White Paper

MegaRAID® Release 3.6

New Features and Benefits

FEATURES AND FUNCTIONS

The new features and functions specifically related to MegaRAID Release 3.6 include:

- Solid State Drive (SSD) Support
- SSD Guard™
- Dimmer Switch™ - Phase I
- VMware ESXi Virtualization Support
- UEFI 2.0 support for new Intel Platforms
- SAS tape drive support
- OS Enhancements: Solaris X86, FreeBSD support

The MegaRAID SAS 87xx and 88xx series adapters are supported under Release 3.6. To download the latest MegaRAID Release, go to www.lsi.com/support and select your adapter.

Executive Summary

MegaRAID Release 3.6 offers new product features and functionality for the MegaRAID SAS 87xx and 88xx families of SAS/SATA adapters. These new features enhance our four cornerstones of leadership; Features and Usability, Data Protection and Availability, Performance and Green. This release provides tangible end-user benefits such as reduced installation and setup time, enhanced data security, improved performance and increased energy efficiency. With each firmware release, LSI delivers a more robust and reliable utility for managing storage arrays.

LSI Cornerstones of Leadership

FEATURES AND USABILITY	DATA PROTECTION AND AVAILABILITY
Items that reduce the time required for installation, setup, or maintenance of systems containing MegaRAID and/or make MegaRAID applicable for a broader range of applications	Items that either improve the security of data or reduce the failure rate of systems containing MegaRAID
PERFORMANCE	**GREEN**
Items that make MegaRAID run faster	Items that make MegaRAID more environmentally friendly

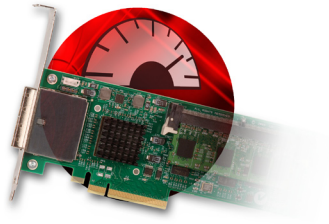
The following table displays the major items in each of the LSI MegaRAID firmware releases. The most recent, MegaRAID Release 3.6, offers seven new features that span the four cornerstones of leadership.

MegaRAID Releases

RELEASE	FEATURES AND USABILITY	DATA PROTECTION AND AVAILABILITY	PERFORMANCE	GREEN
3.1	■ 240 Physical Device Support	■ RAID 6		■ RoHS 6
3.2	■ OS Enhancements: SLES 10 ■ Extend maximum chained enclosures to 16 ■ Support 3 Drive R6 in management utilities ■ Email event notification	■ RAID 6 support for 84016E	■ NCQ Support ■ Increase maximum stripe size to 256K	
3.3	■ Dynamic enclosure import ■ SCSI Enclosure Services (SES) over i2C physical interface ■ OS Enhancements: MS Vista, Solaris x86, Redhat 5.0, VMWare 3.01, Sco UnixWare, SCO Open Server 6.0, XEN support for SLES 10 ■ Extensible Firmware Interface (EFI) support ■ Support up to 16 MegaRAID adapters per system ■ Patrol Read Throttle ■ Enclosure affinity for hot spare ■ Integrated RAID support in MSM ■ Label a spanned RAID 0 logical drive 'RAID 00'	■ iTBBU2, miniDimm support	■ Increase maximum stripe size to 512k and 1MB	
3.4	■ Enhanced Foreign Configuration Import ■ Schedulable Check Consistency ■ OS Enhancements: XEN support for RHEL 5 ■ Dual Boot Support in MegaCLI ■ WebBIOS option to enable/disable disk drive failure history ■ MegaCLI support for EM64T environments	■ Enhanced Bad Block Management ■ New iBBU support		
3.5	■ Extensions to RAID 1 ■ Revertible Hot Spare ■ Console Redirect ■ Microsoft VDS Provider Support	■ Single Controller Multi-pathing	■ Load Balancing	■ LSISAS 1078 low power ROC
3.6	■ VMware ESXi Virtualization Support ■ UEFI 2.0 support for new Intel Platforms ■ OS Enhancements: Solaris X86, FreeBSD support ■ SAS Tape drive support	■ SSD Guard™	■ SSD Support	■ Dimmer Switch™

Please note that the representation above is only a small subset of features integrated on LSI MegaRAID adapters.

Cornerstone: Performance



SSD Support

User Benefit:

With Release 3.6, MegaRAID SAS 87xx and 88xx series adapters now support Solid State Drives (SSDs). In short, a solid state drive is a high-performance plug-and-play storage device that contains no moving parts. SSD components include either DRAM or flash memory boards, a memory bus board, a CPU and a battery card.

Until recently, SSDs were too costly for mobile computing. However, as flash manufacturers transition from NOR to NAND flash, SSDs are becoming more affordable and are being used more and more in the enterprise and consumer electronics space. As raw flash material costs decline 50% each year and drive capacities double at the same rate, SSDs are becoming increasingly more popular.

MegaRAID adapters and SSDs are most effective for server applications and server systems where I/O response time is crucial. The below table highlights some advantages of MegaRAID adapters used with SSDs:

Advantages and Disadvantages of SSD vs. HDD			
Advantages		**Disadvantages**	
Faster Start-up	No spin-up required	Price	SSDs still carry a price premium (~2-5x)
Extremely low latency	Results in faster boot and application launch times	Capacity	Currently lower, but predicted to increase rapidly
Zero/Near Zero noise pollution	No moving parts provide for silent operation (high-end SSDs could have cooling fan)	Performance	Streaming write performance is generally lower than HDDs
High reliability	Lack of moving parts essentially eliminates risk of mechanical failure Ability to endure extreme shock and vibration		
Extreme environmental tolerance	Works in larger range of temperatures (up to 25% greater) & higher altitudes		
Performance	Seek times are magnitudes lower with no rotational vibration. (e.g.. 15K RPM SAS disk can perform up to 385 IOPs, while an SSD device can perform up to 70K)		

Three specific enhancements have been made to MegaRAID Storage Manager (MSM) to support SSDs. As shown in Figure 1, MSM now clearly identifies SSDs within the logical and physical views as well as the properties tab of the SSD itself.

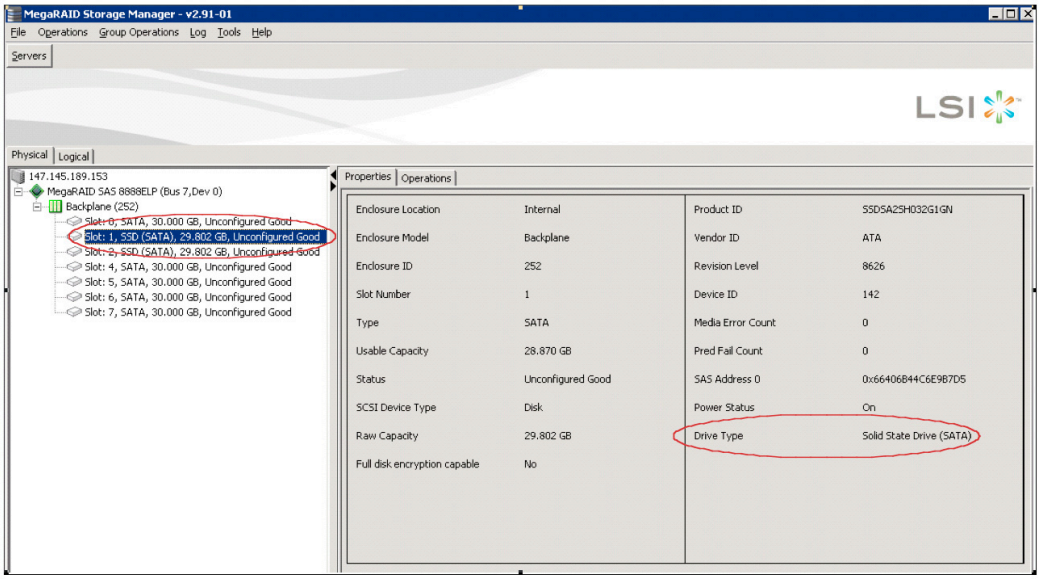


Figure 1

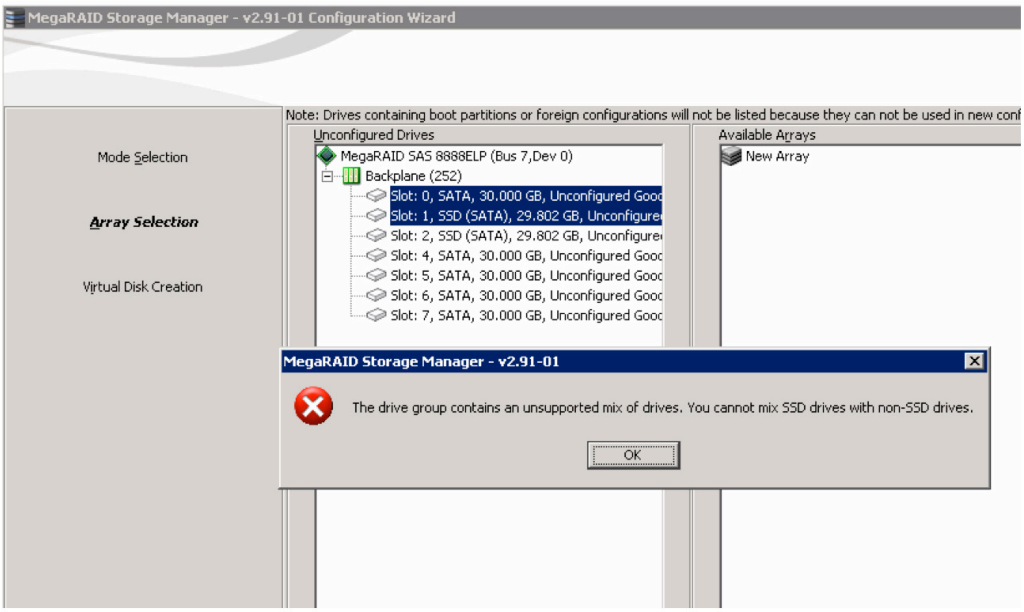


Figure 2

MSM also now monitors for proper usage of SSDs. Since SSDs suffer from both limited write cycles and a characteristic known as "read disturbance", MSM automatically disables patrol read and other maintenance tasks on SSDs, thereby prolonging their useful life.

Figure 2 shows what happens when a user tries to mix standard hard disk drives with SSDs in a single logical volume. When properly utilized, SSDs are configured and maintained just like any other hard drive.

When it comes to performance, users often assume that SSDs will provide huge advantages over traditional hard drives. In figure 3, we see an eight drive RAID 5 array performing large block sequential writes. The traditional enterprise SAS hard drives outperform SSDs from both Vendor A and Vendor B.

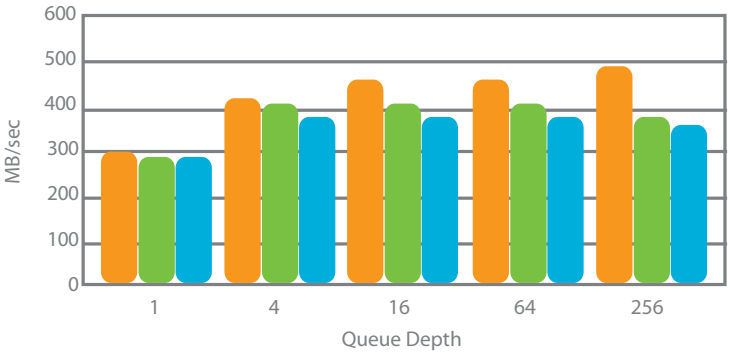


Figure 3

SSD Performance
8 Drive RAID 5 (WB, NOR, DIO, DCE)
64KB Sequential Writes

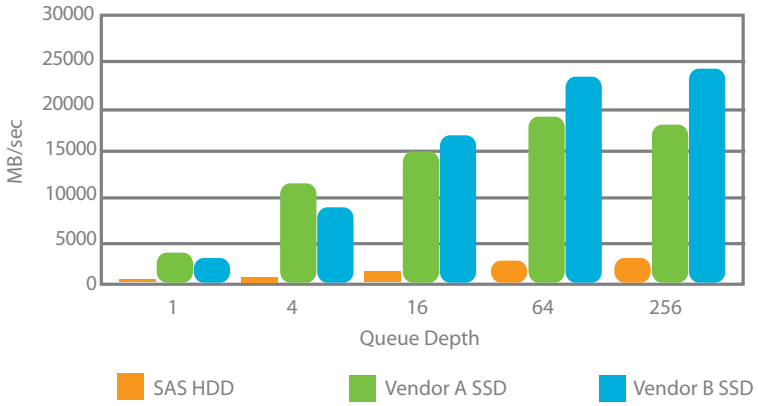


Figure 4

SSD Performance
8 Drive RAID 5 (WB, NOR, DIO, DCE)
4KB Random Writes

While SSDs may not provide the highest performance in every instance, they do provide amazing performance in many applications. In figure 4, we see 8 drive RAID 5 arrays performing small block random reads. In this case, SSDs deliver nearly 10 times the performance of their rotating media cousins.

SSDs have access times of over 100 times faster than traditional hard disk drives. Therefore, they provide huge performance benefits for primarily random applications. These applications include online transaction processing, high transaction databases, level 4 cache, very high capacity web servers, and OS paging applications (Figure 5)

SATA Workloads	SAS Workloads	SSD Workloads
Video Servers	Online Transaction Processing	Online Transaction Processing
Video Editing	Databases	High Transaction Databases
Virtual Tape Libraries	Enterprise E-mail Servers	Level 4 Cache
Backup Servers	Web Servers	High Capacity Web Servers
SoHo Business Systems	File Server	OS Paging
Medical Imaging Archiving	Application Servers	

Figure 5

Cornerstone: Data Protection and Availability

SSD Guard™

User Benefit(s):

Solid State Drives are renowned for their reliability and performance. SSD Guard™, unique to MegaRAID, increases the reliability of SSDs by automatically copying data from a drive with potential to fail to a designated spare or newly inserted drive. A predictive failure event notification, or S.M.A.R.T command, automatically initiates this rebuild to preserve the data on an SSD whose health or performance falls below par. This new feature will greatly benefit users employing a RAID 0 configuration due to the added data protection.

When enabled in MSM, SSD Guard will protect any and all logical volumes built using SSD devices (figure 6). In figure 7 and figure 8, we see a MegaRAID adapter with a RAID 0 volume built from two solid state disk drives. Should one of these drives fail, data loss would occur. However, since SSD Guard is enabled, the MegaRAID adapter is actively monitoring the status of both SSDs. Should a failure appear to be eminent, the MegaRAID adapter will automatically begin rebuilding data onto a third SSD hot spare. If a hot spare is not present or not assigned to the RAID 0, MSM will recommend that the user insert a hot spare drive into an available slot. Once the drive is inserted, copyback will begin.

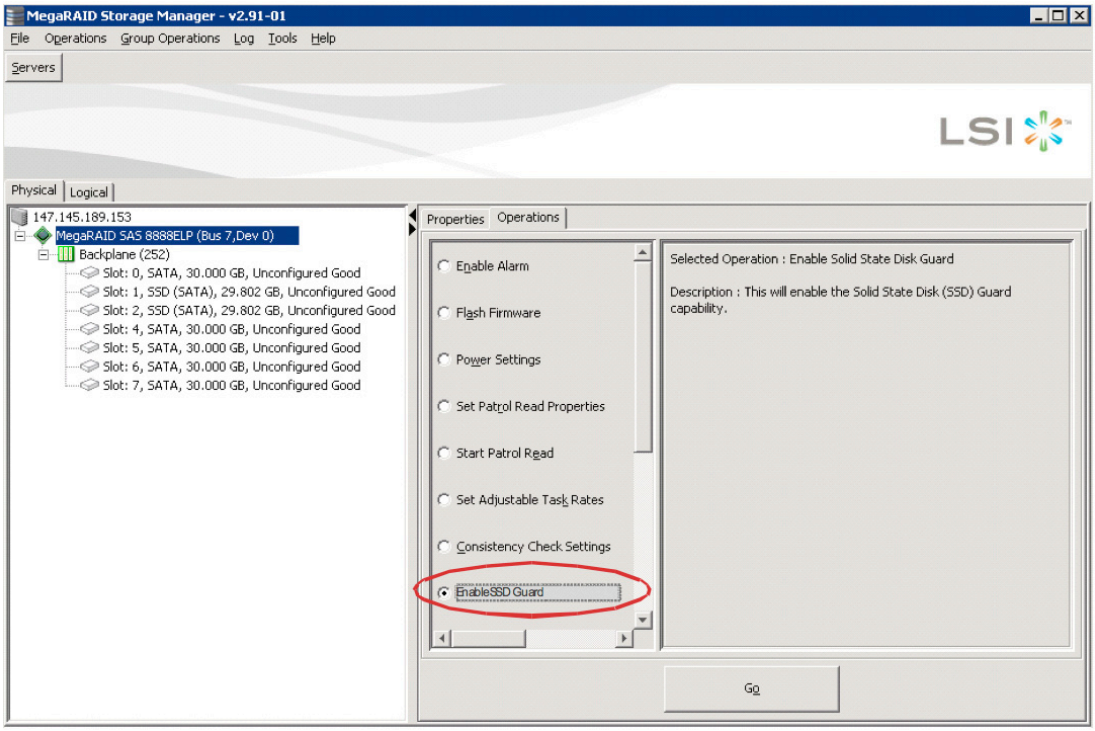


Figure 6

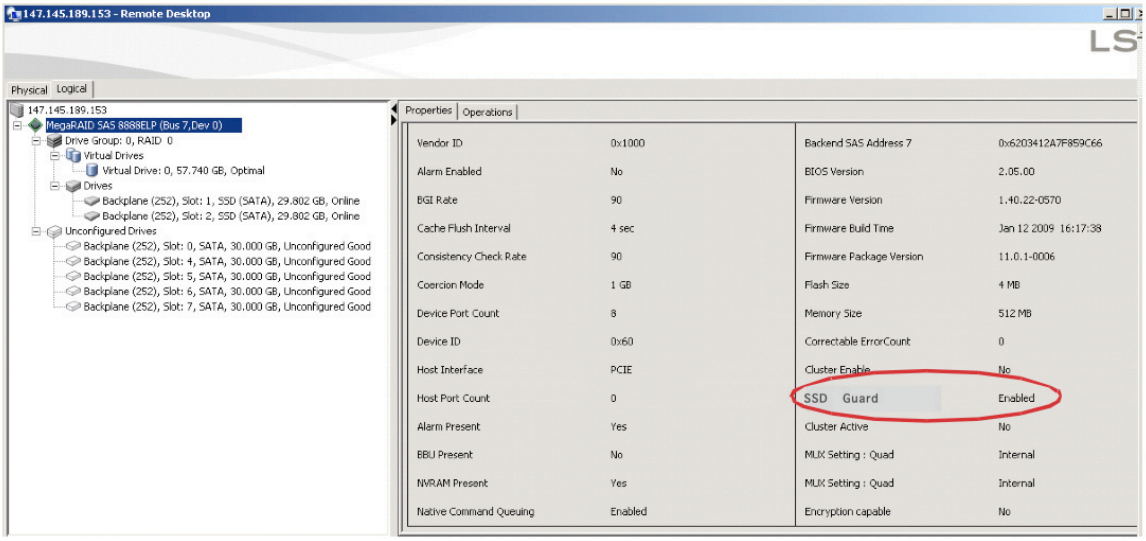


Figure 7

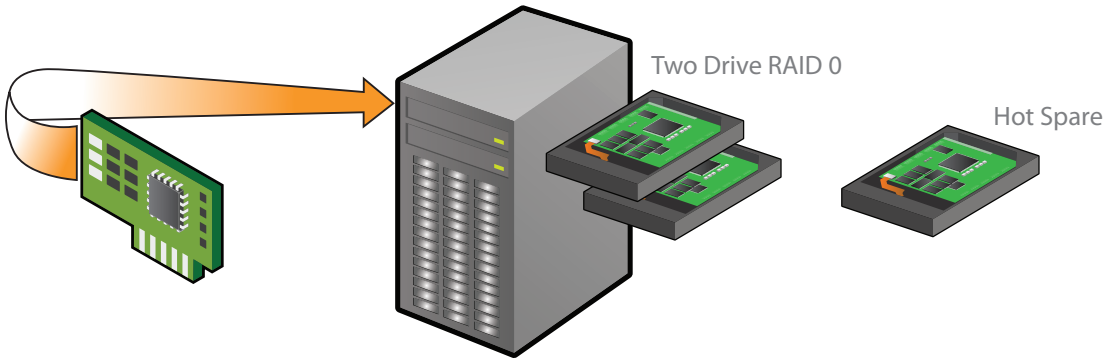
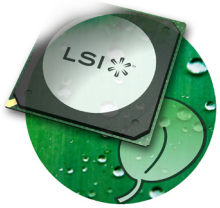


Figure 8

Cornerstone: Green



Dimmer Switch™ - Phase I

User Benefit:

As powering and cooling hard drives becomes a major cost burden in today's data centers, Dimmer Switch promotes ways to reduce the power consumption of a MegaRAID adapter's attached devices. Prior to Release 3.6, any drive connected to a MegaRAID adapter would be spun up on controller power up. Now, with Dimmer Switch, any unconfigured drive connected to a MegaRAID adapter will be spun down after 30 minutes of inactivity, creating a greener computing environment.

The average hard drive draws 10Watts and the mean cost per kilowatt is $0.10. Assuming this, an 8 drive configuration would cost $140.16 to run annually. However, if only 4 drives are truly needed, the remaining global and dedicated hot spare drives go unused. By leaving these unused drives unconfigured, a 50% savings ($70) would be seen. As the unused drive counts increase, so do the savings. The customer pays only for what is actually being used.

In MSM, the operations tab for each MegaRAID adapter in the system contains a power settings button (Figure 9). By selecting "Power Settings", the user is able to enable the Dimmer Switch, allowing unconfigured disk drives to be spun down after thirty minutes of inactivity. As seen in Figure 10, the "Powersave" mode is clearly indicated in both the physical and logical views for the MegaRAID adapter.

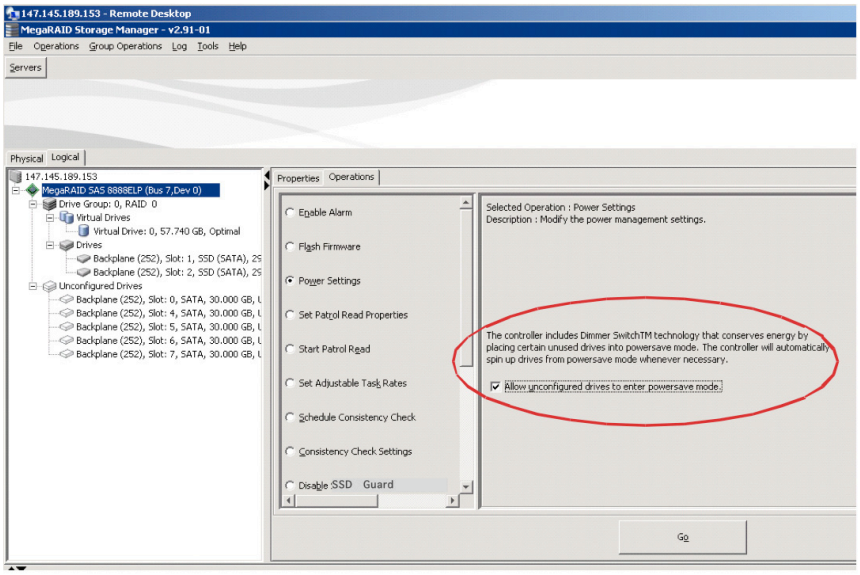


Figure 9

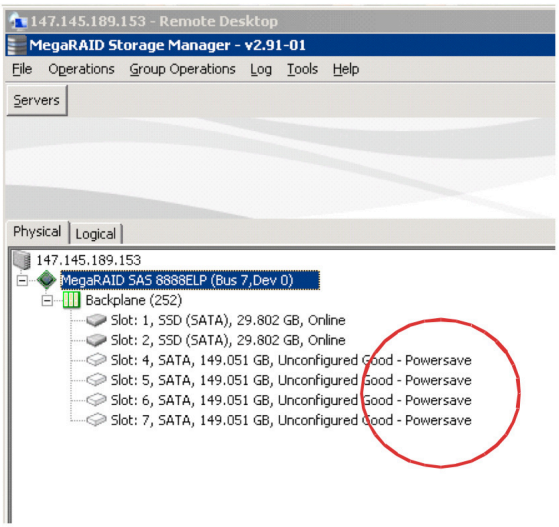
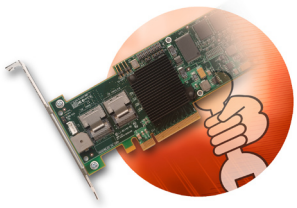


Figure 10

Dimmer Switch is a phased enhancement and LSI will continue to promote new ways to reduce power consumption of the RAID controllers' attached devices. This document describes Phase 1 for MegaRAID Dimmer Switch.

Cornerstone: Features and Usability



VMware ESXi Virtualization Support

MegaRAID Release 3.6 adds validation and support for VMware ESXi, an embedded version of VMware ESX that allows users to implement server virtualization for free and with a small footprint. Because the service console has been removed to reduce the footprint, ESXi does not allow management applications like MegaRAID Storage Manager to be installed directly on the server. With Release 3.6, OEMs and system builders can now use MSM to remotely manage MegaRAID adapters installed in ESXi servers, without the need to re-write applications.

Using CIMPlugin, a new standards-based WBEB Client for MegaRAID Storage Manager and Storelib, MSM can now translate Storelib commands to CIM-based commands and carry them over the network to the VMware ESXi server and back. This new tool preserves customer investments in proven and familiar management applications while allowing for full storage configuration, monitoring and management in the VMware ESXi operating environment. This drastically reduces the time and investment to port the existing management application to use SMI-S-based profiles.

In Figure 11, we see a simplified view of MegaRAID support for VMware ESXi. There are six ESXi severs, each containing a MegaRAID adapter. Historically, management of these adapters would have been problematic. With Release 3.6, any instance of MSM installed on a server in the network can communicate with, manage and configure the MegaRAID adapters within the VMware servers.

In addition, customers that are using their own management application with our Storelib/Storlib-IR can also take advantage of CIMPlugin. As with MSM, they would not have to rewrite their management application to work in a VMware ESXi environment.

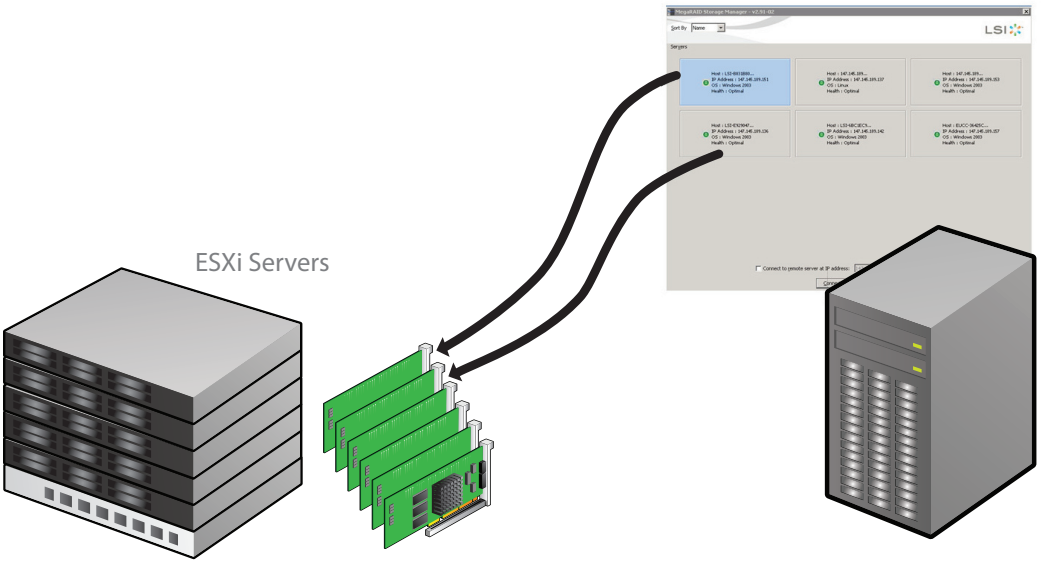
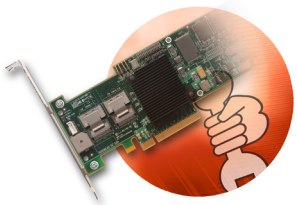


Figure 11

Cornerstone: Features and Usability



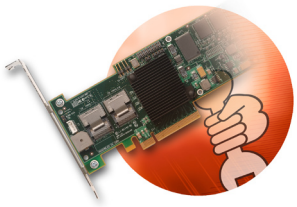
UEFI 2.0 Support for New Intel Platforms

LSI recognizes the significant challenges facing OS and platform developers to innovate and incorporate new technologies using the legacy "PC-AT" BIOS boot environment. These issues include memory constraints, maintenance challenges and increased complexities due to a lack of industry-wide standards. In order to remove these challenges, LSI now offers a UEFI 2.0 (Unified Extensible Firmware Interface) driver which supports a cleaner interface between operating systems and the platform hardware at boot time, as well as an architecture-independent mechanism for initializing add-in cards.

The MegaRAID UEFI driver, a boot service device driver, handles block IO requests, SCSI pass-through commands (SPT), and the ability to launch pre-boot MegaRAID management applications via driver configuration protocol (DCP). The UEFI driver also supports driver diagnostic protocol, which allows administrators to access pre-boot diagnostics

This new feature will provide MegaRAID customers with expanded platform support (e.g. Intel platforms based on the x58 chipset) and a hassle-free experience while maximizing the benefits of UEFI 2.0.

Cornerstone: Features and Usability



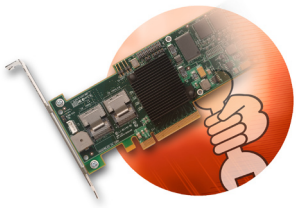
SAS Tape Drive Support

Customers often find it convenient to utilize available ports on a MegaRAID adapter for connection of a tape drive. Users now have the ability to attach SAS tape devices to the MegaRAID 87xx and 88xx families of SAS/SATA adapters. MegaRAID will present the tape drives directly to the operating system, very much like a host bus adapter. This provides high-end backup for less.

Interoperability testing has been completed with the following drives:

- HP DAT160
- HP LTO3 HH
- Quantum LTO3 HH
- HP LTO4 HH
- Quantum LTO4 HH

Cornerstone: Features and Usability



OS Enhancements: Solaris X86, FreeBSD support

LSI is also committed to supporting a wide variety of operating systems for MegaRAID customers. Release 3.6 increases the number of operating systems supported, making MegaRAID usable in more applications than ever before. LSI's extensive list of supported OSes now includes FreeBSD and Solaris X86.

For more information and sales office locations, please visit the LSI web sites at: lsi.com lsi.com/contacts

North American Headquarters
Milpitas, CA
T: +1.866.574.5741 (within U.S.)
T: +1.408.954.3108 (outside U.S.)

LSI Europe Ltd.
European Headquarters
United Kingdom
T: [+44] 1344.413200

LSI KK Headquarters
Tokyo, Japan
Tel: [+81] 3.5463.7811