

Installing and Configuring SAS Hardware RAID on HP Workstations

Introduction

This document provides an overview of hardware RAID solutions for HP workstations running the Windows and Linux operating systems. It assumes a basic understanding of computer hardware, filesystems, and the Linux operating system. It covers an overview of hardware RAID solutions, the differences between software and hardware RAID offerings, and information regarding the configuration of hardware RAID on HP workstations.

Hardware RAID in Windows

For SAS controllers on Windows workstations, support is provided according to what the SAS controller provides, within system limitations or restrictions. HP recommends that only supported SAS drives be attached to SAS controllers for drives located in chassis drive slots.

	xw4400	xw6400	xw8400	xw9400	xw4600	xw6600	xw8600
LSI 3041E							
RAID 0	2 or more drives	2 or more drives			2 or more drives	2 or more drives	
RAID 1	2 drives	2 drives			2 drives	2 drives	
RAID 1/10E	3 or more drives	3 or more drives			3 or more drives	3 or more drives	
LSI 8344ELP							
RAID 0	2 or more drives						
RAID 1	2 drives	2 drives	2 drives	2 drives			
RAID 5	3 or more drives						
RAID 10	4 or more drives						
RAID 50	6 or more drives						
LSI 8888ELP							
RAID 0					2 or more drives	2 or more drives	2 or more drives
RAID 1					2 drives	2 drives	2 drives
RAID 5					3 or more drives	3 or more drives	3 or more drives

RAID 10		4 or more drives	4 or more drives	4 or more drives
RAID 50		6 or more drives	6 or more drives	6 or more drives
LSI 1064				
RAID 0		2 or more drives		
RAID 1		2 drives		
RAID 1/10E		3 or more drives		
LSI 1068				
RAID 0		2 or more drives		2 or more drives
RAID 1		2 drives		2 drives
RAID 1/10E		3 or more drives		3 or more drives

Hardware RAID in Linux

There are different levels of hardware RAID available; not all of them are supported options for HP Linux workstations.

- Hardware-assisted RAID is a step up from software RAID, but is not considered true hardware RAID. Hardware-assisted SAS RAID uses the LSI megaraid driver already present in the Linux kernel. It is provided by the LSI 3041E plug-in card on the HP xw4000 and xw6000 Workstation series and by the LSI 1064 and 1068 controllers on the motherboard on the HP xw8000 and xw9000 Workstation series.
- True hardware RAID, also known as raid-on-chip, or ROC, makes use of a dedicated RAID processor. It is provided by the LSI 8344ELP and 8888ELP plug-in cards on the HP xw8000 and xw9000 family platforms. SAS drives are the only drives supported for use with RAID on HP Linux workstations.
- Hardware-assisted SATA RAID requires use of the dmraid interface, and is not supported on HP Linux workstations.

Supported Configurations

Hardware RAID for HP Linux workstations is currently supported for user-configured RAID solutions for the HP workstations below. Not all configurations that are made available by the RAID chipsets or plug-in cards are supported by HP; only the configurations listed below are supported on HP Linux workstations.

	xw4400	xw6400	xw8400	xw9400	xw4600	xw6600	xw8600
LSI 3041E							
RAID 0	2-4 drives	2-3 drives			2-4 drives	2-3 drives	
RAID 1	2 drives	2 drives			2 drives	2 drives	

LSI 8344ELP				
RAID 0	2-4 drives	2-4 drives		
RAID 1	2 drives	2 drives		
RAID 5	3-4 drives	3-4 drives		
LSI 8888ELP				
RAID 0		2-4 drives	2-3 drives	2-6 drives*
RAID 1		2 drives	2 drives	2 drives
RAID 5		3-4 drives	3 drives	3-6 drives*
LSI 1064				
RAID 0	2-4 drives			
RAID 1	2 drives			
LSI 1068				
RAID 0		2-5 drives		2-6 drives*
RAID 1		2 drives		2 drives

* HP xw8600 Workstation can accommodate 6 internal 2.5" drives

Not all possible hardware RAID configurations are supported on HP Linux workstations.

- Only SAS drives are supported with hardware-assisted and full hardware RAID.
- SATA and PATA drives are not supported with hardware RAID, but can be used with software RAID solutions.
- Supported operating systems are:
 - Red Hat Enterprise Linux 4.5 and later
 - Red Hat Enterprise Linux 5.0 and later
 - SUSE Linux Enterprise Server 9 SP4 and later
 - SUSE Linux Enterprise Server 10 SP1 and later
 - SUSE Linux Enterprise Desktop 10 SP1 and later
- Support for Red Hat Enterprise Linux (RHEL) operating systems will be provided by HP. Support for SLE operating systems will be provided by Novell.
- The Linux Hardware Matrix contains information on all current platforms and is a good place to learn which RAID controllers are supported on a given platform.

LSI 3041E and Integrated LSI 1064/1068 Setup

The LSI 3041E is a 4-port SATA/SAS RAID controller providing SAS support for the HP xw4000 and xw6000 Workstation series. Note that while the controller provides functionality for SATA RAID, SATA RAID is not supported on HP Linux workstations. The HP xw8000 and xw9000 Workstation series use an onboard LSI 1064 or 1068 SAS controller, which uses the same BIOS configuration utility as the LSI 3041E plug-in card. The following steps can be used as a guide for setting up the LSI 3041E or the

onboard LSI controllers for SAS RAID; details will vary based on the specific configuration (RAID level, number of disks) used.

Step 1: Boot the workstation, and when prompted, press any key to view option ROM messages. A message indicating the presence of the LSI onboard controller or plug-in card and the LSI Logic MPT SAS BIOS will appear.

Figure 1 LSI Logic MPT SAS BIOS

```
Serial ATA AHCI BIOS, Version 13rc 1.05 07102006
Copyright (c) 2003-2006 Intel Corporation
** This version supports only Hard Disk and CDROM drives **
Please wait. This will take few seconds.

Controller Bus#00, Device#1F, Function#02: 06 Ports, 02 Devices
  Port-00: CDROM, ATAPI DVD D 00160YS
  Port-01: Hard Disk, ST3160012AS
           (Drive is controlled by the RAID BIOS)
  Port-02: No device detected
  Port-03: No device detected
  Port-04: No device detected
  Port-05: No device detected
AHCI BIOS installed

LSI Logic Corp. MPT SAS BIOS
MPTBIOS-6.16.00.00 (2007.05.07)
Copyright 2000-2007 LSI Logic Corp.

Press Ctrl-C to start LSI Logic Configuration Utility...
```

Step 2: Press CTRL-C when indicated to begin RAID configuration and enter the LSI Logic MPT Setup Utility. The first screen will display a list of available adapters. The LSI 3041E plug-in card appears on this list as the SAS1064E, the LSI onboard controllers are listed as the LSI1064 or LSI1068. This screen can be used to change the boot order of the adapters.

Figure 2 LSI Logic MPT Setup Utility – Adapter selection



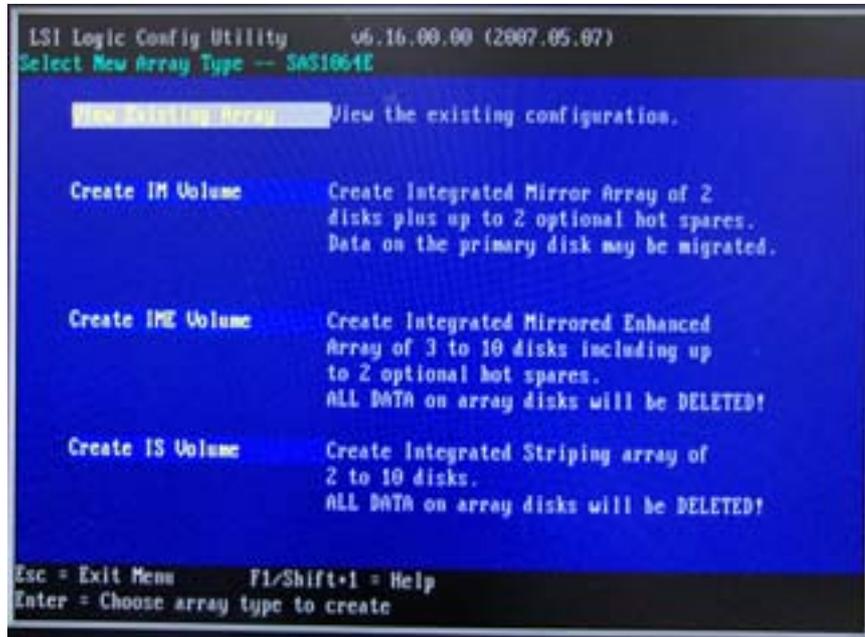
Step 3: Press enter to select and configure the highlighted adapter from the list. The next screen will display properties of the selected adapter. Information on the attached drives, any RAID arrays present, and more advanced adapter properties is available.

Figure 3 LSI Logic MPT Setup Utility – Adapter properties



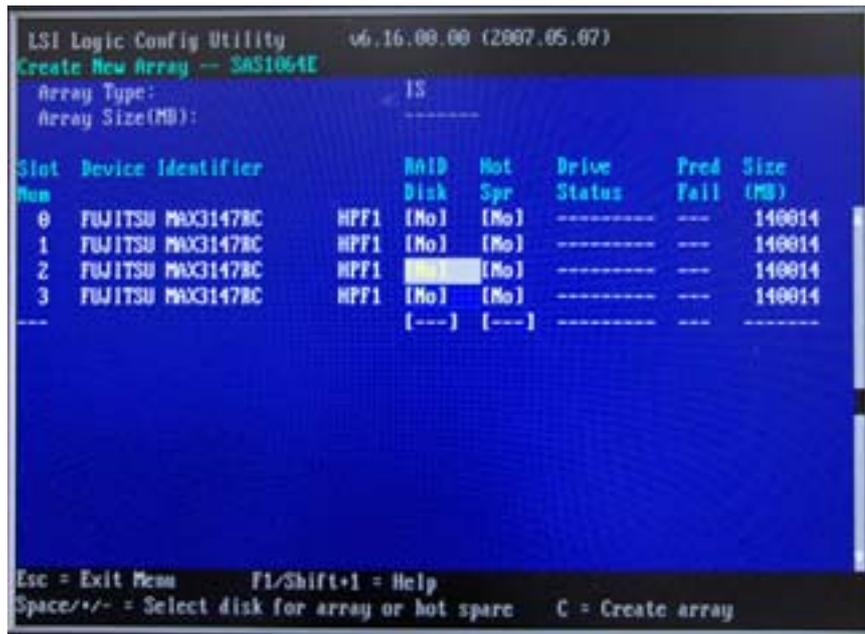
Step 4: To create, manage or delete a SAS RAID array, highlight RAID Properties and press enter. If an array is presently configured on the controller, the “View Existing Array” will be present.

Figure 4 Logic MPT Setup Utility – RAID properties



Step 5: To create a new array, select one of the options to create either an IM, IME, or IS volume and press enter. IM, or Integrated Mirroring, is also known as RAID-1. IME, or Integrated Mirroring Enhanced, is RAID-10. IS, or Integrated Striping, is RAID-0. The next screen will list the disks. For each disk to be part of the array, move to the column labeled “RAID Disk” and press the space bar to add the disk to the array. The next column, “Hot Spr,” can be used to mark disks to be hot spares in case of disk failure. When the disks have been marked as desired, press C to create the array.

Figure 5 LSI Logic MPT Setup Utility – Array creation



Step 6: After an array has been created, the utility gives options for managing it through the “View Existing Array” menu. Viewing the array will display various properties of the RAID array, including the disks present and their status.

Figure 6 LSI Logic MPT Setup Utility – View array



Step 7: Select the “Manage Array” option and press enter to use the utility’s management features. From here, the disks that are configured to be hot spares can be managed, the array can be activated, deactivated, or deleted, and if the array is not at an “Optimal” status due to a disk failure or other problem, it can be synchronized from this menu.

Figure 7 LSI Logic MPT Setup Utility – Manage array



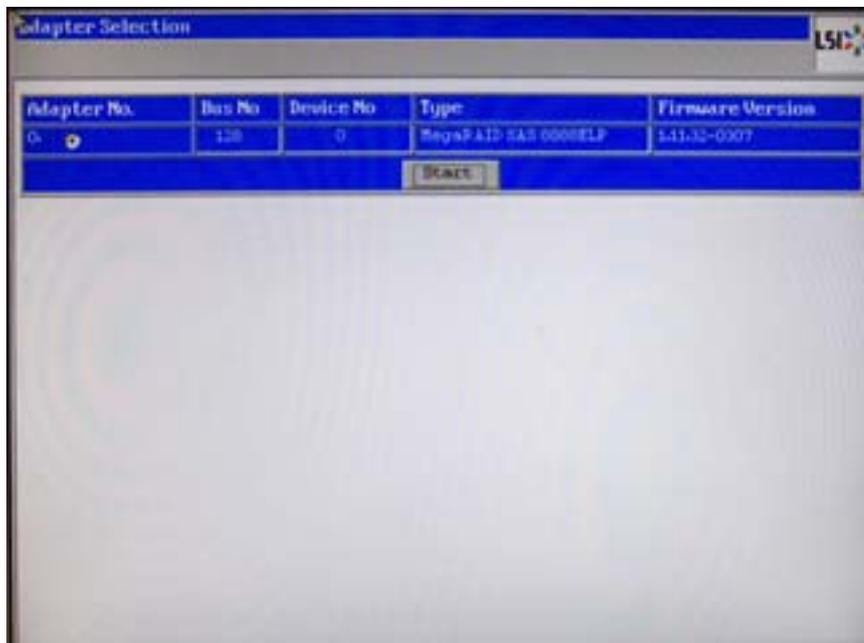
When finished, or at any step in the process, the escape key can be used to exit the current view, canceling or saving any changes as needed.

LSI 8344ELP and LSI 8888ELP Setup

The LSI 8344ELP and LSI 8888ELP are 8-port SATA/SAS RAID controllers providing additional SAS support for the HP xw8000 and xw9000 family platforms. Note that while the controller provides functionality for SATA RAID, SATA RAID is not supported on HP Linux workstations. The HP xw8000 and xw9000 family platforms also have onboard SAS RAID capabilities that can be described best as hardware-assisted RAID; the 8344ELP and 8888ELP plug-in cards are considered to be full hardware RAID. The following steps can be used as a guide for setting up the LSI 8344ELP or the LSI 8888ELP for SAS RAID; details will vary based on the specific configuration used.

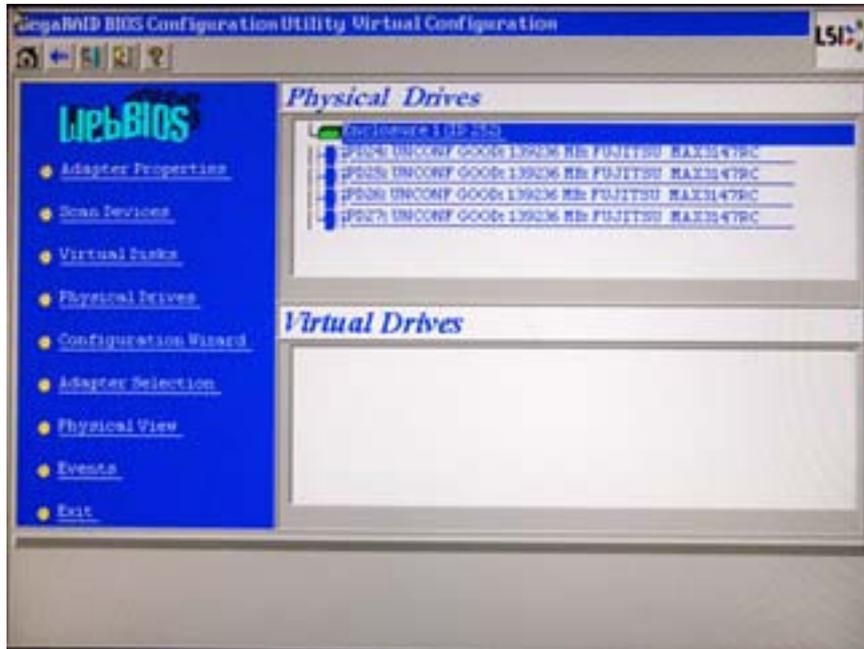
Step 1: Boot the workstation, and when prompted, press CTRL-H to enter LSI's WebBIOS utility. WebBIOS will be run after POST completes. Select your adapter from the Adapter Selection screen and press start to enter the utility.

Figure 8 LSI WebBIOS – Adapter selection



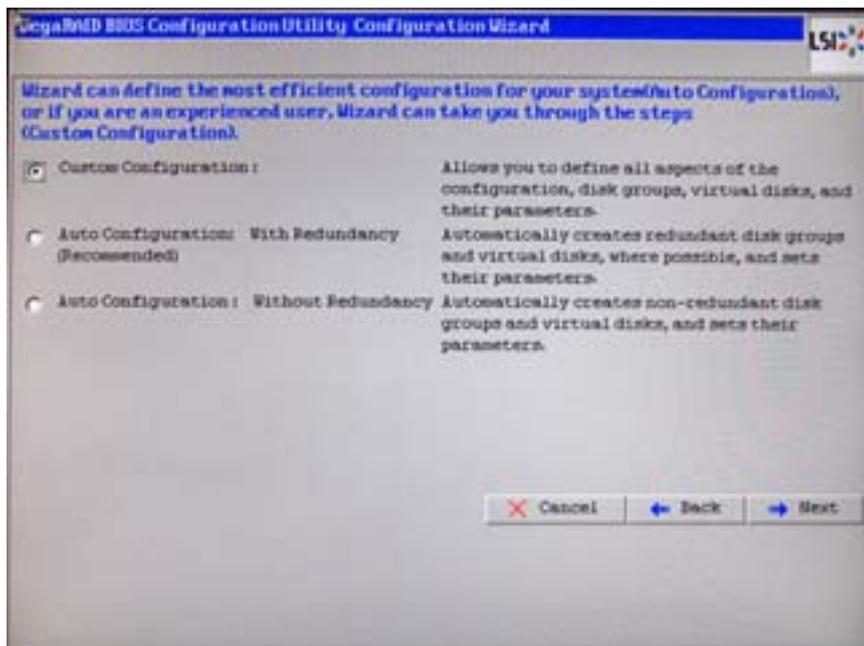
Step 2: The main WebBIOS screen can be used to configure the adapter, the physical disks, and the virtual disks or RAID arrays. The first view shows the physical disks connected to the adapter, any RAID arrays presently configured, as well as the status of both physical and virtual disks.

Figure 9 LSI WebBIOS – Main screen



Step 3: The Configuration Wizard can be used to create a new RAID array on the device. From the MegaRAID Configuration Wizard screen, there are options available to clear any existing device configuration, add new drives to an existing configuration, or create a new configuration from scratch. Clicking on either “New Configuration” or “Add Configuration” proceeds to the next step of the wizard, where there are options for either custom or automatic configurations.

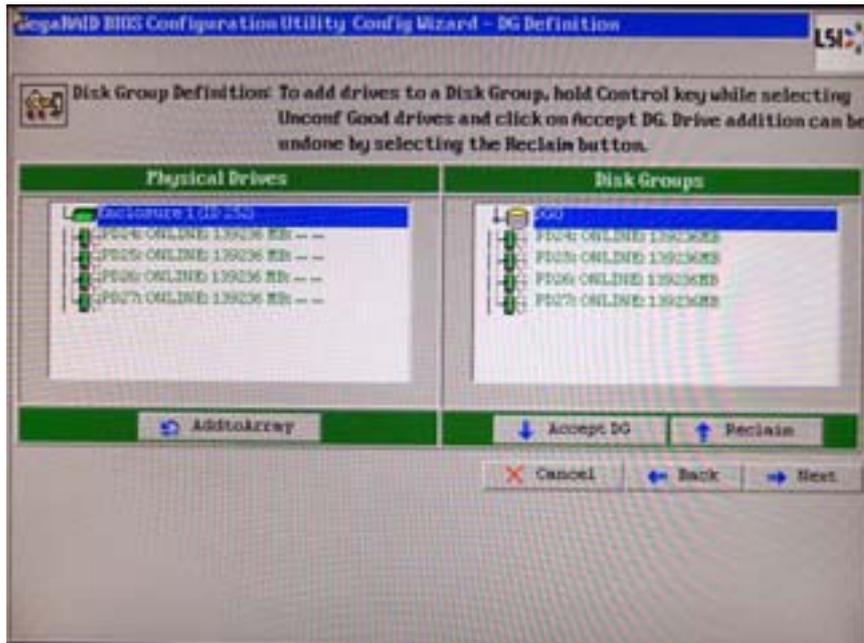
Figure 10 LSI WebBIOS – Configuration wizard



Step 4: Automatic configurations will automatically add all available disks to a RAID array, with the RAID level determined by whether or not redundancy is selected. Custom configuration allows the user to select disks, array size, and RAID level. The next screen allows for the selection of the disks which will

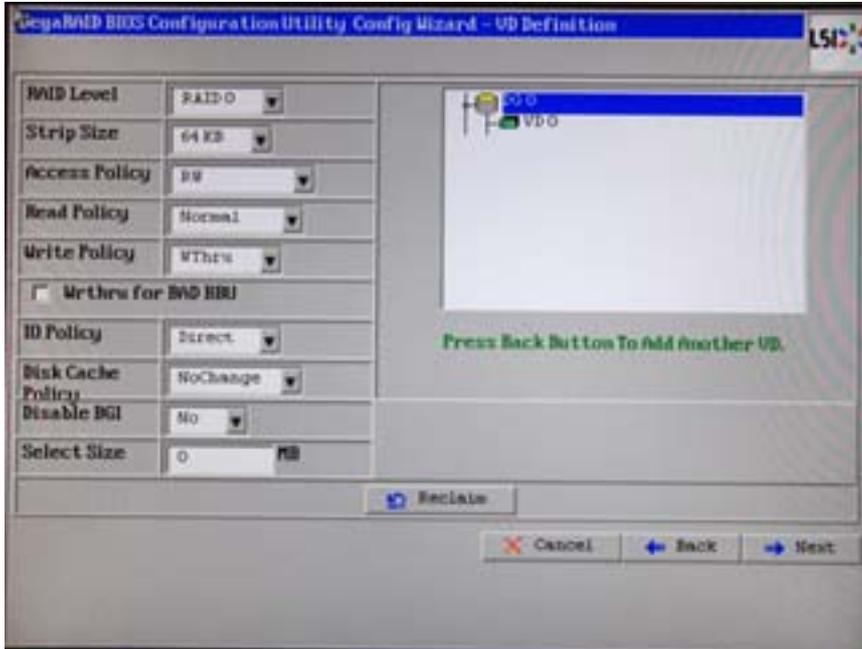
be part of the RAID array. Select from the available disks those disks that will be part of the RAID array and click “Accept DG” to proceed.

Figure 11 LSI WebBIOS – Configuration of disk group



Step 5: The next screen allows for more advanced configuration of the RAID array. Many details about the disk policies can be selected here. The most important options on this screen are the RAID level and size. First select the RAID level from the drop-down menu- the RAID levels available will vary depending on the number of physical disks in the disk group. The configuration window to the right of the screen will display information on the maximum size of the RAID array for the different available RAID levels. In the text box labeled “Select Size,” enter a size in MB up to this available maximum size. When these options have been selected, further customization can be done, or click “Accept” or “Next” to move to the next step of configuration.

Figure 12 LSI WebBIOS – Virtual disk configuration



Step 6: The next screen will display the physical disks on the left and the proposed virtual disk (RAID array) on the right as a preview of the proposed disk configuration. If changes are needed, press “Back” to go back and change details of the configuration, or press “Accept” to accept the configuration. On the next screen, press “Yes” to save the configuration, then press “Yes” to initialize the new RAID array. If a disk in the RAID array fails or needs to be replaced for any reason, the WebBIOS utility can be used to easily rebuild the RAID array. If a disk failure occurs, the change to the RAID array will be indicated by a message on the screen before entering the utility.

Figure 13 Foreign configuration on LSI adapter



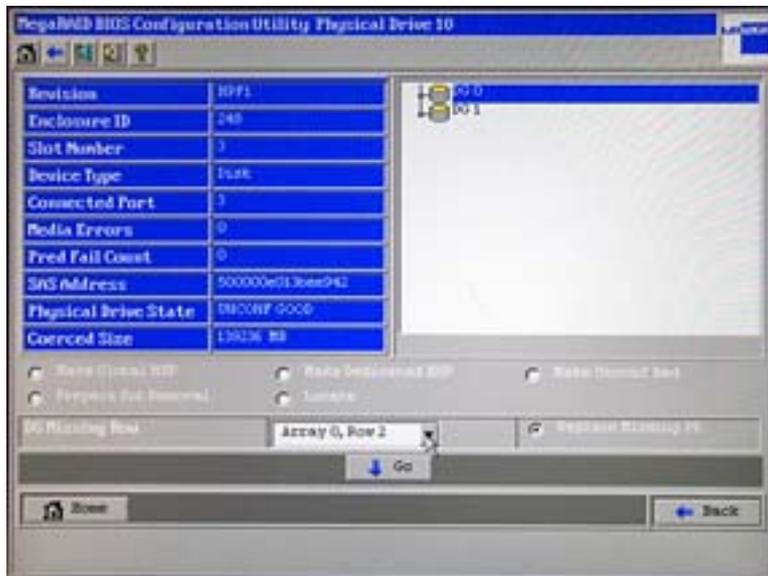
Step 7: Press C or CTRL-H when indicated to enter the utility. When the home screen appears, the new disk will be marked as “Unconfigured bad” and the missing disk will be labeled in red. Click on the new unconfigured disk in order to configure it and add it to the RAID array.

Figure 14 LSI WebBIOS – Unconfigured bad disk



Step 8: From the next screen, select the option to make the disk “Unconfigured good” so it can be made to be part of a disk group and click “Go.” The next screen will display the configured disk groups. The group from which the original disk was missing will be indicated. Select the location of the disk from the row labeled “DG Missing Row,” where the listed options will be the locations where a disk was missing from the RAID array. The radio button marked “Replace Missing PD” will be checked. Click “Go” to complete the operation.

Figure 15 LSI WebBIOS – Replacing a physical disk



Step 9: After the disk has been replaced, it will start with an offline status. Select the option marked “Make Online” to bring the physical disk online and finish rebuilding the RAID array.

At any point during RAID configuration or management, the home button will return to the main screen of the configuration utility, and the exit button will cancel any unsaved changes and exit the application.

Additional RAID Information

OS Installation

The above steps document the process for setting up a hardware RAID array using the tools provided by the hardware RAID adapter. After this setup process is complete, an operating system can be installed. If the user does not wish to have the RAID array be bootable, a separate SATA or SAS boot disk can be used, and the RAID array can be a separate disk group for data storage only. During operating system installation, the configured RAID array will be recognized as a logical disk group, and can be set up and partitioned as desired.

Other Workstation Platforms

The above information applies only to the desktop workstation platforms discussed herein. Hardware RAID support is not available on the HP xw4550, since only SAS RAID is supported on HP Linux workstations. The xw4550 only supports SATA drives, and SATA RAID support is not available. The HP xw460c blade workstation supports hardware RAID levels 0 or 1 using the SAS drives that are available for use on that platform.

