracle/`) and download the MegaRAID Storage Manager software and the StorCLI utility software, along with supporting documentation.**

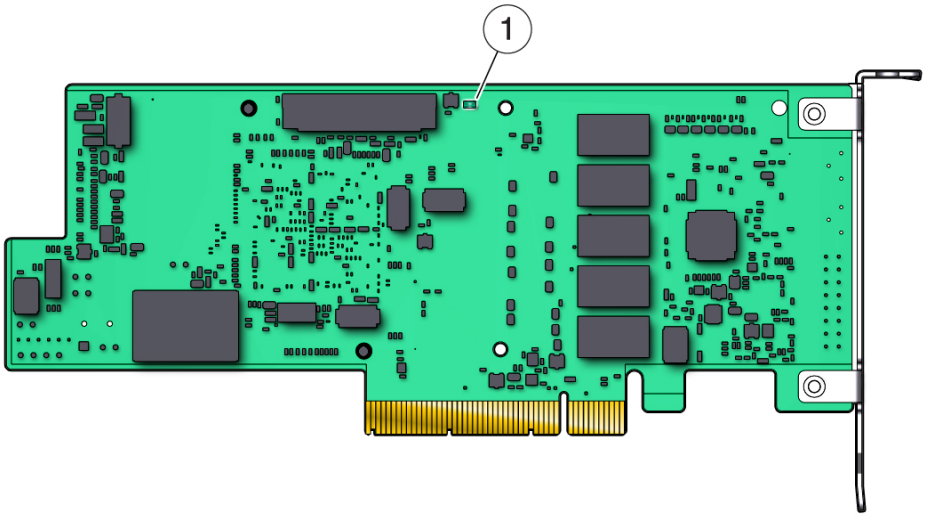
   c. **Install the MegaRAID software and StorCLI software on the system that will manage your storage.**

   d. **From the MegaRAID Storage Manager software or the `StorCLI` utility, create logical drives for the HBA.**

HBA LEDs

The HBA has one, System Heartbeat LED that is visible. Figure 2, “HBA LED,” on page 23 shows the LED.

FIGURE 2 HBA LED



A green System Heartbeat LED (CRT4B1) indicates that the SAS3108 RAID-on-chip (ROC) ASIC is operating normally.

The different states of the System Heartbeat LED are listed in the following table.

TABLE 3 System Heartbeat LED and System Error Status LED

State	Meaning
Off	The ASIC on the HBA is not operating normally.
Blinking	The ASIC on the HBA is operating normally.

Next Steps

If you are using the Oracle Solaris OS, the installation is complete. You can obtain the latest SRUs for the Oracle Solaris OS at: `https://support.oracle.com`

If you are using a supported operating system other than the Oracle Solaris OS, install the HBA driver for your operating system, as described in Chapter 4, “HBA Software Installation”.

Removing the HBA

If you need to remove the HBA from the system, follow the procedure in this section.

▼ To Remove the HBA

1. **Prepare your operating system for HBA removal.**
2. **Attach an antistatic wrist strap.**
   See “Observing ESD and Handling Precautions” on page 17.
3. **Refer to the service manual for your specific system to remove the system cover, power down the system, and remove AC power cords from the system, if required.**
4. **Refer to the service manual for your specific system to locate the HBA in the chassis of the system.**
5. **Disengage the retention clip that is securing the HBA to the chassis of the system and pull up carefully to unseat the HBA from the PCIe slot.**
6. **Detach all cables from the HBA.**
7. **Refer to the service manual for your specific system to reattach the system cover, reinstall AC power cords to the system, and power on the system, as necessary.**

♦ ♦ ♦ CHAPTER 3

Creating a Bootable Drive in a Preboot Environment

This chapter describes how to use the HBA for your boot device prior to installing an operating system (OS) on the system.

Note - If you are installing the HBA into a system that already has an OS installed, do not perform any tasks in this chapter. Instead, complete the HBA installation, as described in "To Complete the Installation" on page 21.

This chapter contains the following topics:

About Creating a Bootable Drive in a Preboot Environment

As an installation option, you can choose to install the HBA into a system that does not yet have an OS installed. With this installation option, if you plan to use the HBA as your boot device, you can create a logical drive for the HBA to enable you to boot from the HBA. On a SPARC system, you would perform these actions through the Preboot Command-Line Interface (`pcli`) utility. On an x86 system, you would do so either through the Unified Extensible Firmware Interface (UEFI) MegaRAID Configuration menu of the BIOS Setup utility (UEFI booting) or, if your system is set to Legacy BIOS booting, through BIOS Configuration Utility.

This section contains the following topics:

- "Methods For Creating a Bootable Drive" on page 26

Utilities Overview

You can specify the HBA to be your boot device by using one of these utilities:

- `pcli` **utility** - A utility that you can run on SPARC systems. You can access this utility by issuing a break at a remote console. This utility is an implementation of RAID commands that you can execute from the Open Boot Prom (OBP) environment. Creating a logical drive through the `pcli` utility enables the HBA to expose the drive to the system.

  The command-set of the `pcli` utility is identical to the command-set of the `storcli` utility. Therefore, to help determine the syntax and structure of the `pcli` commands referenced in this chapter, review the equivalent `storcli` commands, as described in the *MegaRAID SAS Software User's Guide*, located at: `https://www.broadcom.com/support/oem/oracle/`
- **LSI MegaRAID Configuration Utility menu of the BIOS Setup Utility** – A utility that you can run on an x86 system only if you have set your system BIOS to boot in Unified Extensible Firmware Interface (UEFI) Boot Mode (which you can specify through the Boot menu of the BIOS Setup Utility). You can access this utility by pressing F2, when prompted during bootup, and then using the right arrow key to navigate to the Advanced tab and then to the LSI MegaRAID Configuration Utility menu option near the bottom of the screen. The MegaRAID Configuration Utility menu provides a standard environment for booting an operating system, managing physical disks and RAID volumes, and running preboot applications.

  Note - Some operating system versions do not support UEFI Boot Mode. For information about whether your operating system supports UEFI Boot Mode, see your system and operating system documentation.

- **BIOS Configuration Utility** – A legacy utility that you can run on an x86 system only if you have set your system BIOS to boot in Legacy Boot Mode. You can access this utility by typing **`Ctrl+R`** during system bootup. This utility consists of a graphical user interface (GUI) that enables you to manage physical disks and logical drives that you have created. Use this utility to specify the boot drive for your x86 system.

Methods For Creating a Bootable Drive

You must perform different procedures in this chapter, based on the type of system in which you are installing the HBA:

- **If you are installing the HBA into a SPARC system**, go to “Creating a Bootable Drive (SPARC)” on page 27.
- **If you are installing the HBA into an x86 system**, go to “Creating a Bootable Drive (x86)” on page 32.

Creating a Bootable Drive (SPARC)

This section describes how to create or import a logical drive and then create an alias for that drive on a SPARC system. You can then use the logical drive as your boot drive upon which to install the Oracle Solaris OS. If you are an x86 system user, do not perform the steps in this section. Instead, go to “Creating a Bootable Drive (x86)” on page 32.

This section contains the following topics:

▼ To Create a Bootable Drive (SPARC)

- **Do one of the following:**

  - **Create a logical drive, as described in “Using the `pcli` Utility to Create a Bootable Drive (SPARC) ” on page 27.**

    Or:

  - **Import a logical drive configuration from a different MegaRAID controller, as described in “Importing an Existing Logical Drive Configuration (SPARC)” on page 32.**

Using the `pcli` Utility to Create a Bootable Drive (SPARC)

This section describes how to use the `pcli` utility to create a logical drive on a SPARC system prior to installing the Oracle Solaris operating system (OS). This section contains the following topics:

▼ To Prepare to Use the pcli Utility

1. **Open an xterm or a gnome terminal window.**
   pcli commands can produce large amounts of detailed output. The xterm and gnome terminal windows provide scroll bar functionality, which helps with viewing such output.

   Note - If you do not have access to a terminal window with scroll bars, such as the xterm or gnome windows, you can use the pcli pagination feature. This feature enables you to specify a number of lines to be printed on the screen before pausing, at which time you must hit a key to continue. For example, the following pcli command prints 20 lines at a time to the screen: `{0} ok ok cli show page 20`

   ---

2. **Enter the OBP environment by performing one of the following tasks:**
   - **Press STOP+A on a Sun keyboard from Oracle.**
   - **Issue a break from a remote console.**

3. **Use the show-devs command to list the device paths on the system and select the device path for the HBA.**

```
 {0} ok show-devs
<...>
/pci@1e,600000/pci@0/pci@3/LSI,mrsas@0
 /pci@1e,600000/pci@0/pci@3/LSI,mrsas@0/disk
 /pci@1e,600000/pci@0/pci@3/LSI,mrsas@1
<...>
```

4. **Use the select-dev command to select the HBA on which the pcli commands that you issue will operate.**

```
{0} ok " /pci@1e,600000/pci@0/pci@3/LSI,mrsas@0" select-dev
```

   You have now selected the HBA upon which all pcli commands will operate. This means you do not need to specify the HBA in any pcli command that you issue, unlike with the storcli utility. For example, if you issue the pcli command, show, the command automatically applies to the selected HBA. However, the equivalent command through the storcli utility would apply only to the card that you specify (the 0 card, as shown here):

SPARC pcli: `{0} ok cli show`

storcli: `storcli /c0 show`

5. **Review the following table for useful `pcli` commands.**

pcli Command	Description
`cli /c0/eall/sall show`	Lists all physical drives.
`cli add`	Creates a RAID logical drive.
`cli /c0/vX del`	Deletes a logical drive.
`cli /c0/vall show`	Displays information about logical drives.
`cli show`	Displays HBA configuration information.
`cli /c0/vall show`	Lists all logical drives.

You are now ready to use the `pcli` commands to create a logical drive, or MegaRAID virtual drive, on the HBA.

▼ To Create a Logical Drive With the `pcli` Utility

1. **Use the `/c0/eall/sall show` command to list all the physical drives attached to the HBA.**

Drives attached directly to the HBA are assigned an Enclosure Device ID number of 252 (only eight physical drives can be attached in this way). Drives connected to the HBA through a SAS expander or an external enclosure are assigned different Enclosure Device ID values. In the following example, the physical drive listed in the output is attached directly to the HBA (Enclosure Device ID value of 252).

```
{0} ok cli /c0/eall/sall show
Drive Information :
==================


{0} ok cli /c0/eall/sall show

  Drive Information :
  ==================

  ---------------------------------------------------------------------------
  EID:Slt DID State  DG       Size Intf Med SED PI SeSz       Model            Sp
  ---------------------------------------------------------------------------
```

```
252:0    41 UGood   0 557.861 GB SAS  HDD N   N  512B       ST360057SSUN600G  U

252:1    25 UGood   0 557.861 GB SAS  HDD N   N  512B       ST360057SSUN600G  U
```

2. **Use the `add` command to create a logical drive (MegaRAID virtual disk) from the physical disks.**

```
{0} ok cli add vd r0 drives=252:0 -- for RAID 0, with Enclosure #252 and Slot 0 --
{0} ok cli add vd r1 drives=252:0,1 -- for RAID 1, with Enclosure #252 and Slots 0 and 1 --
```

3. **Use the `format(1M)` utility to label the physical disks from which you created the logical drive.**

   All disks used by the HBA must be labeled, or contain a volume table of contents (VTOC). If you attempt to use an unlabeled disk with the HBA, the disk might not be recognized by the OS or the OS installation itself might fail. For more information about labeling disks, see the documentation for the physical disks.

4. **Create an alias for the drive, as described in "To Create an Alias for a Bootable Drive (SPARC)" on page 30.**

▼ To Create an Alias for a Bootable Drive (SPARC)

After you have created a bootable drive, as described in "To Create a Logical Drive With the `pcli` Utility " on page 29, you can create an alias for that drive. The alias helps to simplify the process of booting the drive.

1. **Issue the `show-disks` command to list the disks on the system.**

   Note that, as shown in the following example, you can determine the HBA drives by looking for the `LSI,mrsas@`*number* label, where *number* is 0 for the first HBA detected, and increments for each additional HBA detected.

```
{0} ok show-disks
<...>
a) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@0/disk
b) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@1/disk
c) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@2/disk
<...>
q) NO SELECTION
Enter Selection, q to quit:
```

2. **Select the bootable drive for which you want to create an alias.**

```
a) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@0/disk
b) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@1/disk
c) /pci@1e,600000/pci@0/pci@3/LSI,mrsas@2/disk
<...>
q) NO SELECTION
Enter Selection, q to quit: c
/pci@1e,600000/pci@0/pci@3/LSI,mrsas@2/disk has been selected.
```

3. **Issue the `nvalias` *alias-name HBA-drive-path* command to create an alias for the bootable drive that you selected in the previous step (you can press `Ctrl+Y` to paste the device path).**

   In the following example, the alias name is `mydev`.

```
{0} ok nvalias mydev /pci@1e,600000/pci@0/pci@3/LSI,mrsas@2/disk
```

4. **You can now boot from the bootable drive by using the `boot` *alias-name* command.**

```
{0} ok boot mydev
```

5. **To optionally add the bootable drive to the boot-device list and then automatically boot from the drive by controlling the boot device order, issue the following commands, as shown.**

```
{0} ok printenv boot-device
boot-device = disk0 disk1
{0} ok setenv boot-device mydev disk0
boot-device = mydev disk0
```

   In this example, the `mydev` alias is set as `disk0`, the first disk in the boot device list. This results in the automatic booting of the bootable drive, `/pci@1e,600000/pci@0/pci@3/LSI,mrsas@2/disk`.

6. **Validate the label of the bootable drive that you created (see "Validating the Label of the HBA Logical Drive" on page 57).**

Importing an Existing Logical Drive Configuration (SPARC)

Instead of creating a logical drive, as described in "Using the `pcli` Utility to Create a Bootable Drive (SPARC) " on page 27, you might need to import an existing logical drive (MegaRAID virtual disk) configuration from a different MegaRAID controller. To import an existing configuration, complete the steps in this section.

▼ To Import an Existing Logical Drive Configuration From a Different Controller (SPARC)

Note - Only MegaRAID logical drives can be imported; Integrated RAID (IR) logical drives cannot be imported.

---

1. **Issue the `/c0/fall` command to display any foreign logical volumes which might exist.**

Note - A foreign logical volume is logical volume created on a different controller, and then the logical volume disks are moved to this controller. Do not use foreign logical volumes without explicit consent from the administrator of the foreign logical volumes.

---

2. **Use the `/c0/f`*foreign-logical-volume-number* `import` command to import the logical drive to the HBA.**

   In the example below, the foreign logical volume, `2`, is specified for importing.

```
{0} ok cli /c0/f2 import
```

Creating a Bootable Drive (x86)

This section describes how to create or import a logical drive and then make that drive bootable on an x86 system. You can then use the logical drive as your boot drive upon which you can install an OS.

▼ To Create a Bootable Drive (x86)

- **Do one of the following:**

  - **If you have set your system BIOS to UEFI Boot Mode (which you can specify through the Boot menu of the BIOS Setup Utility), create a new logical drive by performing the steps in "Using the LSI MegaRAID Configuration Utility Menu to Create a Bootable Logical Drive (x86)" on page 33.**

  - **If you have set your system BIOS to Legacy Boot Mode, create a new logical drive by performing the steps "Using the BIOS Configuration Utility to Create a Bootable Logical Drive (x86)" on page 48.**

Using the LSI MegaRAID Configuration Utility Menu to Create a Bootable Logical Drive (x86)

This section describes how to use the LSI MegaRAID Configuration Utility menu in the BIOS Setup Utility to create a logical drive on an x86 system. You can then define the logical drive as bootable, and install an operating system onto that logical drive. Follow the procedures in this section if you have set your system BIOS to UEFI Boot Mode. If you have set your sytem BIOS to Legacy Boot Mode, do not perform the procedures in this section. Instead, go to "Using the BIOS Configuration Utility to Create a Bootable Logical Drive (x86)" on page 48.

Before performing the steps in this section, verify the firmware level on the HBA and perform any firmware updates, as necessary. For information about updating firmware, see Chapter 4, "HBA Software Installation".

Perform the following procedures, in the order listed, to create a logical drive on an x86 system:

▼ To Verify the Drives and Their Slots (x86)

This procedure helps you identify drives to be used in a logical drive configuration.

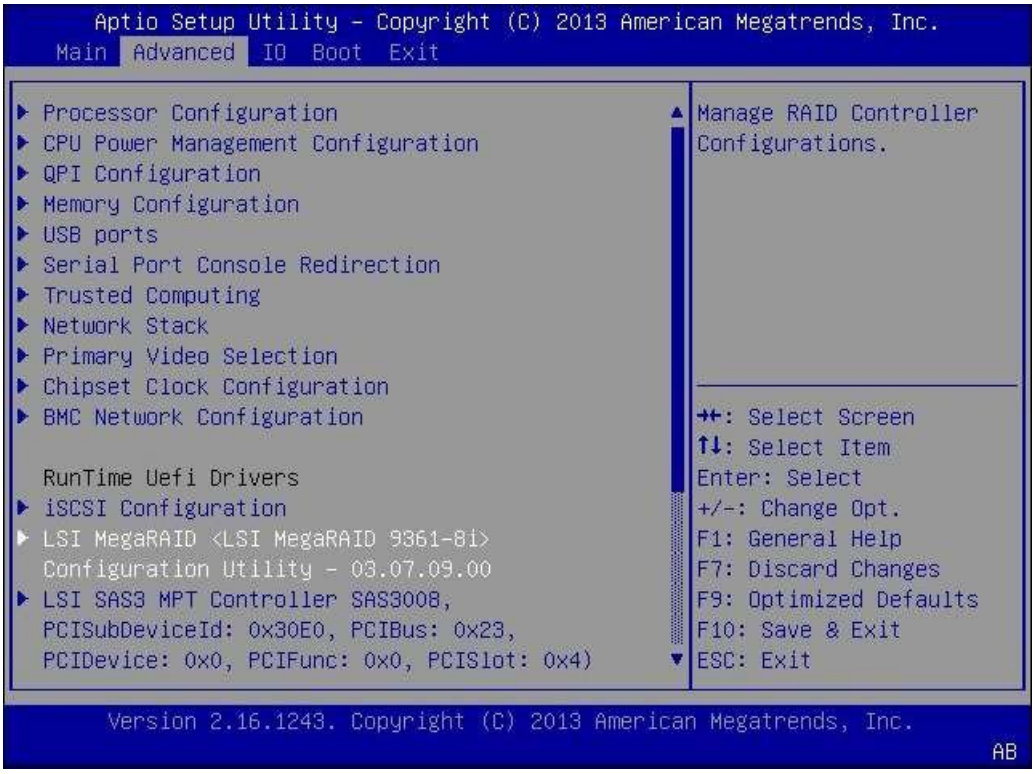
1. **Access the system console from the Oracle Integrated Lights Out Manager (ILOM) software or Video Graphics Array (VGA) video port.**

2. **Initiate a system boot.**

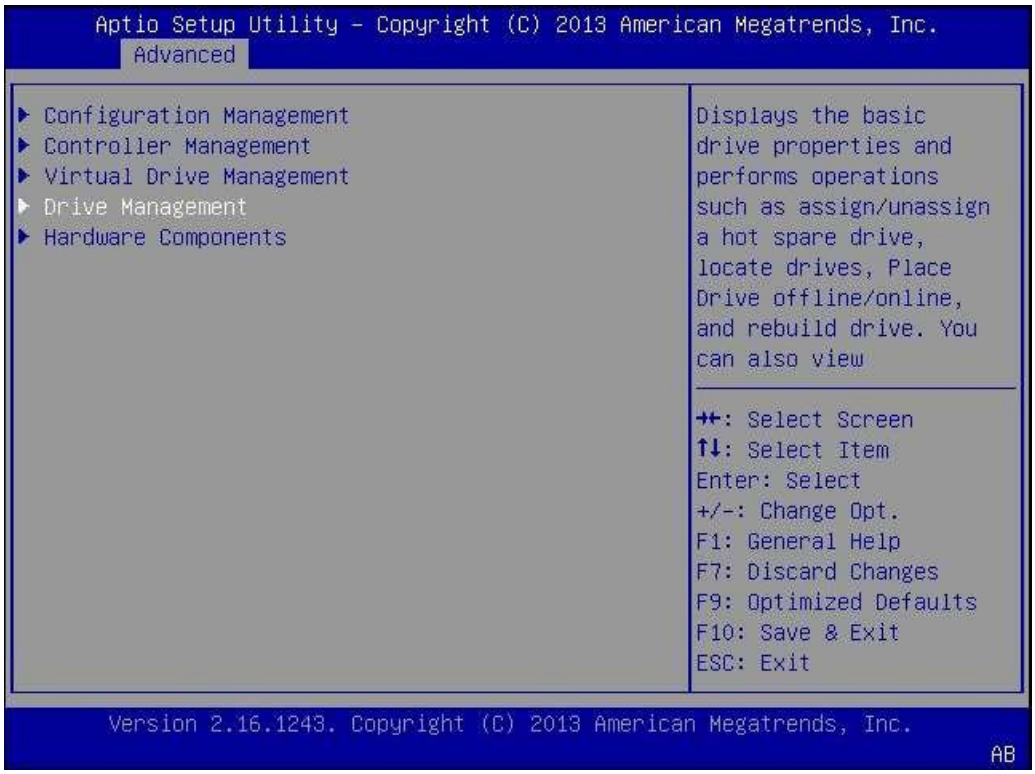
   During the boot process, the BIOS initialization banner lists information about the discovered SAS adapters and devices that are attached to the discovered HBAs in the system.

3. **Press F2 during the boot process, when prompted, to launch the BIOS Setup Utility, and then use the right arrow key to navigate to the Advanced menu.**

4. **Use the arrow keys to navigate to the LSI MegaRAID Configuration Utility menu option, and press Enter.**

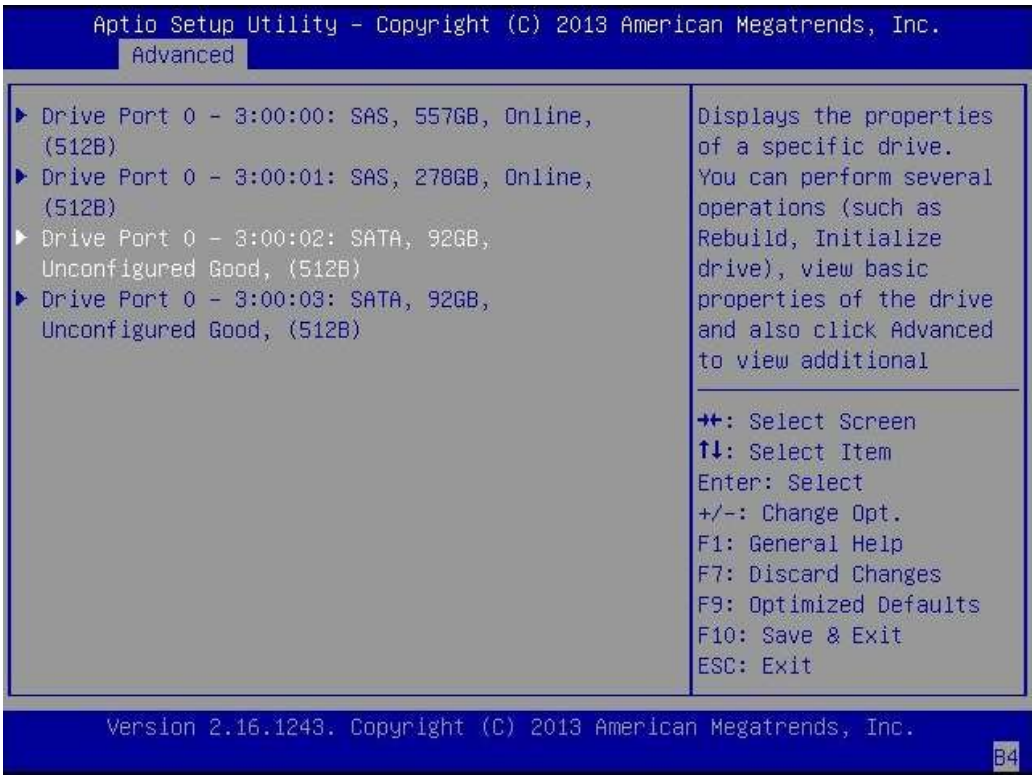


5. **From the menu options that are displayed, use the arrow keys to navigate to the Drive Management menu option, and press Enter.**



6. **From the page that is displayed, review the attached drives and note their respective slots for future reference.**

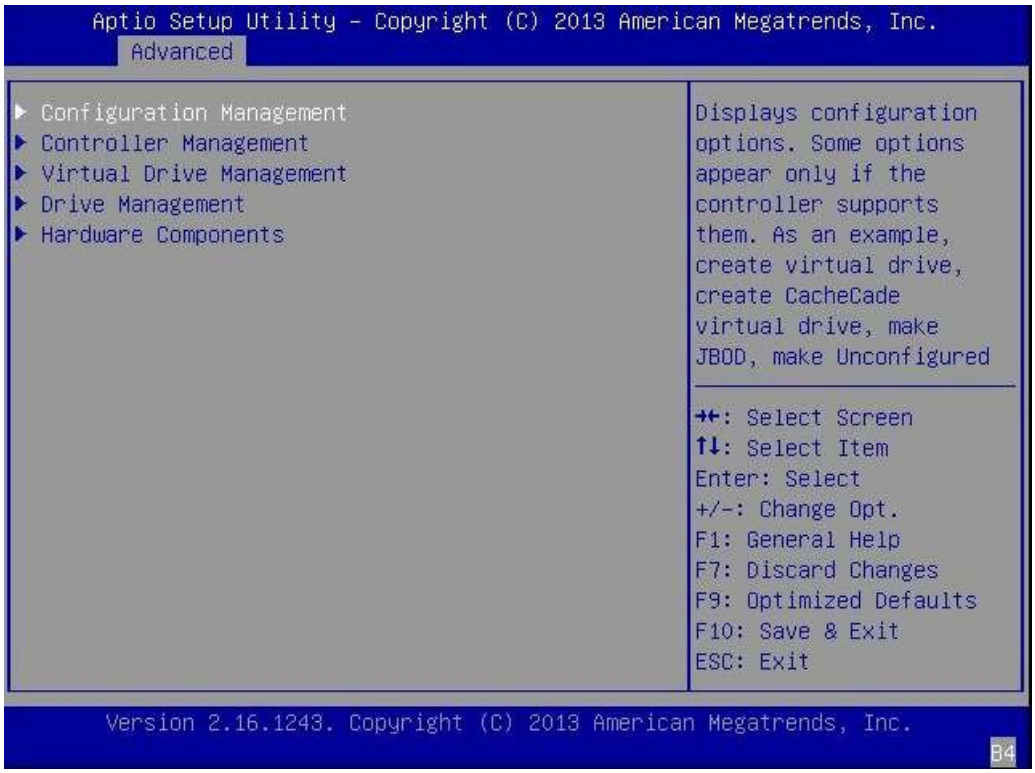
In the following example, there are four drives in slots 0, 1, 2, and 3. Slots 2 and 3 are not currently used (indicated by the `Unconfigured Good` text). You can use `Unconfigured Good` drives to be part of your logical drive configuration.



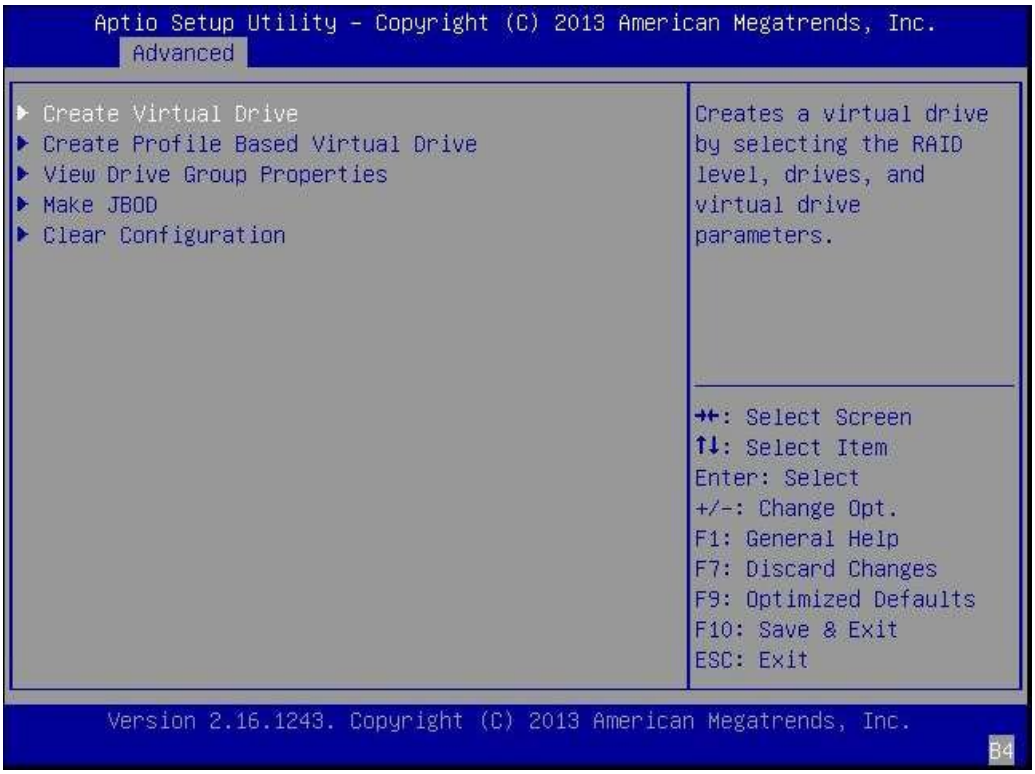
▼ To Create a Logical Drive (x86)

After you have verified which drives are available for logical drive configuration, as described in "To Verify the Drives and Their Slots (x86)" on page 33, you can use those drives to create a logical drive. In the following procedure, drives 2 and 3 (`3:00:02`, `3:00:03`) are being used to create a RAID 1 volume.

1. **From the Drive Management screen that is displaying the attached drives, press the Esc key to return to the previous menu, use the arrow keys to navigate to the Configuration Management menu option, and press Enter.**

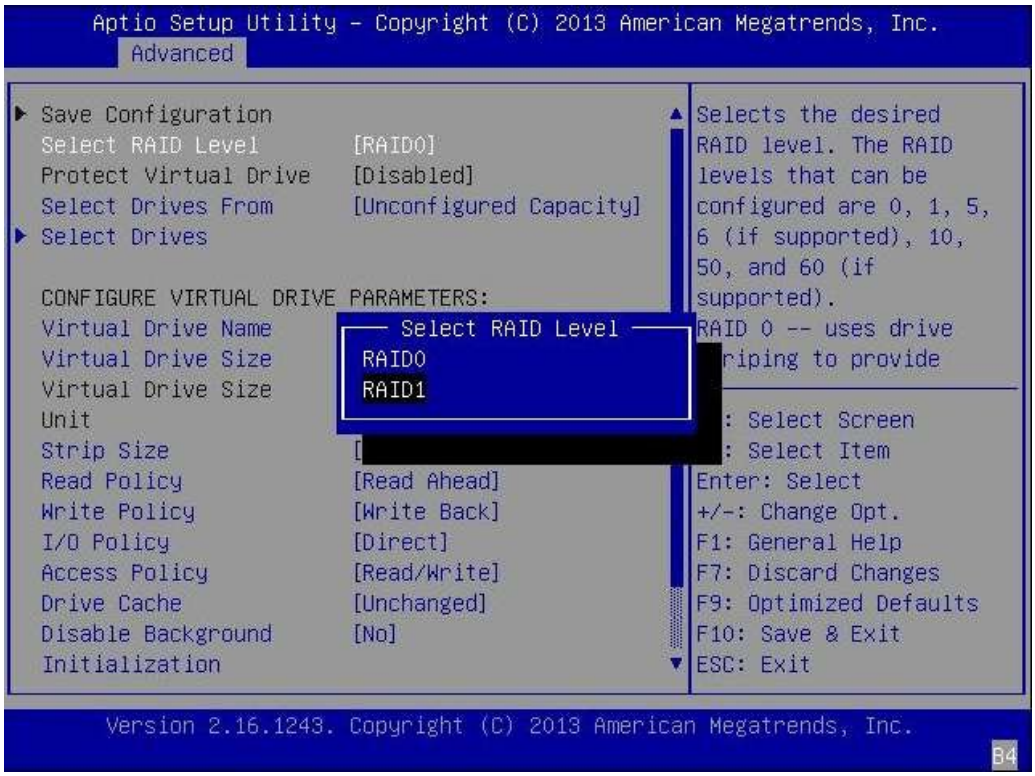


2. **From the page that is displayed, use the arrow keys to navigate to the Create Virtual Drive menu option, and press Enter.**

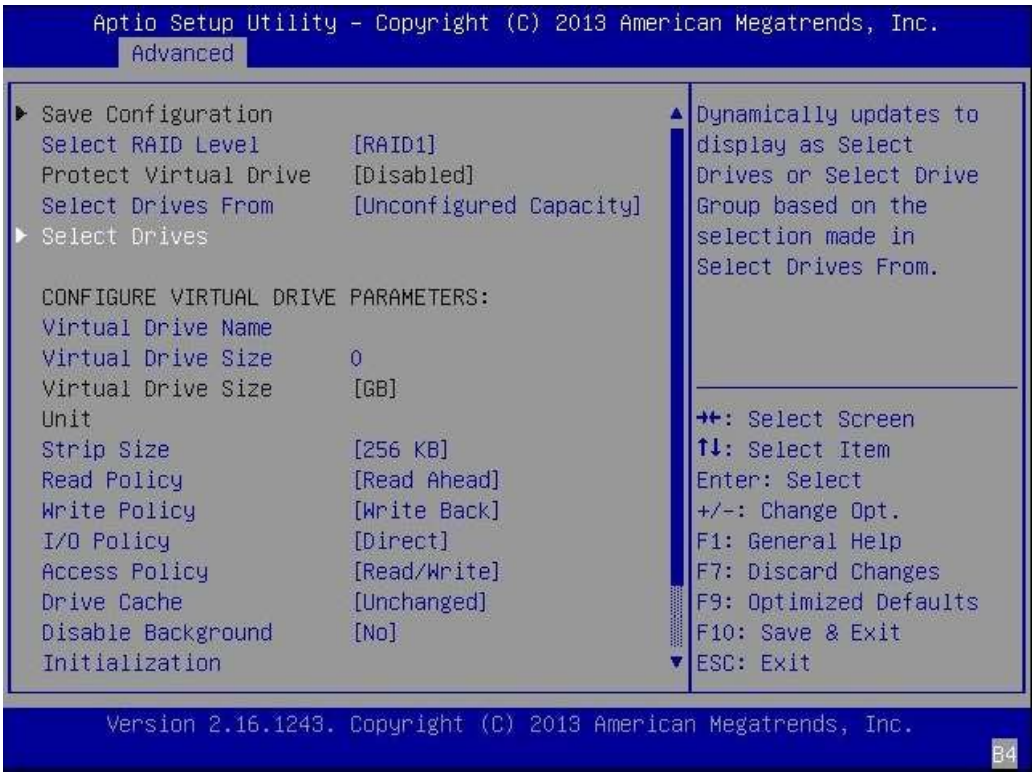


3. **From the page that is displayed, navigate to the Select RAID Level field, press Enter to display the Select RAID Level popup window, choose the RAID level that you want, based on your requirements, and press Enter.**

In the following example, the RAID 1 level is selected.



4. **Use the arrow keys to navigate to the Select Drives field, and press Enter.**



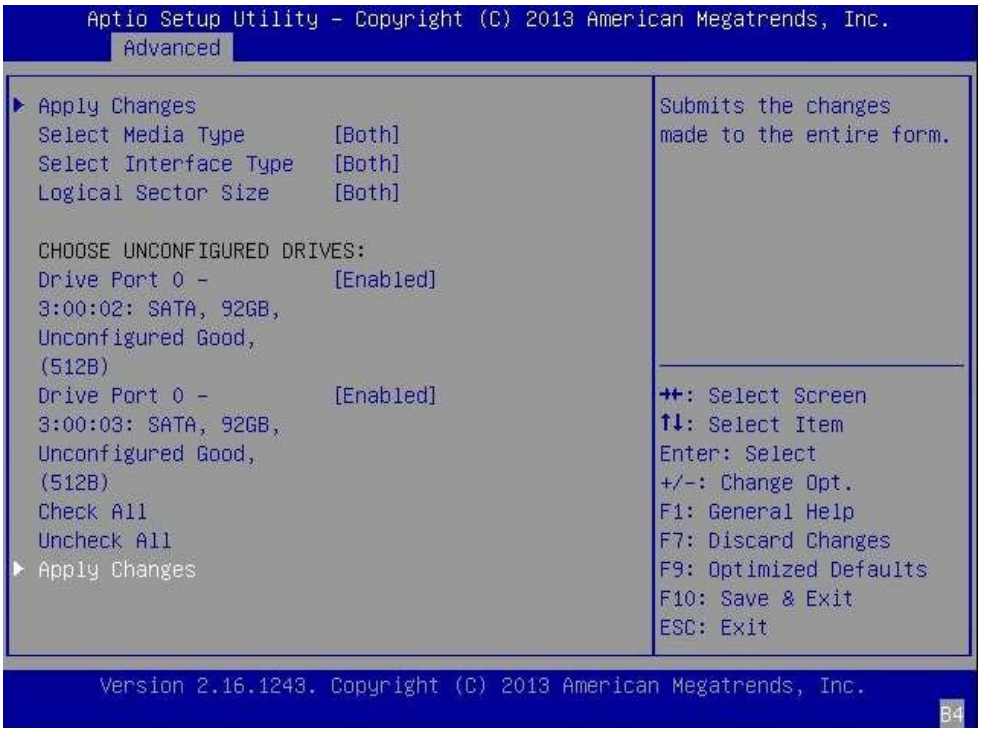
5. **For each drive that you want in the RAID volume configuration, do the following:**

   a. **Use the arrow keys to navigate to the drive.**

   b. **Use the arrow keys to navigate to the Enabled or Disabled field associated with the drive, and press Enter.**

   c. **From the popup window that is displayed, use the arrow keys to navigate to the Enabled field, and press Enter.**

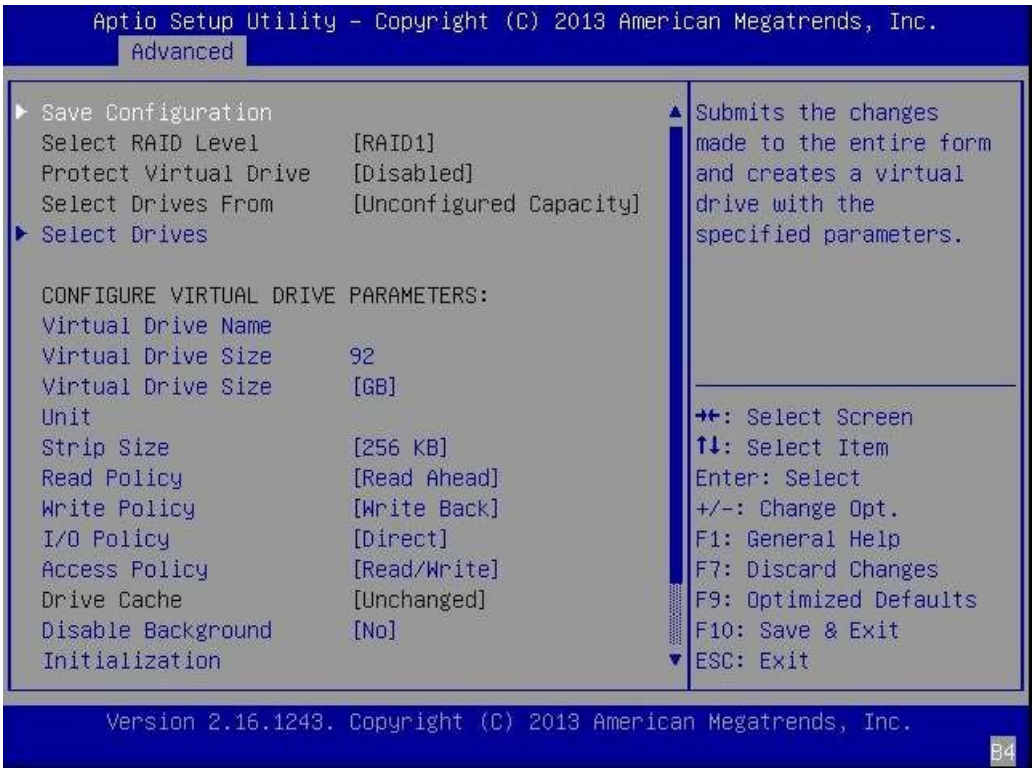
The drive is now listed as Enabled. In the following example, drives 2 and 3 are enabled.



6. **After you have enabled all the drives that you want to be part of the logical drive, use the arrow keys to navigate to the Apply Changes field on the same page, and press Enter.**

   The logical drive is now created with the drives that you enabled, and the Confirmation page is displayed.

7. **Press Enter on the Confirmation page to return to the Create Virtual Drive page.**



8. **Complete the steps in "To Confirm the Logical Drive Creation (x86)" on page 42.**

▼ To Confirm the Logical Drive Creation (x86)

Before You Begin Before performing this procedure, verify the drives and their slots (see "To Verify the Drives and Their Slots (x86)" on page 33) and create a logical drive (see "To Create a Logical Drive (x86)" on page 36).

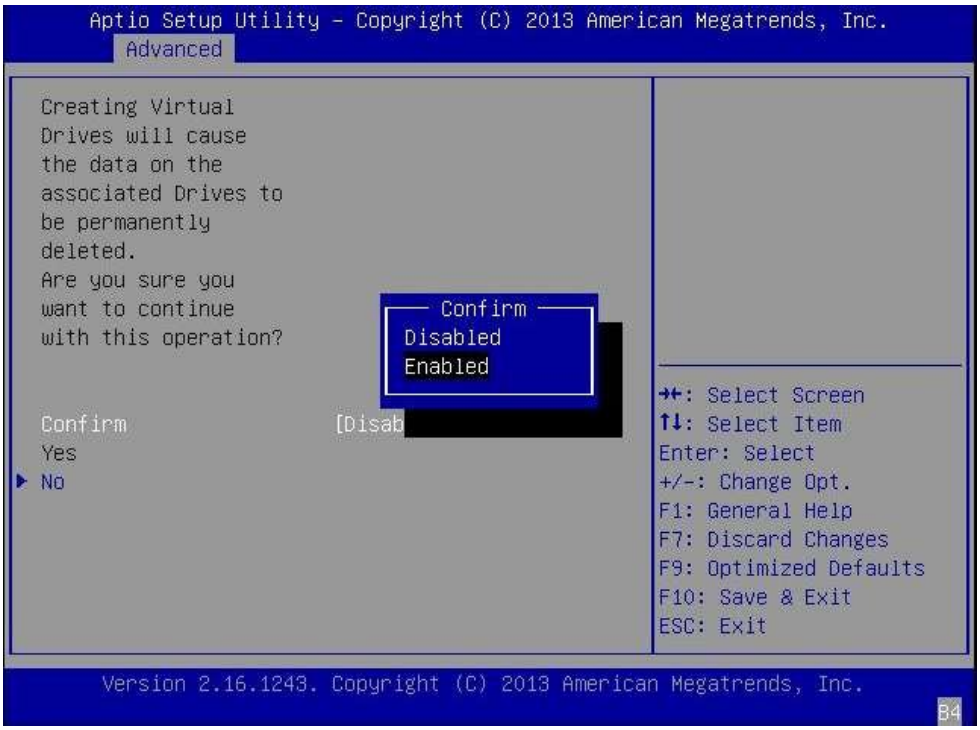
1. **On the Create Virtual Drive page, optionally make any changes that you would like (such as defining a drive name), and press Enter at the Save the Configuration field to save the new configuration.**

The Save Configuration confirmation page is displayed.

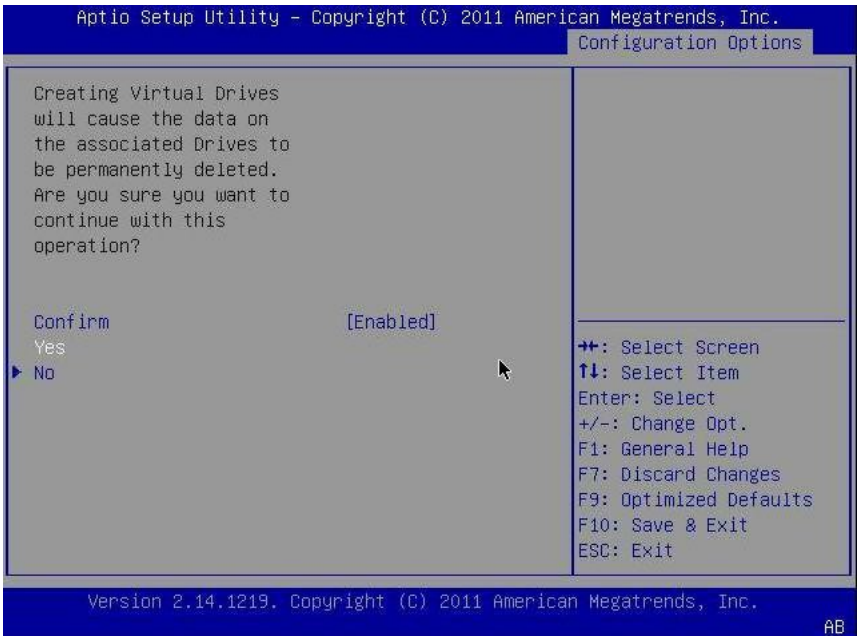
2. Confirm the drive creation by doing the following:

a. Use the arrow keys to navigate to the Confirm field, and press Enter.

b. From the popup window, change the value of the Confirm field to Enabled, and press Enter.



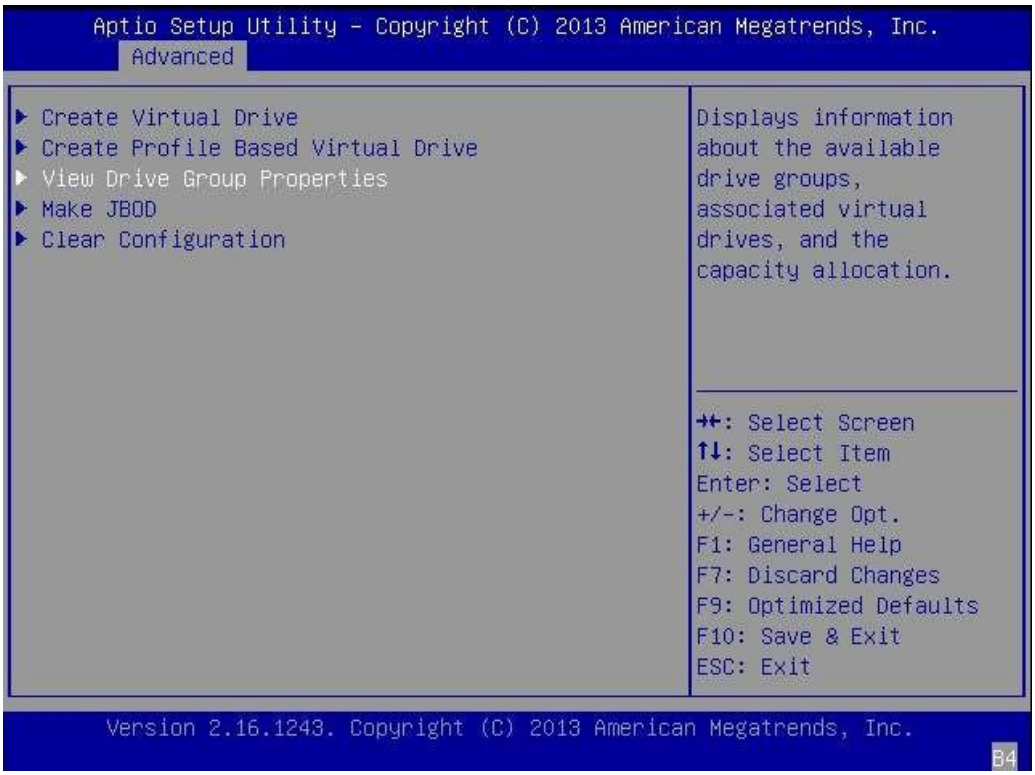
c. Use the arrow key to navigate to the Yes field, and press Enter.



3. At the page that is displayed, press Enter to complete the virtual drive creation.

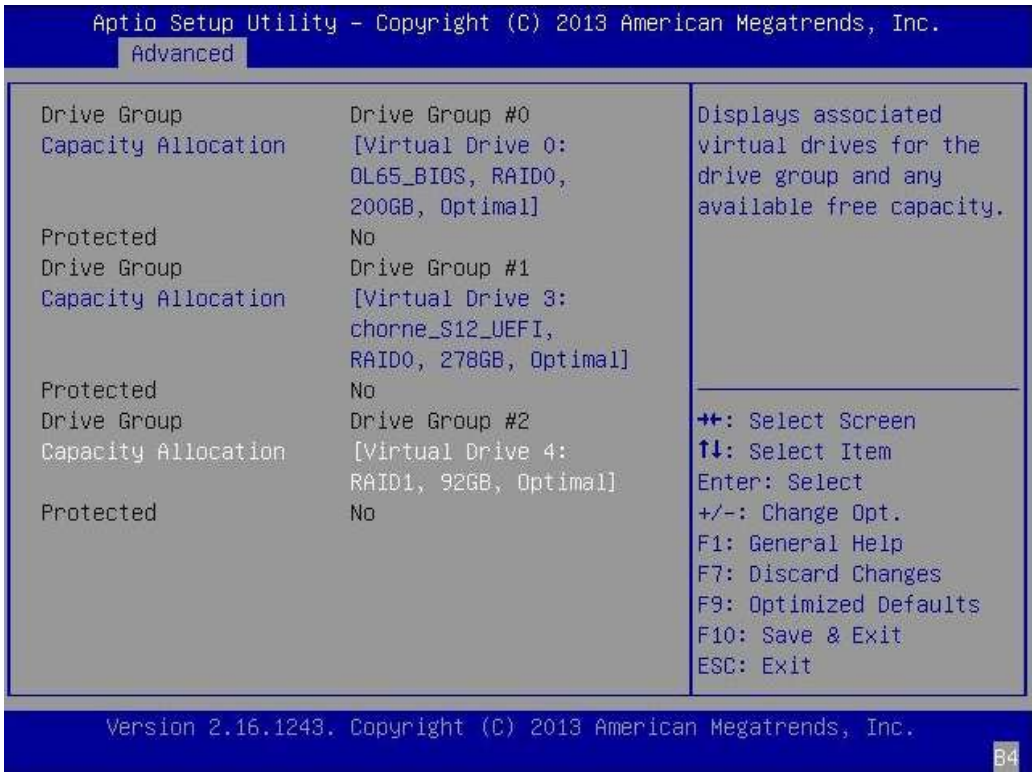
A message is displayed, stating that the virtual drive creation was successful and that all free unconfigurable space has been used.

4. **To verify that the logical drive (virtual drive) was created, press the Esc key to return to the Configuration Utility menu, use the arrow keys to navigate to the View Drive Group Properties menu option, and press Enter.**



5. **Review the logical drive information on the page that is displayed.**

In the following example, Drive Group 2, Virtual Drive 4 has been created.



6. **Exit the BIOS Setup Utility and reboot into the Oracle System Assistant utility (if available on your system) to install an OS on that logical drive or to manipulate the boot drive.**

   For information about verifying the label of the newly created logical drive, see "To Verify That the Label of a Logical Drive Is Valid" on page 58.

   For information about Oracle System Assistant, refer to the Administration Guide for your system.

   For information about installing the Oracle OS, see "Installing the Oracle Solaris OS" on page 60.

Using the BIOS Configuration Utility to Create a Bootable Logical Drive (x86)

This section describes how to use the BIOS Configuration Utility to create a logical drive on an x86 system. You can then define the logical drive as bootable, and install an operating system onto that logical drive. Follow the procedures in this section if you have set your system BIOS to Legacy Boot Mode. If you have set your system BIOS to UEFI Boot Mode, do not perform the procedures in this section. Instead, go to "Using the LSI MegaRAID Configuration Utility Menu to Create a Bootable Logical Drive (x86)" on page 33.

Before performing the steps in this section, verify the firmware level on the HBA and perform any firmware updates, as necessary. For information about updating firmware, see Chapter 4, "HBA Software Installation".

Perform the following procedures, in the order listed, to create a logical drive on an x86 system:

▼ To Verify the Drives Available for Logical Drive Creation (x86)

This procedure helps you identify drives to be used in a logical drive configuration.

1. **Access the system console from the Oracle Integrated Lights Out Manager (ILOM) software or Video Graphics Array (VGA) video port.**

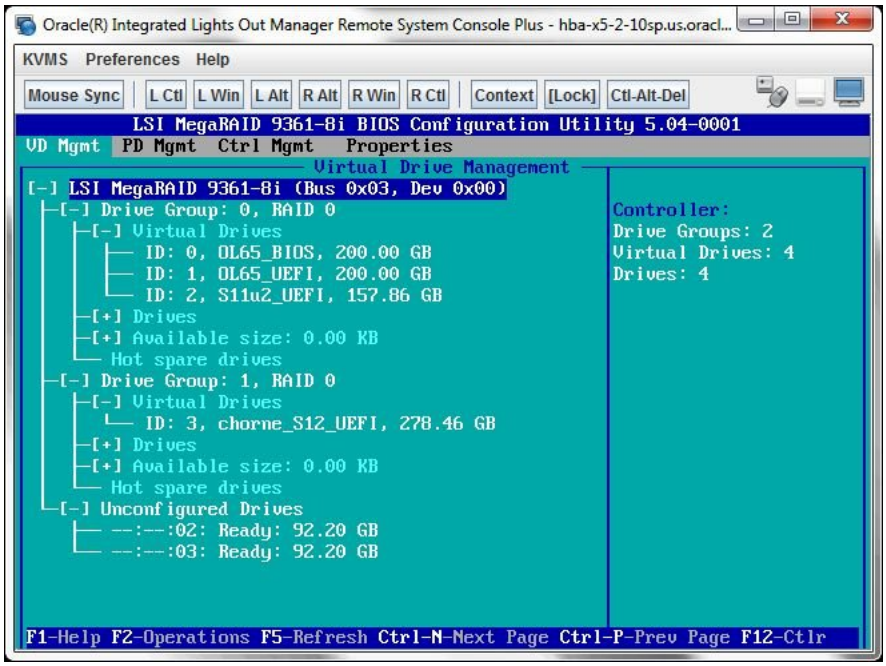
2. **Initiate a system boot.**

   During the boot process, the BIOS initialization banner lists information about the discovered SAS adapters and devices that are attached to the discovered HBAs in the system.

3. **Type `CTRL+R` during the boot process to launch the BIOS Configuration Utility.**

4. **Upon accessing the main page of the utility, review the drives that are listed in the utility to determine which drives are available for logical drive creation.**

Note in the following example, there are two unconfigured drives, drives 02 and 03, that can be used to create a virtual drive.

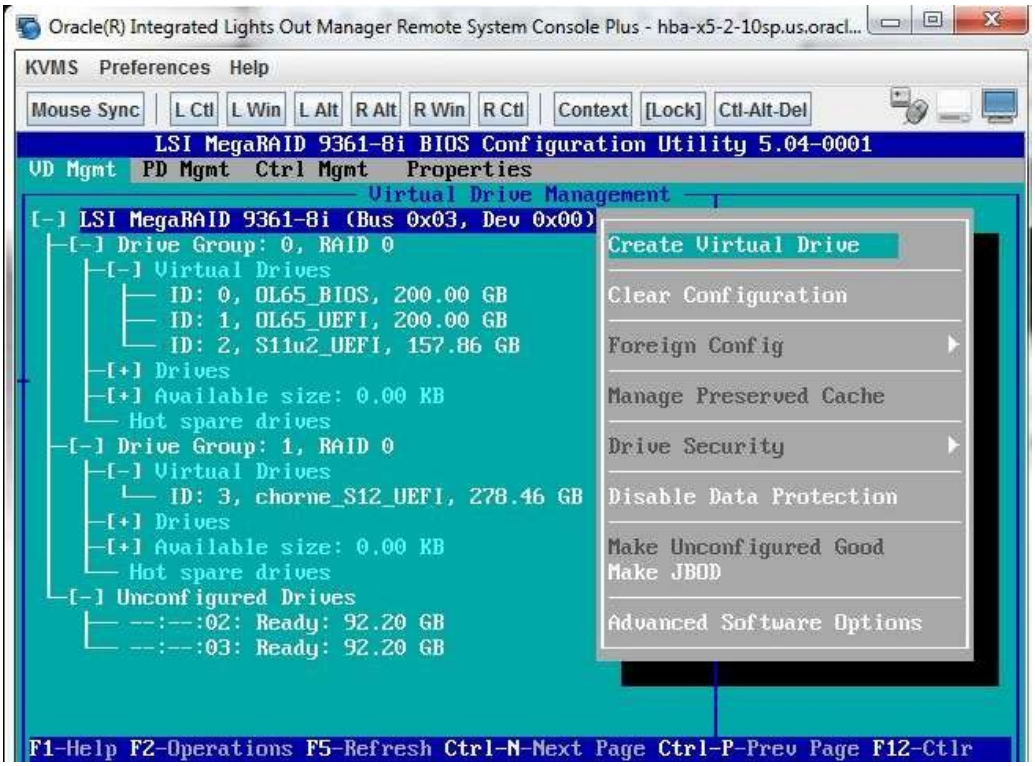


▼ To Create a Virtual Drive (x86)

After you have verified which drives are available for logical drive configuration, as described in "To Verify the Drives Available for Logical Drive Creation (x86)" on page 48, you can use those drives to create a logical drive. In the following procedure, drives 2 and 3 (`02`, `03`) are being used to create a RAID 1 volume.

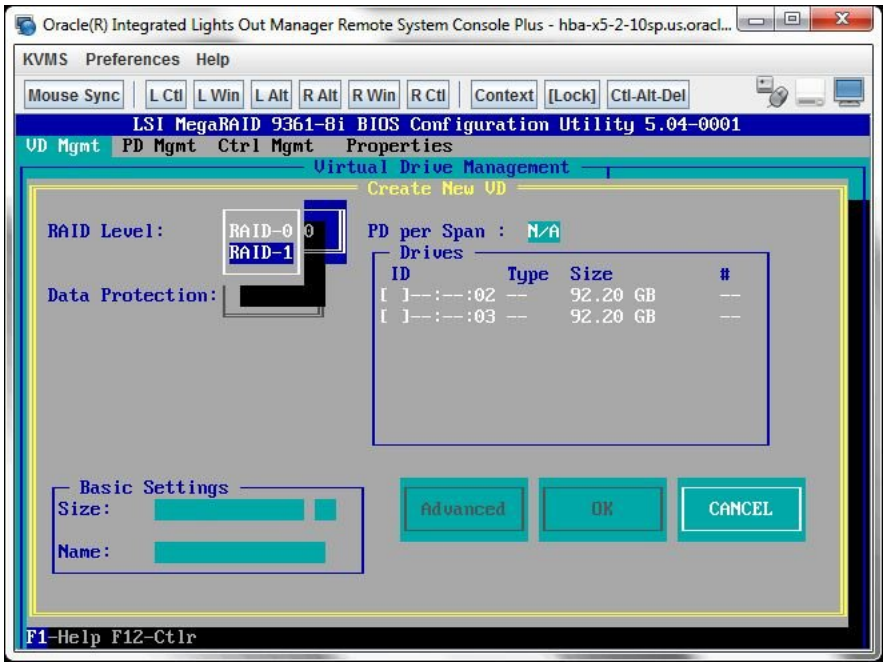
1. **In the BIOS Configuration Utility, use the arrow keys to navigate to the HBA, and press F2 to view the Operations menu.**

2. **Use the arrow keys to navigate to the Create Virtual Drive menu option, and press Enter.**



3. **From the page that is displayed, press Enter on the RAID Level field, and, from the popup window that is displayed, use the arrow keys to select the RAID level**

that you want, based on your requirements, and press Enter to exit the popup window.

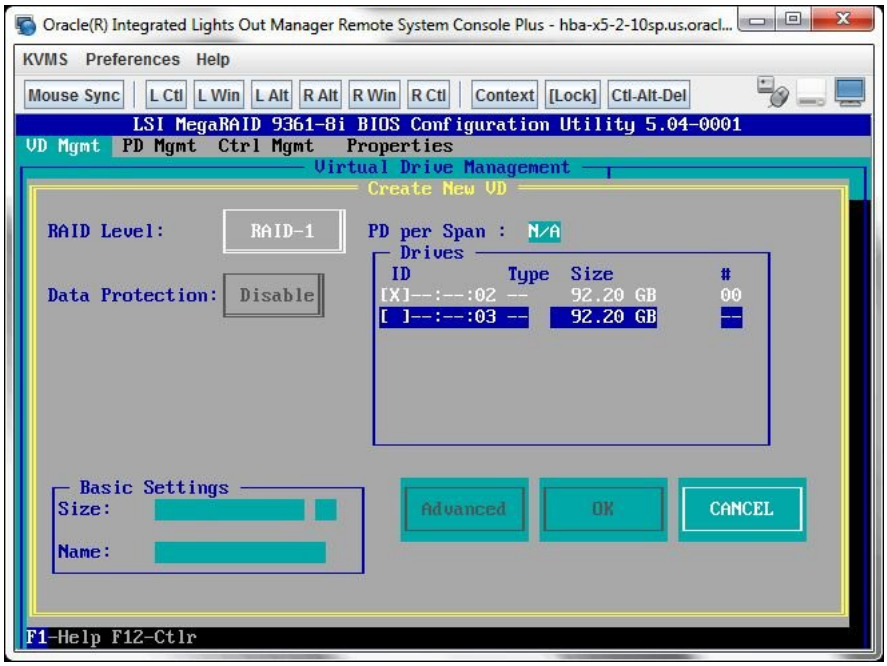


4. **Use the arrow keys to navigate to the Drives box.**

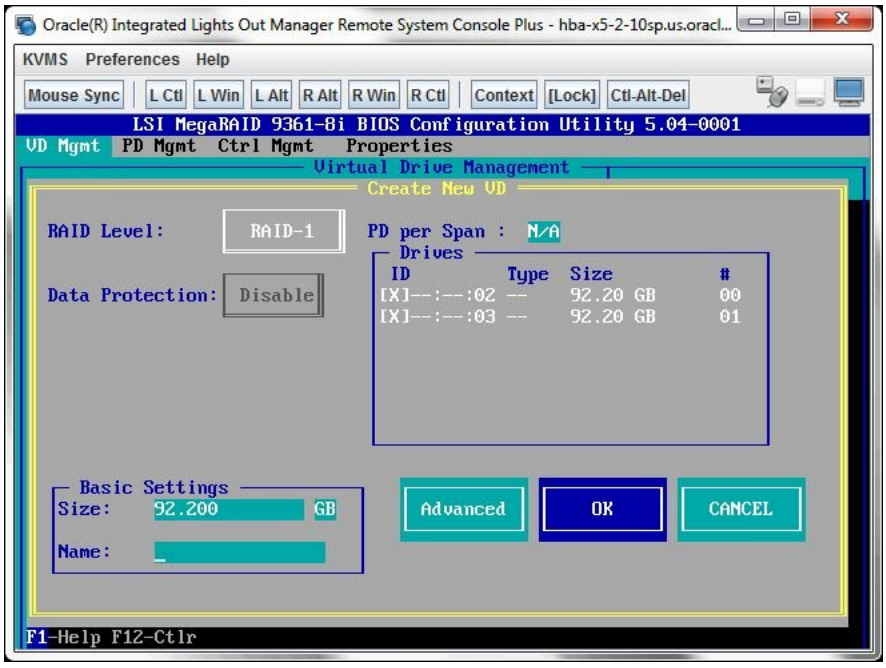
   Only drives that are available to be configured in a logical drive are displayed in the Drives box.

5. **For each drive that you want in the logical drive, navigate to the drive and press Enter in its ID field to produce an X in the field.**

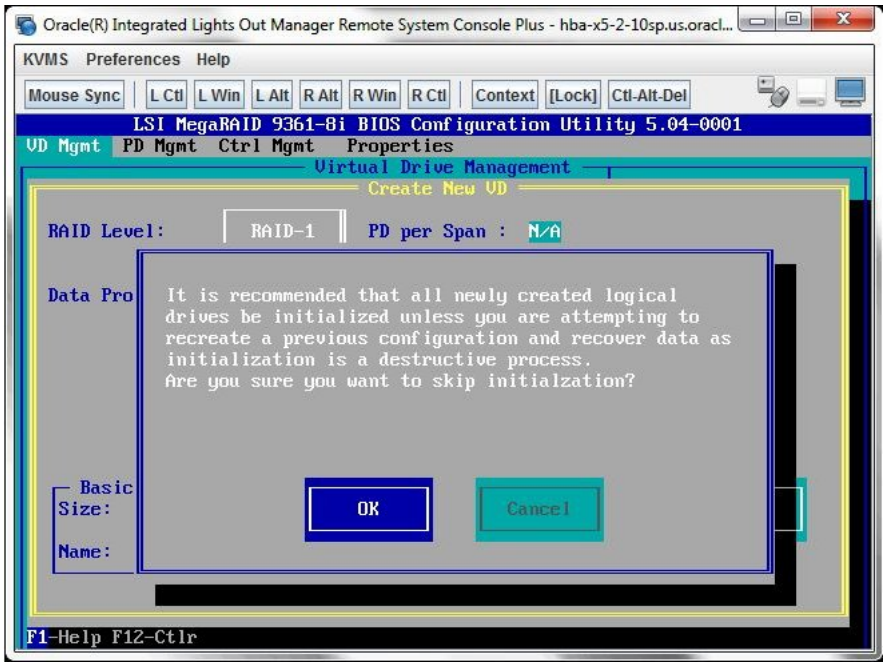
This selects the drive to be included in the logical drive configuration.



6. **After you select all the drives that you want included in the logical drive, use the arrow keys to navigate to the OK button, and press Enter.**



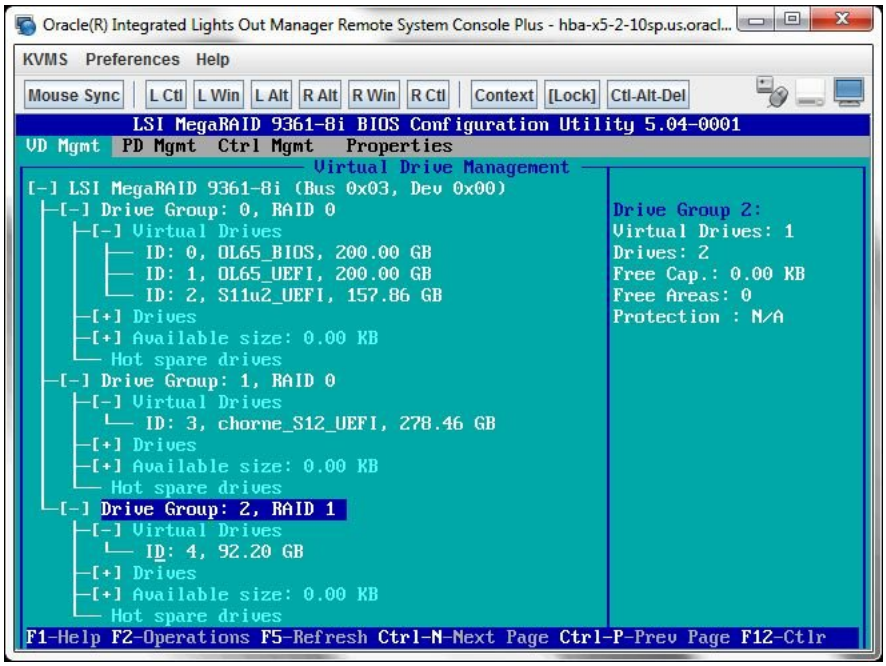
7. **At the next page that is displayed, use the arrow key to move to the OK button, and press Enter.**



The logical drive is now created.

8. **To verify the logical drive creation, review the drive groups on the main page of the BIOS Configuration Utility and note the new drive group that is now displayed on the page.**

In this example, Drive Group 2, RAID 1 is created.



▼ To Define the Newly Created Logical Drive as the Boot Device (x86)

If you want to install an operating system (OS) onto the newly created logical drive and boot from that drive, perform the steps in this section to define the new logical drive as the boot device for your system.

1. **From the BIOS Configuration Utility, type `CTRL+N` to navigate to the Ctrl Mgmt tab.**

2. **From the Ctrl Mgmt page, use the arrow keys to navigate to the Boot device field, and press Enter.**

A boot device popup window is displayed.

3. **Use the arrow keys to navigate to the newly created logical drive, and press Enter.**

4. **Use the arrow keys to navigate to the Apply button, and press Enter.**

5. **Type CTRL+S to save the configuration.**

   The creation of a bootable logical drive is complete. To validate the label of the logical drive, see "To Verify That the Label of a Logical Drive Is Valid" on page 58.

Validating the Label of the HBA Logical Drive

With this HBA, no drives will be visible to the OS until you have created at least one logical drive. This section describes how to verify that the logical drive you created for the HBA has a valid Oracle Solaris label, and therefore can be recognized by the OS. Sometimes, logical drives need to be relabeled using the `format` command (in the case of SPARC systems) or the `fdisk` command (in the case of x86 systems) in order to be recognized.

▼ To Verify That the Label of a Logical Drive Is Valid

Note - For your reference, this section provides an example procedure for a SPARC system that runs the Oracle Solaris OS. For an x86 system that runs the supported OS, you would use the `fdisk` command for that OS to verify the label of a disk. For more information about labeling disks using the `fdisk` command, see the documentation for your OS.

1. **Become a root user and issue the `format` command.**

```
# format
Searching for disks...done
AVAILABLE DISK SELECTIONS:
 0. c1t0d0 <DEFAULT cyl 24611 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@a/pci17c2,10@4/sd@0,0
 1. c1t1d0 <DEFAULT cyl 24810 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@a/pci17c2,10@4/sd@1,0
 2. c3t8d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@8,0
 3. c3t9d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@9,0
 4. c3t10d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@a,0
 5. c3t11d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@b,0
 6. c3t12d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@c,0
 7. c3t13d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@d,0
Specify disk (enter its number):
```

2. **When prompted, type the number of the disk drive that is attached to the HBA card you just installed, and press Enter.**

   The Format menu is displayed.

```
# format
Searching for disks...done
AVAILABLE DISK SELECTIONS:
 0. c1t0d0 <DEFAULT cyl 24611 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@a/pci17c2,10@4/sd@0,0
 1. c1t1d0 <DEFAULT cyl 24810 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@a/pci17c2,10@4/sd@1,0
 2. c3t8d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@8,0
```

```
 3. c3t9d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@9,0
 4. c3t10d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@a,0
 5. c3t11d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@b,0
 6. c3t12d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@c,0
 7. c3t13d0 <DEFAULT cyl 24619 alt 2 hd 27 sec 107>
  /pci@0,0/pci1022,7450@b/pci1000,10c0@1,1/sd@d,0
Specify disk (enter its number): 2
selecting c3t8d0
[disk formatted]
```

3. **Type `q` at the two prompts to quit the test and the Format menu.**

```
analyze> q
FORMAT MENU:
  disk  - select a disk
  type  - select (define) a disk type
  partition  - select (define) a partition table
  current  - describe the current disk
  format  - format and analyze the disk
  fdisk  - run the fdisk program
  repair  - repair a defective sector
  label  - write label to the disk
  analyze  - surface analysis
  defect  - defect list management
  backup  - search for backup labels
  verify  - read and display labels
  save  - save new disk/partition definitions
  inquiry  - show vendor, product and revision
  scsi  - independent SCSI mode selects
  cache  - enable, disable or query SCSI disk cache
  volname  - set 8-character volume name
  !<cmd>  - execute <cmd>, then return
  quit
format> q
#
```

Next Steps

If you are installing the HBA in a SPARC system, install the Oracle Solaris OS, as described in “Installing the Oracle Solaris OS” on page 60.

If you are installing the HBA in an x86 system, install a supported OS (for a list of supported operating systems, see “Operating System and Technology Requirements” on page 14). If you plan to install the Oracle Solaris OS on a system, follow the instructions in “Installing the Oracle Solaris OS” on page 60.

Installing the Oracle Solaris OS

You can install the Oracle Solaris 11.2 with SRU5, at minimum, on the bootable drive that you created or imported, as described in this chapter. Starting with the Oracle Solaris 11.2 SRU5 OS, the driver required by the HBA is provided with the Oracle Solaris OS. This section contains the folllowing topics:

▼ To Prepare to Install the Oracle Solaris OS

- **Create a bootable drive upon which to install the Oracle Solaris OS, as described in this chapter.**

▼ To Install the Oracle Solaris OS

1. **Obtain the Oracle Solaris 11.2 OS, at minimum, from the Oracle download site:**

   `http://www.oracle.com/technetwork/server-storage/solaris11/overview/index.html`

2. **Perform a normal installation, as described in Oracle's Solaris 11.2 installation documentation.**

3. **Obtain the latest SRUs for the Oracle Solaris 11.2 OS, as required for your hardware platform. The HBA requires SRU5 to work on x86 systems with the Oracle Solaris 11.2 OS.**

   You can obtain these Oracle Solaris SRUs at the My Oracle Support web site:

   `http://support.oracle.com`

4. **Reboot the system.**

```
# reboot
```

The system can now see, and boot from, the RAID volume on which you installed the Oracle Solaris OS.

Next Steps

Continue with the HBA installation, as described in “To Complete the Installation” on page 21.

♦ ♦ ♦ CHAPTER 4

HBA Software Installation

After you have completed the hardware installation and powered on the system, follow the instructions in this chapter for your operating system to install the HBA driver and any other utilities required for the installation.

Note - Software listed in this chapter as being located at the Oracle designated web site will only be available at the web site if required by the HBA.

This chapter contains the following topics:

Note - This chapter describes how to obtain HBA driver and firmware updates from the Oracle support area of the Broadcom web site. For x86 systems, you can also obtain the HBA driver and firmware updates from the internal Oracle System Assistant USB flash drive, if provided with your system. For information about downloading the HBA driver from Oracle System Assistant, refer to your platform Administration Guide.

Note - For x86 systems, another option to obtain HBA driver and firmware updates is to go to the My Oracle Support web site at: `http://support.oracle.com`

Installing the Oracle Solaris Driver and Firmware

The latest driver (`lmrc`) for this HBA is included as part of the Oracle Solaris 11.2 OS with SRU5, if the Oracle Solaris OS is ordered. You can obtain the latest version of the Oracle Solaris OS at:

http://www.oracle.com/technetwork/server-storage/solaris11/overview/index.html

You can obtain the latest Oracle Solaris SRUs at the My Oracle Support web site:

http://support.oracle.com

Firmware Updates

The Oracle Solaris firmware and boot code update for the HBA, along with any accompanying documentation, are available for download at:

https://www.broadcom.com/support/oem/oracle/

Installing the Linux Driver and Firmware

Consult the Oracle hardware platform documentation to determine which Oracle Linux and Linux releases are supported on your specific host platform.

The drivers required to run the HBA with the Oracle Linux, Red Hat Enterprise Linux, and SUSE Linux Enterprise Server OSs are available for download at the Oracle designated web page at:

https://www.broadcom.com/support/oem/oracle/

▼ To Install the Linux Driver

1. **Log in to the host.**
2. **In a browser, go to `https://www.broadcom.com/support/oem/oracle/`.**
3. **Select the type and then model of the HBA that you want to use (7110116, 7110117).**

4. **Select and download the Linux driver that is supported by the Linux release (Oracle Linux, Red Hat Enterprise Linux, or SuSE Linux Enterprise Server) on your hardware platform.**

5. **Select and download the corresponding Readme file for the Linux driver, and follow the instructions in the Readme file to complete the driver installation.**

Firmware Updates

The Linux firmware and boot code update for the HBA, along with any accompanying documentation, are available for download at:

`https://www.broadcom.com/support/oem/oracle/`

Installing the Windows Server Driver and Firmware

Consult the Oracle hardware platform documentation to determine which Windows releases are supported on your specific host platform. Immediately after HBA installation, you must upgrade the Windows Server 2012 or 2012 R2 driver to `MegaSAS2` version 6.702.04.00 or later.

The Windows Server driver required to run the HBA is available for download at the Oracle designated web page at:

`https://www.broadcom.com/support/oem/oracle/`

▼ To Install the Windows Driver

1. **Log in to the host.**

2. **In a browser, go to `https://www.broadcom.com/support/oem/oracle/`.**

3. **Select the type and then model of the HBA that you want to use (7110116, 7110117).**

4. **Select and download the specific Windows driver that is supported by the Windows release on your hardware platform.**

5. **Select and download the corresponding Readme file for the Windows driver, and follow the instructions in the Readme file to complete the driver installation.**

Firmware Updates

The Windows firmware and boot code update for the HBA, along with any accompanying documentation, are available for download at:

https://www.broadcom.com/support/oem/oracle/

Installing the Oracle VM Driver and Firmware

Consult the Oracle hardware platform documentation to determine which Oracle VM releases are supported on your specific host platform.

The driver required to run the HBA with the Oracle VM technology is available for download at the Oracle designated web page at:

https://www.broadcom.com/support/oem/oracle/

▼ To Install the Oracle VM Driver

1. **Log in to the host.**
2. **In a browser, go to https://www.broadcom.com/support/oem/oracle/.**
3. **Select the type and then model of the HBA that you want to use (7110116, 7110117).**
4. **Select and download the Oracle VM driver that is supported by the Oracle VM release on your hardware platform.**
5. **Select and download the corresponding Readme file for the Oracle VM driver, and follow the instructions in the Readme file to complete the driver installation.**

Installing the VMware Driver and Firmware

In order for the HBA to work with the VMware technology, you must replace the native HBA driver, `lsi_mr3`, with the `megaraid_sas` HBA driver. If you plan to install the VMware ESXi 5.5 technology on your system after installing the HBA, there are two steps you must perform to use the HBA with the VMware technology. First, prior to replacing the driver, you must

change the HBA default cache settings during the VMware technology installation so that the technology installation can complete. Then, after completing the technology installation, you can replace the native HBA driver.

If you already have the VMware technology installed on your system prior to HBA installation, you do not need to change the HBA default cache settings. Instead, go directly to “Replacing the Native VMware HBA Driver ” on page 78.

This section contains the following topics:

Note - For x86 systems, the `megaraid_sas` HBA driver is provided on the embedded Oracle System Assistant flash drive. See your platform Administration documentation for information on how to obtain and install the driver from Oracle System Assistant.

Changing the HBA Default Cache Settings

As an installation option, you can install the VMware ESXi technology on your system after you have installed the HBA in your system. This section describes how to complete the VMware ESXi technology installation on your system by changing the default cache settings of the HBA. If you have already installed the VMware ESXi technology on your system, do not perform the procedures in this section. Instead, go directly to “Replacing the Native VMware HBA Driver ” on page 78.

During the VMware ESXi technology installation, the following error message is displayed:

```
ESXi 5.5 install error: could not create locker database
```

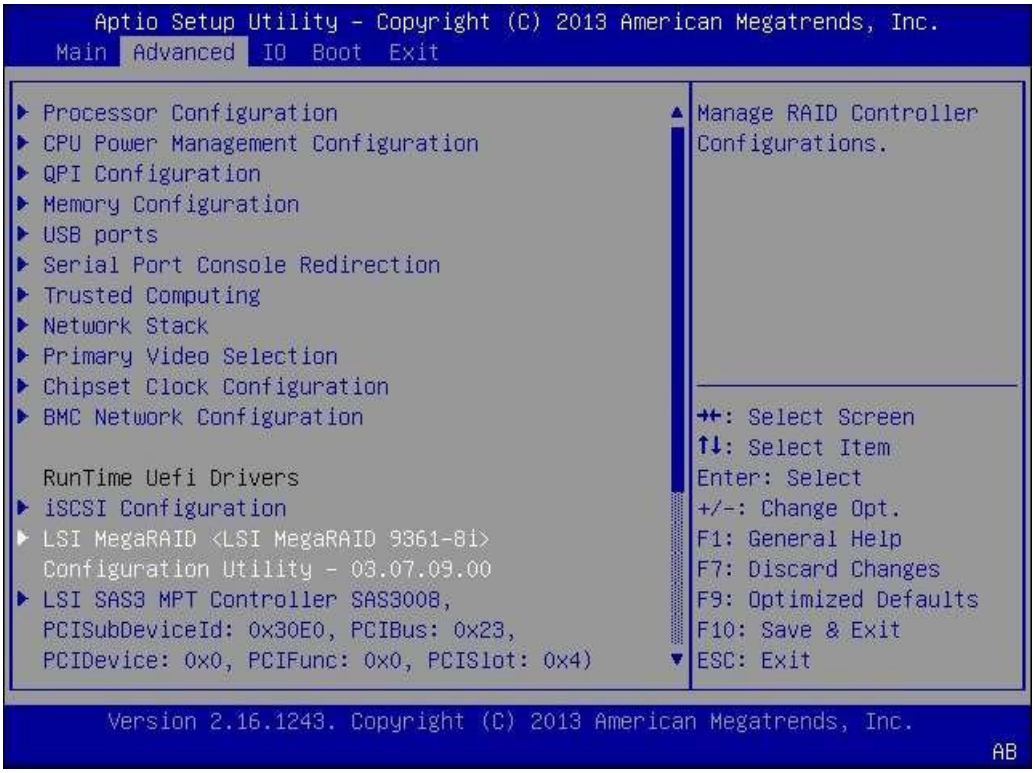
At this point in the installation, you must change the HBA default cache settings. Based on whether your system BIOS is set to UEFI Boot Mode or Legacy Boot Mode, you need to use a different utility to change the default cache settings for the HBA. Do one of the following:

▼ To Change the HBA Default Cache Settings in UEFI Boot Mode

Perform the procedure in this section if your system BIOS is set to UEFI Boot Mode, and you are installing the VMware technology after you have already installed the HBA in your system.

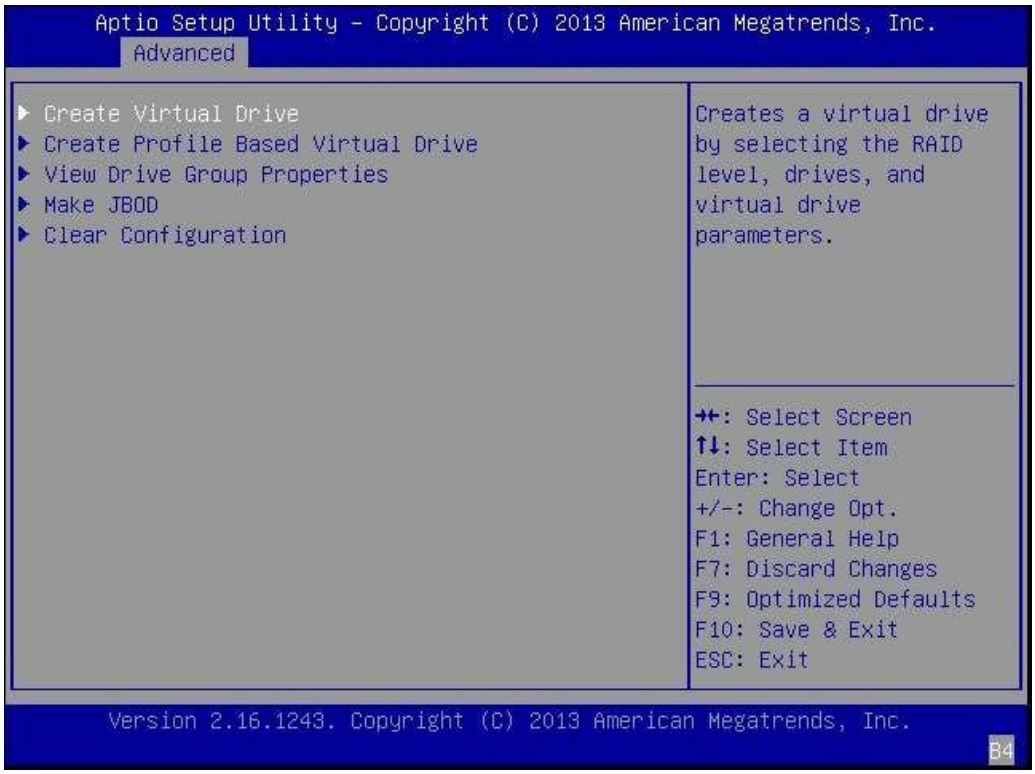
1. **Access the MegaRAID Configuration Utility menu of the BIOS Setup Utility, as described in "To Verify the Drives and Their Slots (x86)" on page 33.**

2. **Use the arrow keys to navigate to the LSI MegaRAID Configuration Utility menu option, and press Enter.**

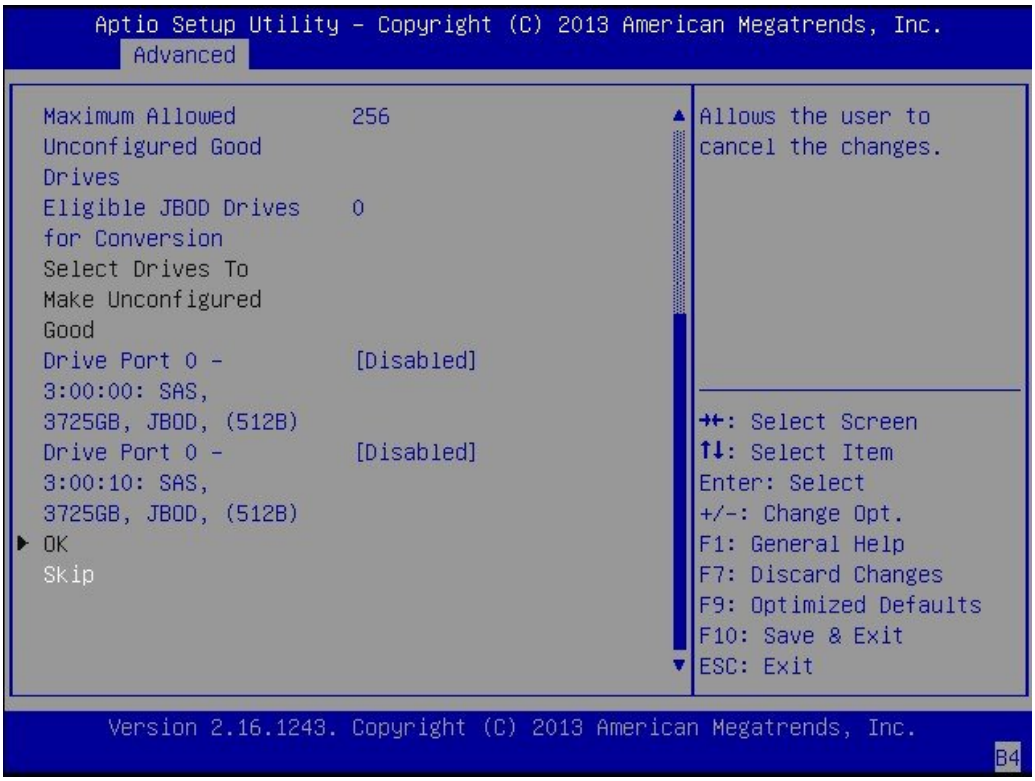


3. **From the menu options that are displayed, navigate to the Configuration Management menu option, press Enter, and then navigate to the Create Virtual Drive menu option, and press Enter.**

This is the virtual drive upon which you plan to install the VMware ESXi technology.



4. **On the page that is displayed, use the arrow keys to navigate to the Skip field, and press Enter.**



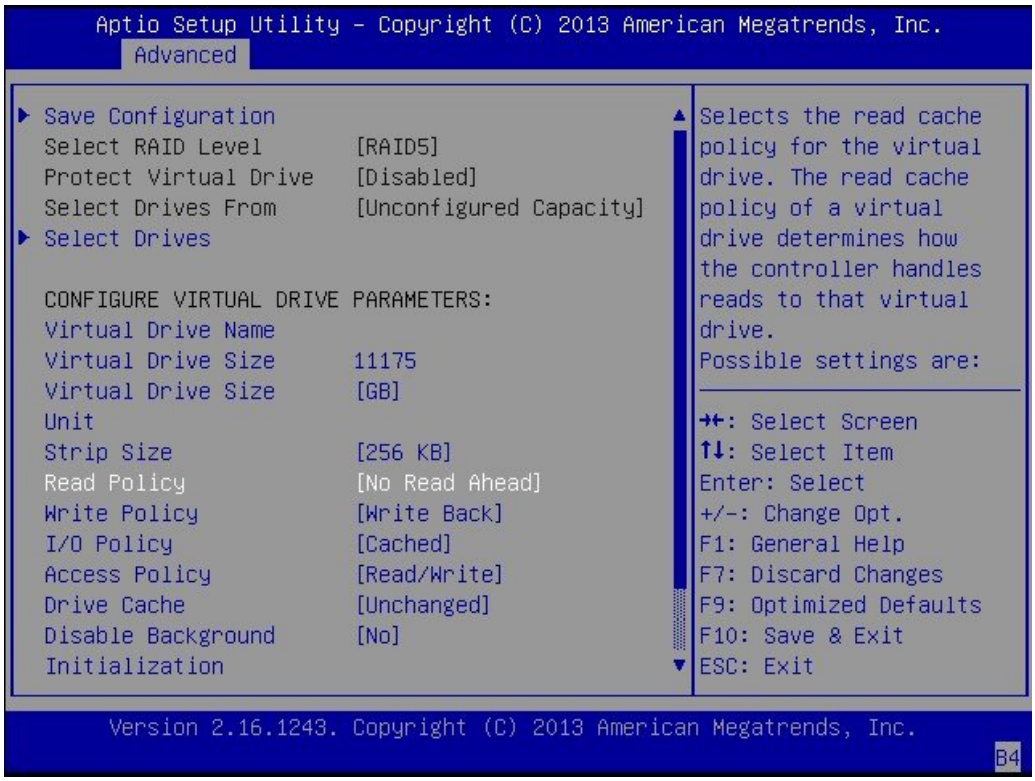
5. **Review the values of the Read Policy and I/O Policy fields and write them down.**

   These are the default HBA cache settings. After the VMware technology installation completes, you will need to revert to these default cache settings.

6. **Use the arrow keys to navigate to, and then edit, the following fields, as follows:**

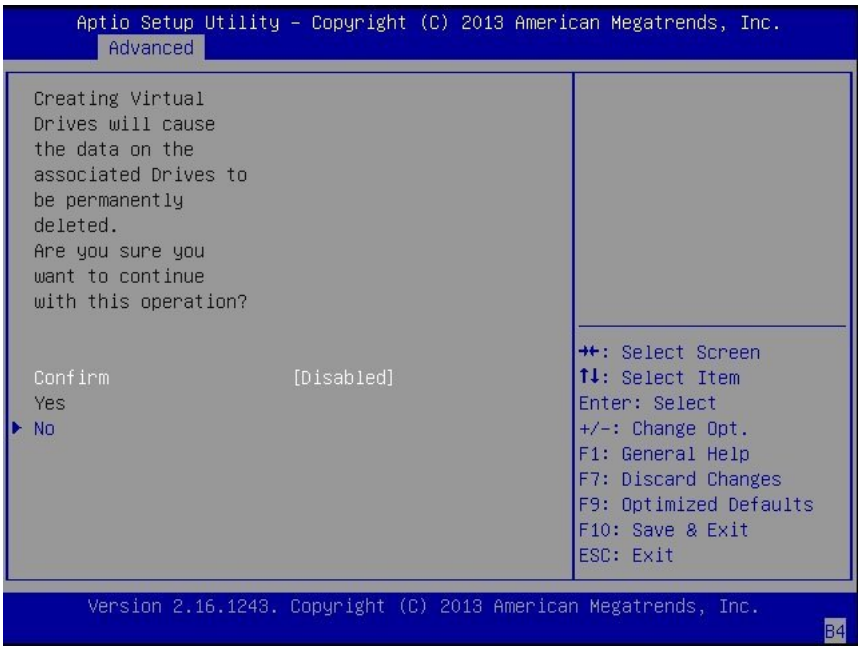
   - *Select RAID Level* – Use the arrow keys to navigate to this field, and press Enter. From the popup window that is displayed, choose the RAID level that you want for the virtual drive, and press Enter.
   - *Read Policy* – Use the arrow keys to navigate to this field, and press Enter. From the popup window that is displayed, choose No Read Ahead, and press Enter.

- *I/O Policy* –Use the arrow keys to navigate to this field, and press Enter. From the popup window that is displayed, choose Cached, and press Enter.

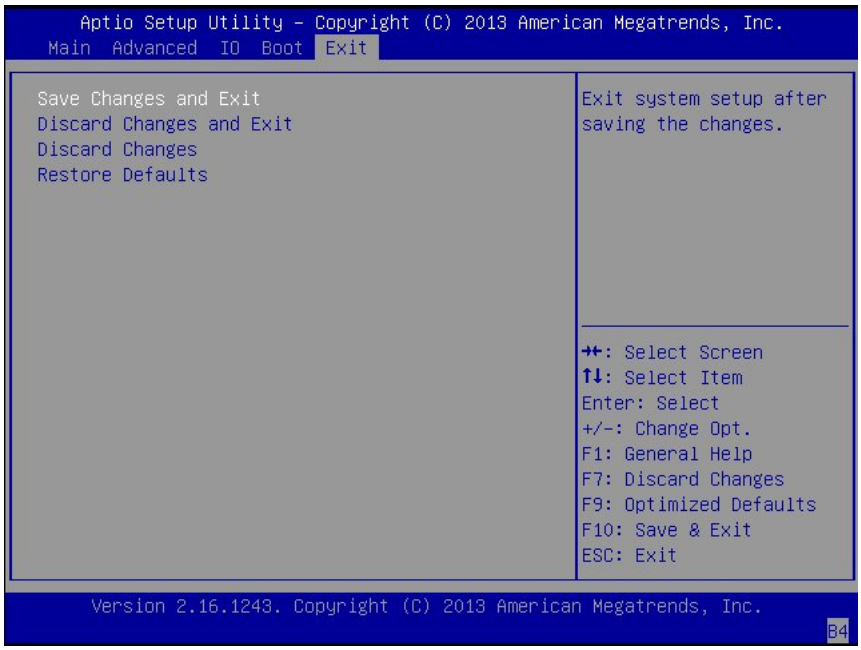


7. Use the arrow keys to navigate to the Save Configuration field, and press Enter.

8. **From the screen that is displayed, change the Confirm field value to Enabled, navigate to the Yes field, and press Enter to save the configuration.**



9. **Use the Tab keys to navigate to the Exit tab, select Save Changes and Exit, and press Enter.**



This exits you from the utility. You can now reboot the system to accept the cache setting changes, and then complete the VMware ESXi 5.5 installation.

10. **After completing the VMware ESXi technology installation, return to the utility and revert to the default cache settings (the values that you wrote down earlier in the procedure).**

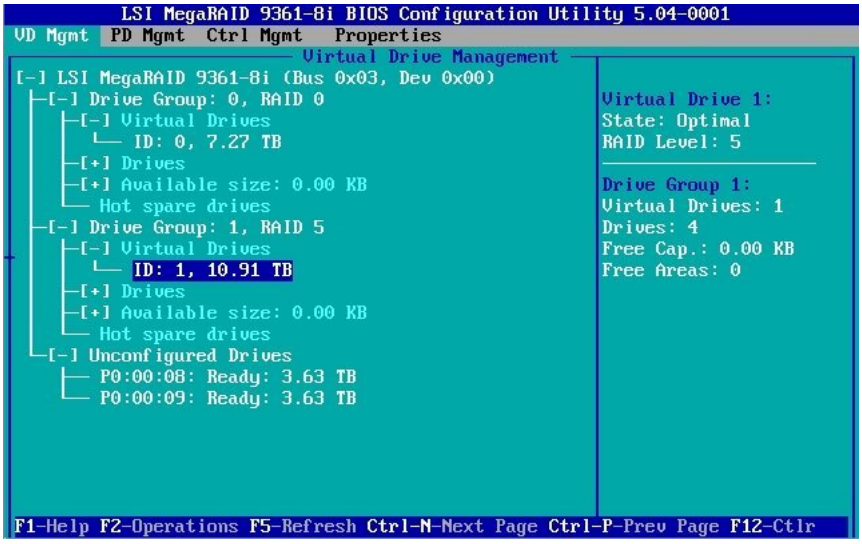
You can now replace the HBA native driver, as described in “Replacing the Native VMware HBA Driver ” on page 78.

▼ To Change the HBA Default Cache Settings in Legacy Boot Mode

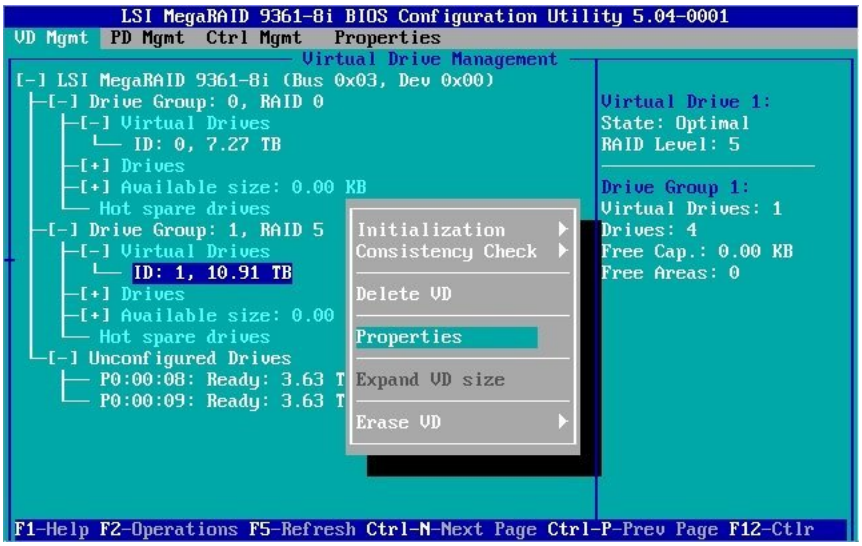
Perform the procedure in this section if your system BIOS is set to Legacy Boot Mode, and you are installing the VMware technology after you have already installed the HBA in your system.

1. **Access the BIOS Configuration Utility, as described in "To Verify the Drives Available for Logical Drive Creation (x86)" on page 48.**

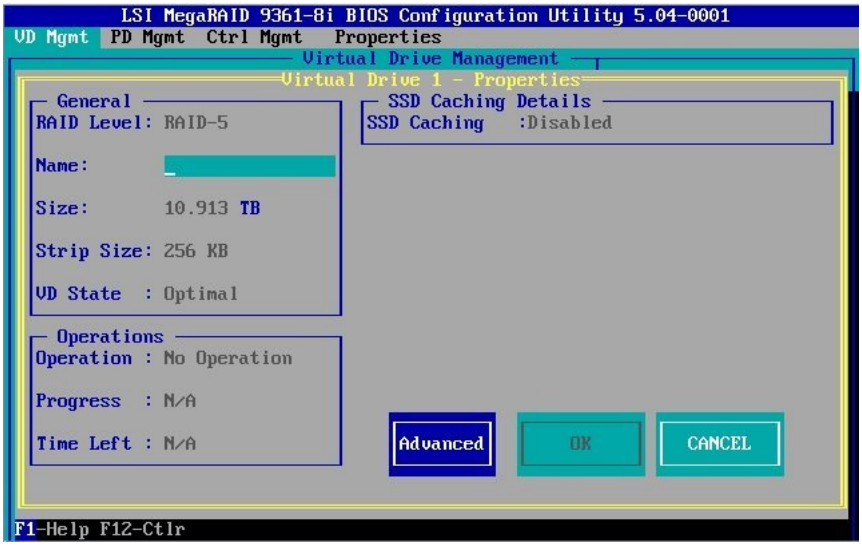
2. **From the main page that is displayed, use the arrow keys to navigate to the virtual drive upon which you plan to install the VMware ESXi technology, and press Enter.**



3. **Press F2 to view the Operations menu for the virtual drive, use the arrow keys to navigate to the Properties menu option, and press Enter.**



4. **From the page that is displayed, use the arrow keys to navigate to the Advanced button, and press Enter.**



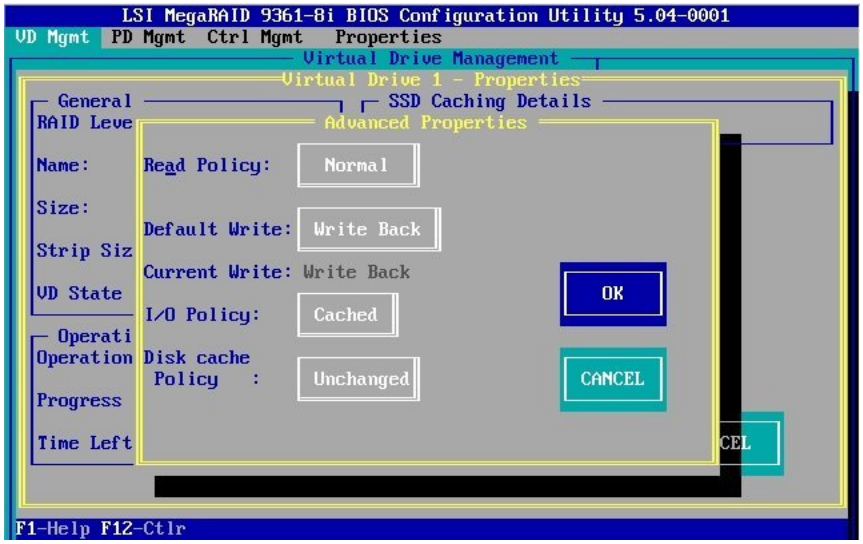
5. **Review the values of the Read Policy and I/O Policy fields and write them down.**

   These are the default cache settings. You will need to revert to these default cache settings after the VMware technology installation compeletes.

6. **From the Advanced Properties popup window that is displayed, use the arrow keys to navigate to, and then edit, the following fields as follows:**

   - Read Policy – Navigate to this field, and press Enter. From the popup window that is displayed, choose Normal, and press Enter.

- I/O Policy – Navigate to this field, and press Enter. From the popup window that is displayed, choose Cached, and press Enter.

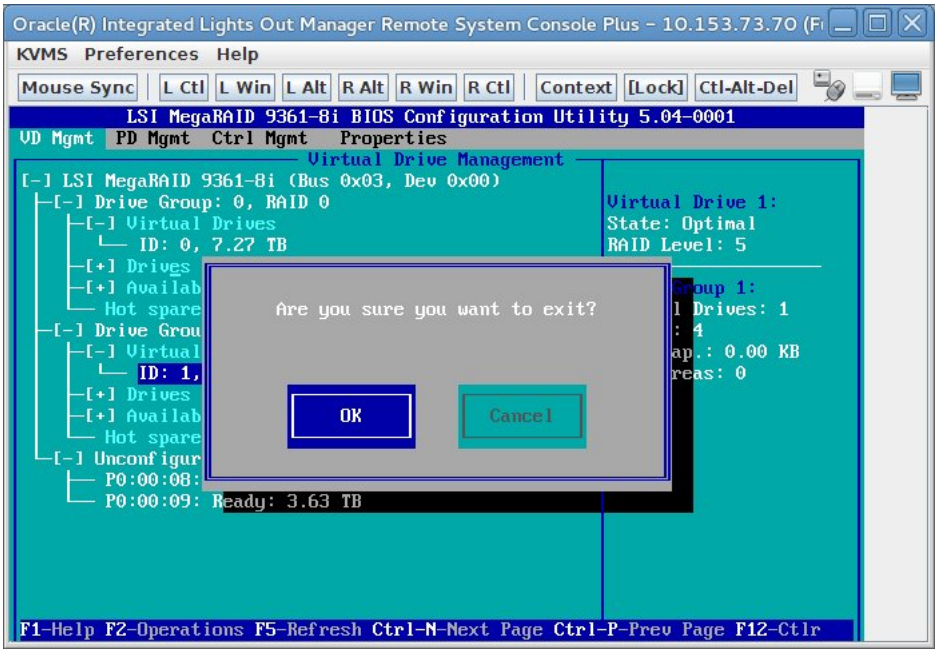


7. **Use the arrow keys to navigate to the OK button, and press Enter to exit the Advanced Properties popup window.**

8. **Use the arrow keys to navigate to the OK button on the Properties page to save the changes.**

   You are now returned to the main page of the utility.

9. **Press `Esc`, and at the popup window that is displayed, use the arrow keys to navigate to the OK button, and press Enter.**



This exits you from the utility. You can now reboot the system to accept the cache setting changes, and then continue with the VMware ESXi technology installation.

10. **After completing the VMware ESXi technology installation, access the utility again and revert to the default cache settings (the values that you wrote down earlier in the procedure).**

You can now replace the native HBA driver, as described in “Replacing the Native VMware HBA Driver ” on page 78.

Replacing the Native VMware HBA Driver

In order to use the HBA with the VMware ESXi 5.5 technology, you must replace the native VMware HBA driver, `lsi_mr3`, with the `megaraid_sas` HBA driver.

This section contains the following topics:

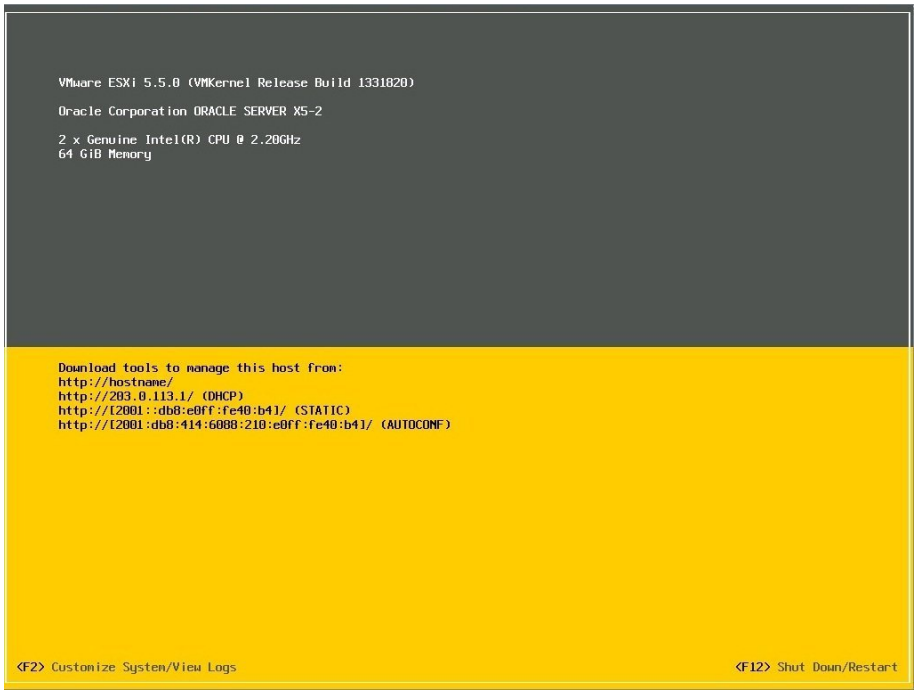
- "To Enable IP Connectivity, the ESXi Shell, and SSH" on page 79
- "To Replace the Native VMware HBA Driver" on page 82

▼ To Enable IP Connectivity, the ESXi Shell, and SSH

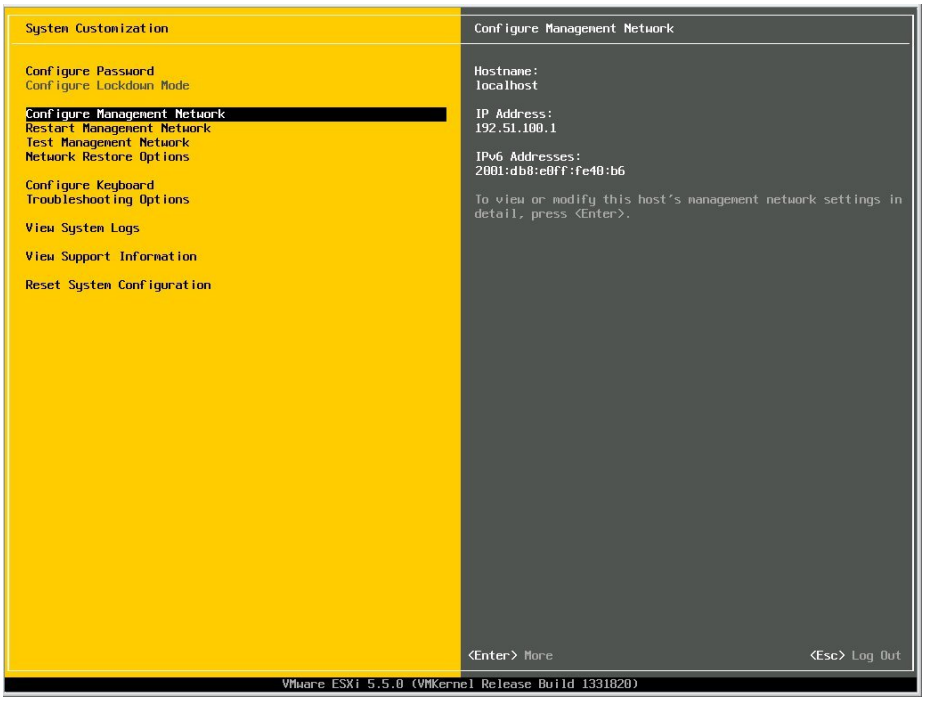
Before you can replace the VMware native HBA driver, you must enable IP connectivity to the ESXi server, and enable the ESXi shell and SSH.

1. Access the VMware ESXi technology software.

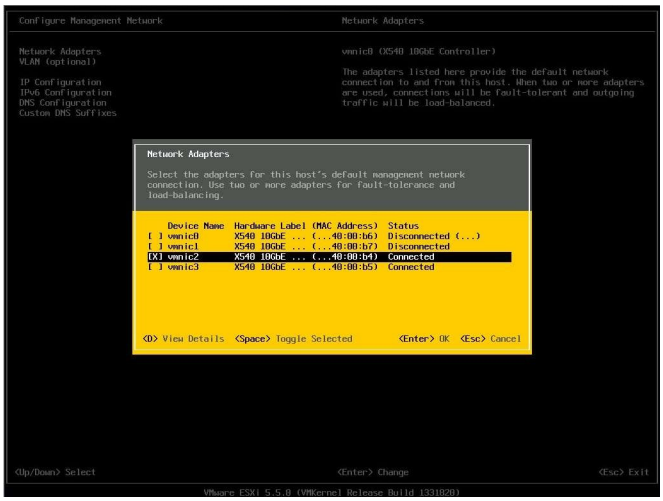
If your system is an x86 system, you can use Oracle System Assistant to access the VMware ESXi technology software.



2. **Press F2 to customize the system and use the arrow keys to navigate to the Configure Management Network menu option.**



3. **From the page that is displayed, select Network Adapters, and from the popup window that is displayed, select the connected `vmnic` device for IP connectivity.**



4. **At the popup window, press Enter to confirm the selection and press Esc to exit the popup window.**

5. **From the page that is displayed, type `Y` at the prompt to apply the changes you made and to restart the management network.**

   If your network is configured for DHCP, you now have IP connectivity.

Note - If you are using static IP addressing, you can enable IP connectivity by accessing the Configure Management Network screen, and then specifying the appropriate IP and DNS configuration settings for your ESXi 5.5 server and your IP network. You must restart the management network after making these changes to enable IP connectivity.

---

6. **Return to the VMware ESXi technology software main page, and navigate to the Troubleshooting Options menu option, and press Enter.**

7. **From the page that is displayed, navigate to the ESXi Shell and SSH fields and enable both services.**

8. **Replace the native VMware HBA driver, as described in "To Replace the Native VMware HBA Driver" on page 82.**

▼ To Replace the Native VMware HBA Driver

1. **Log in to the host.**
2. **In a browser, go to `https://www.broadcom.com/support/oem/oracle/`.**
3. **Select the type and then model of the HBA that you want (7110116, 7110117).**
4. **Select and download the VMware driver (generally, a VIB zip file) that is supported by the VMware release on your hardware platform.**

5. **At a terminal window on the host, run the `esxcfg-scsidevs -a` command to view the current driver that is being used by the HBA.**

   Note that the `lsi_mr3` HBA driver is currently being used by the HBA.

```
   # esxcfg-scsidevs -a

   vmhba38 ahci link-n/a sata.vmhba38 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
   vmhba39 ahci link-n/a sata.vmhba39 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
   vmhba0 ahci link-n/a  sata.vmhba0 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
   vmhba1 lsi_mr3 link-n/a  pscsi.vmhba1 (0:3:0.0) LSI MegaRAID SAS Invader Controller
   vmhba40  ahci link-n/a sata.vmhba40 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
   vmhba33 usb-storage link-n/a  usb.vmhba33 () USB
   vmhba35 usb-storage link-n/a  usb.vmhba35 () USB
   #
```

6. **Issue the `vim-cmd hostsvc/maintenance_mode_enter` command to place the ESXi host into maintenance mode.**

```
   # vim-cmd hostsvc/maintenance_mode_enter
   'vim.Task:haTask-ha-host-vim.HostSystem.enterMaintenanceMode-394644943'
   /vmfs/volumes/535592a8-1d9ce82f-333b-0010e04000b4
   #
```

7. **Install the VMware HBA driver VIB zip file that you obtained earlier in this procedure using the `--no-sig-check` parameter.**

```
    # esxcli software vib install -d
         "directory-path-to-the-driver-zip-file/megaraid_sas.zip" --no-sig-check
         Installation Result Message: The update completed successfully, but the system
needs to be
         rebooted for the changes to be effective. Reboot Required: true VIBs
         Installed: LSI_bootbank_scsi-megaraid-sas_6.603.53.00-1OEM.550.0.0.1331820
VIBs
         Removed: VMware_bootbank_scsi-megaraid-sas_5.34-9vmw.550.0.0.1331820 VIBs
Skipped:
         /vmfs/volumes/535592a8-1d9ce82f-333b-0010e04000b4
   #
```

8. **Reboot the ESXi host and reconnect with SSH.**

9. **Issue the `esxcli software vib list` command to verify that the `scsi-megaraid-sas` VIB is present.**

```
   # esxcli software vib list

   Name                Version                             Vendor  Acceptance Level
Install Date

   ----------------    -------------                       ------  ----------------
------------

   scsi-megaraid-sas   6.603.53.00-1OEM.550.0.0.1331820   LSI     VMwareCertified
2014-04-23
   ata-pata-amd        0.3.10-3vmw.550.0.0.1331820         VMware  VMwareCertified
2014-04-21
   ata-pata-atiixp     0.4.6-4vmw.550.0.0.1331820          VMware  VMwareCertified
2014-04-21
   ata-pata-cmd64x     0.2.5-3vmw.550.0.0.1331820          VMware  VMwareCertified
2014-04-21
   ata-pata-hpt3x2n    0.3.4-3vmw.550.0.0.1331820          VMware  VMwareCertified
2014-04-21
   ata-pata-pdc2027x   1.0-3vmw.550.0.0.1331820            VMware  VMwareCertified
2014-04-21
   ata-pata-serverworks 0.4.3-3vmw.550.0.0.1331820         VMware  VMwareCertified
2014-04-21
   ....
```

10. **Issue the following commands to disable the `lsi_mr3` native VMware HBA driver and to exit maintenance mode.**

```
   # esxcli system module set --enabled=false --module=lsi_mr3
   # vim-cmd hostsvc/maintenance_mode_exit
   'vim.Task:haTask-ha-host-vim.HostSystem.exitMaintenanceMode-16263936'
    #
```

11. **Reboot the ESXi 5.5 host and reconnect with SSH.**

12. **Issue the `esxcfg-scsidevs -a` command to verify that the HBA (in the following example:`vmhba1`) is now using the `megaraid-sas` driver.**

```
   # esxcfg-scsidevs -a
    vmhba38  ahci  link-n/a  sata.vmhba38 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
    vmhba39  ahci  link-n/a  sata.vmhba39 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
    vmhba0   ahci  link-n/a  sata.vmhba0  (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
    vmhba1   megaraid_sas link-n/a  unknown.vmhba1 (0:3:0.0) LSI/Symbios Logic MegaRAID
SAS Invader Controller
    vmhba40  ahci  link-n/a  sata.vmhba40 (0:0:31.2) Intel Corporation Wellsburg AHCI
Controller
    vmhba33 usb-storage   link-n/a usb.vmhba33 () USB
    vmhba35 usb-storage   link-n/a usb.vmhba35 () USB
    ...
```

Installing the RAID Configuration Utilities

The HBA can be configured for RAID levels 0, 1, 5, 6, 10, 50, and 60. The following RAID configuration utilities are available for the HBA:

- **MegaRAID Storage Manager Software** – A graphical user interface from which you can create RAID volumes for the HBA.

  Note - The MegaRAID Storage Manager software is not supported with the Oracle Solaris OS.

- **StorCLI Utility** – A command-line utility from which you can create RAID volumes for the HBA.

These utilities, and their associated documentation, are available for download at the Oracle designated web site:

https://www.broadcom.com/support/oem/oracle/

♦ ♦ ♦ CHAPTER 5

Known Issues

This chapter provides supplementary and workaround information for known issues related to the HBA. Specific bug identification numbers are provided for service personnel, when applicable.

This chapter contains the following topics:

Usable Capacity Reduction Is Possible Only With a RAID Level Migration

Bug ID: 30706613

Issue: Removing a drive from any redundant RAID level forces that RAID volume into a degraded state. You can only remove a redundant RAID level drive, such as a RAID 5 drive, in conjunction with a RAID level migration.

Workaround: None. This is expected behavior of RAID volumes.

Do Not Downgrade From Firmware Version 4.650.00-7176 to an Older Firmware Version

Bug ID: 26167176

Issue: After performing a downgrade from firmware version 4.650.00-7176 to 4.230.40-3739, the Oracle Solaris operating system fails to boot.

Workaround: None. Downgrading the HBA firmware version from 4.650.00-7176 to an older firmware version is not supported. The HBA must remain at the 4.650.00-7176 level, or higher.

Virtual Disk Performance Might Be Degraded During Some Operations

Bug ID: 19587107

Issue: Performance of a virtual disk that uses parity for data reconstruction (RAID 5 and RAID 6) will be degraded during rebuild operations, for example, copying data to a hot spare. This performance loss is most notable on virtual disks with very high workloads.

Workaround: None. This is expected behavior of RAID volumes.

From the BIOS Setup Utility, the State of a Drive Is Not Updating

Bug ID: 17556851

Issue: If your system is set to UEFI Boot Mode, and you access the BIOS Setup Utility to make changes to the state of a physical drive, you might not see the updated state of the drive after exiting and returning to the screen where you originally changed the drive state.

Workaround: This is designed behavior of the BIOS Setup Utility. Per the UEFI specification, screens are not updated when a user performs a single keypress in the UEFI BIOS Setup Utility. If you perform an operation in the utility, and you need to see a status update to confirm the operation completed successfully, exit out of the screen to the root level menu. Returning to the screen at the root level enables you to view the updated status of your operation.

JBOD Mode Properties Are Not Supported

Issue: When you access the BIOS Setup Utility or BIOS Configuration Utility, the option ROMs that are displayed for the HBA include properties for enabling JBOD mode. In JBOD mode, each physical drive on the server is identified as one logical partition. This configuration

is an alternative to redundant array of independent disk (RAID) implementations. However, the HBA does not support JBOD mode.

Workaround: Disregard the JBOD mode options in the following utilities:

- LSI MegaRAID BIOS Configuration menu of the BIOS Setup Utility (UEFI Boot Mode)
- BIOS Configuration Utility (Legacy Boot Mode)

♦ ♦ ♦ APPENDIX A

HBA Specifications

This appendix contains the specifications for the HBA.

This appendix contains the following topics:

Physical Dimensions

The HBA card size is as follows:

- Height: 94.31mm (2.731 inches)
- Length: 167.64mm (6.6 inches)

Environmental Specifications

The HBA environmental requirements are listed in Table 4, "HBA Environmental Specifications," on page 91.

TABLE 4 HBA Environmental Specifications

Specification	Operating	Non-Operating
Temperature	10 °C to 55 °C, non-condensing	-40 °C to 70 °C, non-condensing
Humidity	20% to 80% RH, non-condensing, 40 °C max, 27 °C max wet bulb, 16 hour dwells at extreme	5% to 90% RH, non-condensing, 38 °C max wet bulb
Altitude	3000m at 40 °C, 4 hour dwell	12,000m at 0 °C, 4 hour dwell

Specification	Operating	Non-Operating
Vibration	0.20G in all axes swept for 5-500 Hz, 5 sweeps in all at 1 octave/min	1.0G in all axes swept for 5-500 Hz, 5 sweeps in all at 1 octave/min
Shock	5G, 11 ms half-sine	30G, 11 ms half-sine
Airflow	At least 200 linear feet per minute (LFPM) to avoid operating the HBA processor above the ambient temperature	At least 200 linear feet per minute (LFPM)

Fault Tolerance

The following table lists the fault tolerance features for the HBA.

TABLE 5 Fault Tolerance Features

Specification	HBA Support
Support for SMART	Yes
Drive failure detection	Automatic
Drive rebuild using hot spares	Automatic
Parity generation and checking	Yes

Note - The Self Monitoring Analysis and Reporting Technology (SMART) detects up to 70 percent of all predictable drive failures. In addition, SMART monitors the internal performance of all motors, heads, and drive electronics.

Electrical Characteristics

All power is supplied to the HBA through the PCI Express 3.3V rails and the 12V rail. Onboard switching regulator circuitry operating from the 3.3V rails and the 12V rail provide the necessary voltages. The following states determine the typical current consumption of the controller:

- State 1: During a hard reset
- State 2: During a disk stress test
- State 3: While sitting idle at the DOS prompt

The supply voltages are 12V 8 percent (from PCI edge connector only) and 3.3V 9 percent (from PCI edge connector only). The following table lists the power supply information for the controller for each of the three states at the different voltages.

TABLE 6 Power Supply for the HBA

PCI Edge Connector	State 1	State 2	State 3
3.3V supply	330mA	330mA	330mA
+12V supply	1.00A	1.81A	1.53A
3.3V auxiliary supply	30mA	30mA	30mA

Glossary

A, B

ASIC Acronym for application-specific integrated circuit. A microchip that is designed for a specific application or purpose, such as a particular kind of transmission protocol. An ASIC can improve speed because it is designed to do one specific thing.

BIOS Acronym for Basic Input/Output System. Software that provides basic read/write capability. Usually kept as firmware (ROM-based). The system BIOS on the motherboard of a computer boots and controls the system. The BIOS on your host adapter acts as an extension of the system BIOS. See UEFI.

C

configuration Refers to the way a computer is set up, the combined hardware components (computer, monitor, keyboard, and peripheral devices) that comprise a computer system, or the software settings that enable the hardware components to communicate with each other.

D

DDR Abbreviation for double data rate. DDR is adavanced type of computer memory chip that can transfer data twice as fast as regular memory chips. This is because DDR memory can send and receive signals twice per clock cycle.

DDR2, DDR3 Abbreviation for double data rate 2 or 3. An improved version of DDR memory. See DDR.

device driver A program that enables a microprocessor (through the operating system) to direct the operation of a peripheral device.

DIX Acronym for Digital, Intel, and Xerox. An Ethernet standard, defined by these three companies (Digital, Intel, and Xerox), that specified 10 Mbit/s Ethernet, with 48-bit destination and source addresses and a global 16-bit Ethernet-type field.

domain validation A software procedure in which a host queries a device to determine its ability to communicate at the negotiated data rate.

drive group A group of physical drives that combines the storage space on the drives into a single segment of storage space. A hot-spare drive does not actively participate in a drive group.

E

EEDP Abbreviation for Edison Engineering Development Program. A program, run by General Electric, that provides advanced courses in engineering and technical projects.

EEPROM Acronym for electronically erasable programmable read-only memory. It is a memory chip that typically stores configuration information, as it provides stable storage for long periods without electricity and can be reprogrammed. See NVRAM.

external SAS device A SAS device installed outside the computer chassis. These devices are connected using specific types of shielded cables.

F

Fusion-MPT architecture Abbreviation for Fusion-Message Passing Technology architecture. Fusion-MPT consists of several main elements: Fusion-MPT firmware, the Fibre Channel and SCSI hardware, and the operating system-level drivers that support these architectures. Fusion-MPT architecture offers a single binary, operating system driver that supports both Fibre Channel and SCSI devices.

G, H

HBA Abbreviation for host bus adapter. A piece of hardware that connects a host to network and storage devices.

HD Acronym for high-density.

host The computer system in which a RAID adapter is installed. It uses the RAID adapter to transfer information to and from devices attached to the SCSI bus.

host adapter board A circuit board or integrated circuit that provides a device connection to the computer system.

host bus adapter A piece of hardware that connects a host to network and storage devices.

hot spare An idle, powered-on, standby drive that is ready for immediate use in case of drive failure. A hot spare does not contain any user data. A hot spare can be dedicated to a single redundant array or it can be part of the global hot spare pool for all arrays managed by the HBA.

When a drive fails, the HBA firmware automatically replaces and rebuilds the data from the failed drive to the hot spare. Data can be rebuilt only from virtual drives with redundancy (RAID levels 1, 5, 6, 10, 50, and 60; not RAID level 0), and the hot spare must have sufficient capacity.

I

internal SAS device A SAS device installed inside the computer cabinet. These devices are connected using a shielded cable. SeeSAS.

J, K, L, M

main memory The part of computer memory that is directly accessible by the CPU, usually synonymous with RAM.

N

NVRAM Acronym for nonvolatile random access memory. An EEPROM (electronically erasable read-only memory) chip that stores configuration information. See EEPROM.

O, P

PCI Abbreviation for Peripheral Component Interconnect. A high-performance, local bus specification that enables the connection of devices directly to computer memory. The PCI Local Bus enables transparent upgrades from 32-bit data path at 33 MHz to 64-bit data path at 33 MHz, and from 32-bit data path at 66 MHz to 64-bit data path at 66 MHz.

PCI Express Abbreviation for Peripheral Component Interconnect Express. A high-performance, local bus specification that enables the connection of devices directly to computer memory. PCI Express is a two-way, serial connection that transfers data on two pairs of point-to-point data lines. PCI Express goes beyond the PCI specification in that it is intended as a unifying I/O architecture

for various systems: desktops, workstations, mobile, server, communications, and embedded devices.

peripheral devices A piece of hardware (such as a video monitor, drive, printer, or CD-ROM) used with a computer and under the control of the computer. SCSI peripherals are controlled through an Oracle Storage 12 Gb/s SAS PCIe RAID HBA, Internal (host bus adapter).

PHY The interface required to transmit and receive data packets transferred across the serial bus.

Each PHY can form one side of the physical link in a connection with a PHY on a different SATA device. The physical link contains four wires that form two differential signal pairs. One differential pair transmits signals, while the other differential pair receives signals. Both differential pairs operate simultaneously and enable concurrent data transmission in both the receive and the transmit directions.

Q, R, S

SAS Acronym for Serial Attached SCSI. A serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. The SAS interface provides improved performance, simplified cabling, smaller connections, lower pin count, and lower power requirements when compared to parallel SCSI. SAS host bus adapters leverage a common electrical and physical connection interface that is compatible with Serial ATA. Each port on the SAS RAID adapter supports SAS devices, SATA II devices, or both.

SAS device Any device that conforms to the SAS standard and is attached to the SAS bus by a SAS cable. This includes SAS RAID adapters (host adapters) and SAS peripherals.

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 enable better airflow within the system and permit smaller chassis designs.

SDRAM Acronym for Synchronous Dynamic Random Access Memory. SDRAM is dynamic random access memory (DRAM) that is synchronized with the system bus.

SFF Acronym for Small Form Factor. Any of several physically compact connector designs used in fiber optic systems.

SMP Acronym for Serial Management Protocol. SMP communicates topology management information directly with an attached SAS expander device. Each PHY on the adapter can function as an SMP initiator.

spanning A method for combining multiple drives into a single logical drive. If you want to have all of the drive capacity in one drive group, you can span (merge) the drives so that the operating

system sees just one large drive. For more information, refer to the *MegaRAID SAS Software User's Guide*, located at: https://www.broadcom.com/support/oem/oracle/.

SSP Abbreviation for Serial SCSI Protocol. SSP enables communication with other SAS devices. Each PHY on the SAS adapter can function as an SSP initiator or SSP target.

STP Abbreviation for Serial Tunneling Protocol. STP enables communication with a SATA II device through an attached expander. Each PHY on the SAS adapter can function as an STP initiator. See SATA .

stripe size The total drive space consumed by a stripe not including a parity drive. For example, consider a stripe that contains 64 Kbytes of drive space and has 16 Kbytes of data residing on each drive in the stripe. In this case, the stripe size is 64 Kbytes and the stripe element size is 16 Kbytes. The stripe depth is four (four drives in the stripe). You can specify stripe sizes of 8 Kbytes, 16 Kbytes, 32 Kbytes, 64 Kbytes, 128 Kbytes, 256 Kbytes, 512 Kbytes, or 1 Mbyte for each logical drive. A larger stripe size produces improved read performance, especially if most of the reads are sequential. For mostly random reads, select a smaller stripe size.

striping Drive striping writes data across two or more drives. Each stripe spans two or more drives but consumes only a portion of each drive. Each drive, therefore, may have several stripes. The amount of space consumed by a stripe is the same on each drive that is included in the stripe. The portion of a stripe that resides on a single drive is a stripe element. Striping by itself does not provide data redundancy; striping in combination with parity provides data redundancy.

T, U, V, W, X, Y, Z

UEFI Abbreviation for Unified Extensible Firmware Interface. A standard programming interface used for booting a computer. UEFI is designed to replace BIOS (basic input/output system). See BIOS.

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