Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System

Just the Facts

Copyrights

Introduction

In the highly competitive enterprise workgroup server market, a large and growing proportion of performance-sensitive customers are taking advantage of low-cost hardware RAID storage controller cards to improve the data availability, system throughput, and price/performance of their distributed application servers and database servers. Hardware RAID controllers are an economical way for customers to improve data security and availability without suffering the performance penalty imposed by host-based software RAID. They also deliver controller-based RAID performance advantages economically and space efficiently, by providing RAID functionality via the host systems' internal SCSI disk drives instead of external storage arrays.

The economy and performance advantages offered by hardware RAID controllers is so widely accepted in the server market that many customers consider hardware RAID an absolute requirement for their server purchases. Sun recognizes the growing customer demand for low-cost hardware RAID capability for workgroup servers and has responded to this need by introducing the Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system.

Product Overview

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller (SRC/P) system is a high-performance disk storage controller for Sun Enterprise™ 250 and 450 workgroup servers. It gives Sun's workgroup server customers the performance and data protection advantages of the latest RAID storage technology for a very attractive price. This system supports non-RAID SCSI disk operations as well as RAID levels 0, 1, 1+0, 5, and 5+0.

This 64-bit PCI card supports internal UltraSCSI disk drives or external Sun StorEdge™ MultiPack storage units on each of three 40 MB per second SCSI channels. Its powerful on-board microprocessor offloads many routine storage I/O operations and all RAID management activities from the host system, enabling the host system CPUs to do more productive work. In addition, its 64 MB of on-board, battery-protected, data cache memory and intelligent caching algorithms speed up many disk read and write operations, reducing system response time and increasing overall throughput.

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system will be offered in three standard configurations:

- The first option supports the Sun Enterprise 450 server's internal disks. It includes the Sun StorEdge SRC/P controller, an eight-slot disk backplane, internal cables, and the Sun StorEdge SRC/P software. Two of these options will support up to 16 internal disks. With an optional third internal SCSI bus cable installed, one SRC/P controller option will support 12 internal disks (in the four standard drive bays plus eight option bays), allowing all 20 internal drives to be supported in RAID arrays. (Note: Installation of a third internal SCSI bus cable will not be supported on the Sun Enterprise 450 server at GA.)
- The second option, which supports Sun Enterprise 250 server internal disks, includes the controller, Sun Enterprise 250 server internal cables, Sun StorEdge SRC/P software, and two external SCSI cables. The system's six internal drives are supported by one of the controller's SCSI channel, while the remaining channels can be used to support Sun StorEdge MultiPack storage. (Note: Internal drive support on the Sun Enterprise 250 server will not be available at GA.)

- The third option can be used to support Sun StorEdge MultiPack storage units on all three controller channels. Up to six of these options can be supported on the Sun Enterprise 450 server, providing up to 2 TB of high performance RAID storage capacity. Up to three Sun StorEdge SRC/P controllers can be supported on the Sun Enterprise 250 server, for a maximum RAID storage capacity of 1 TB. This Sun StorEdge SRC/P option will also support Sun StorEdge MultiPack storage on future Sun workgroup servers.

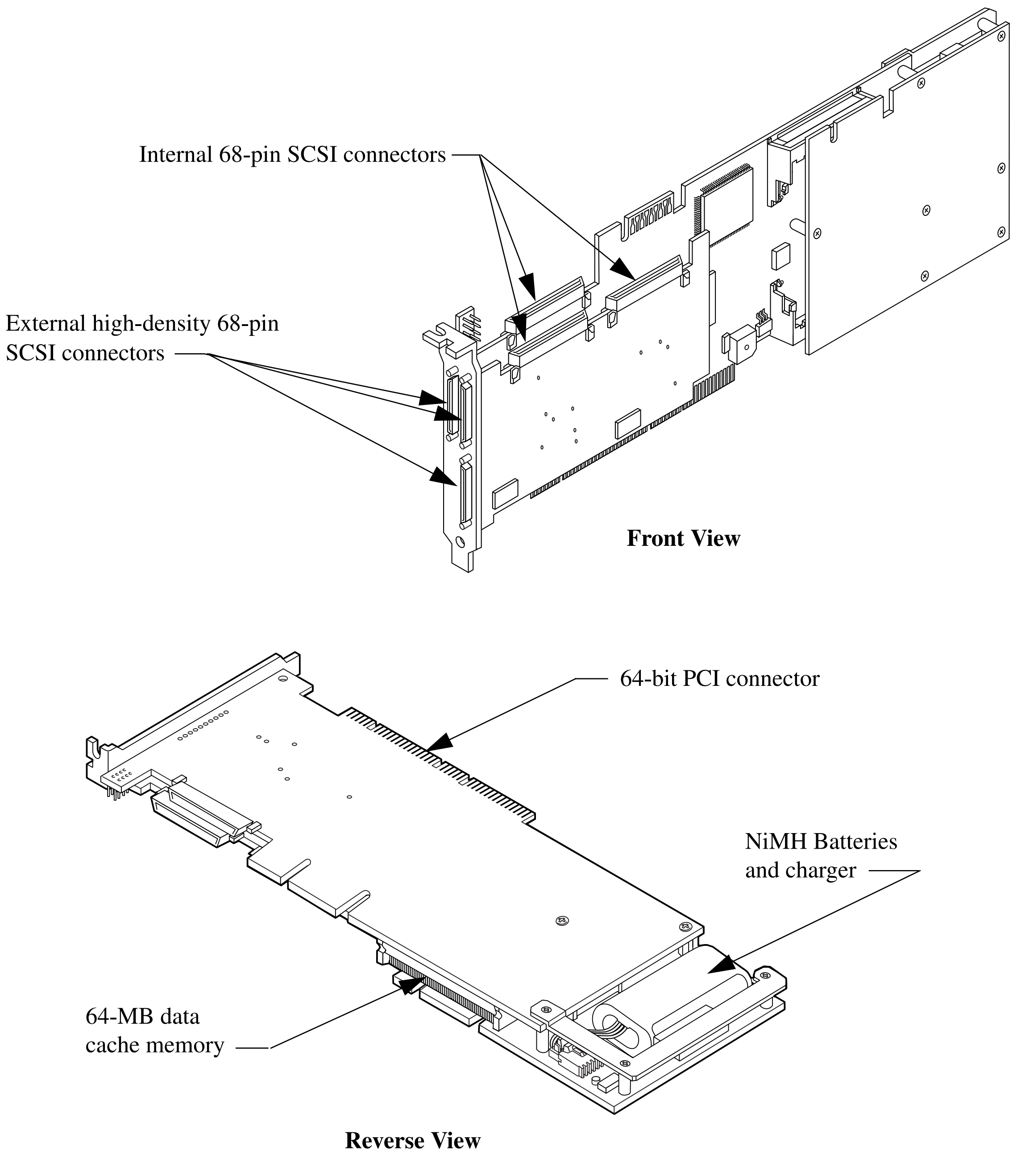


Figure 1. Sun StorEdge SRC/P Intelligent SCSI RAID Controller system physical views

Sun StorEdge SRC/P Storage Manager™ Software

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system comes with device drivers for Solaris™ 2.6 and Solaris 7 operating environments, controller operating firmware, and a controller management interface, called Sun StorEdge SRC/P Storage Manager™ software. The Sun StorEdge SRC/P Storage Manager software provides an easy to use graphical interface for installing, configuring, and managing SRC/P RAID storage. With the Sun StorEdge SRC/P Storage Manager software, system administrators can:

- Setup Sun StorEdge SRC/P controllers and their disks
- Flash update controller firmware
- Verify proper controller, cabling, and disk installation and operation
- Create, configure, and delete RAID 0, 1, or 5 arrays or RAID 1+0 or 5+0 array groups
- Designate a hot spare disk and set up the controller to automatically recover any supported RAID 1, 1+0, 5, or 5+0 array from a disk failure
- Set and change controller caching policies for each RAID array
- Monitor disk and controller status and view event logs
- Review performance data collected by the Sun StorEdge SRC/P controller
- View the status of the memory battery backup unit and run periodic battery maintenance routines
- Manually restore an array after a disk failure
- Swap out a failed drive and install a replacement disk

The Sun StorEdge SRC/P Storage Manager runs on the host server and can display output on the system local graphics console or on a network attached X-windows graphical display. A single Sun StorEdge SRC/P Storage Manager instance can manage all Sun StorEdge SRC/P controllers in the system.

In addition to the graphical interface, Sun StorEdge SRC/P Storage Manager software provides a Solaris operating environment command line interface.

Sun StorEdge SRC/P Controller System Features and Benefits

Features	Benefits
• PCI 2.1 compliant, PCI card with long form factor, single PCI slot width (including battery pack)	• Fits in any 64-bit PCI slot in Sun Enterprise 250 or 450 servers
• 64-bit, 33-MHz PCI card	• Fits in any 64-bit PCI slot in Sun Enterprise 250 or 450 servers
• Supports 64-bit PCI transfers	• Fast data transfers to memory
• 264 MB/sec. maximum PCI data transfer rate	• Efficient use of the PCI bus bandwidth
• Three independent single-ended UltraSCSI buses	• Configuration flexibility
– Each bus will support either internal or external devices (not both)	
– 40 MB/sec. peak throughput per bus	• Meets or exceeds the capabilities of the supported disk drives

Features	Benefits
– Three internal ultra-wide (40 MB/sec.) ports (one on each SCSI bus)	• Can support up to 12 internal disks in Sun Enterprise 450 server or 6 internal drives in Sun Enterprise 250 server
– Three external SCSI-3 (F/W capable) ports (one on each channel); auto-negotiated port speeds	• Supports up to three Sun StorEdge MultiPack disk systems with either 7200-rpm F/W or UltraSCSI drives
• Supports single-ended UltraSCSI SCSI disks (F/W SCSI drives supported in Sun StorEdge MultiPack systems)	• Compatible with internal UltraSCSI disk drives and Sun StorEdge MultiPack disk storage systems • Provides excellent storage capacity and performance for low cost/MB
• On-board microprocessor handles all disk I/O	• Significantly reduces system overhead for disk intensive workloads; frees main system CPUs to do productive work
• Provides hardware acceleration for RAID 0, 1, 1+0, 5, and 5+0	• Supports all of the popular RAID levels, for performance and data availability
• Supports independent disks and different RAID levels for different drives and drives groups attached to the same controller	• Makes it easy to optimize storage for multiple concurrent applications • Makes it easy to match data layouts to meet users' specific requirements for capacity, performance, high availability, and cost
• 64-MB, on-board, ECC-protected I/O data cache memory (additional memory slots on the board are not supported at this time)	• Large-capacity, dedicated data cache memory supports high performance I/O; ECC protection provides data integrity
• Implements read-ahead and predictive caching	• Boosts system read performance
• Cache can be set for write-through or write-back modes of operation	• Write-through mode provides maximum data protection; write-back mode significantly accelerates disk write operations
• Online switching of cache management policies (WB, WT) • No rebooting required after changes to cache management policies	• The ability to switch from write-back to write-through mode online enables data integrity if the battery charge is low without disrupting system operation
• On-board battery backup provides 48 hour cache memory data protection	• Battery backup protects write data cached in the controller against power failure; enables faster data I/O with full data protection
• On-board battery charger plus fast recharge batteries, maximum three hour recharge time	• Allows quicker returns to write-back mode of operation after battery discharges, accelerating system performance
• Battery monitor with battery-low/battery-fail indicator	• Alerts system manager to change cache policy to write-through mode when battery-backup is compromised

Features	Benefits
• Controller installation, configuration, and management is handled through Sun StorEdge SRC/P Storage Manager software – Simple graphical X-windows interface – Solaris operating environment command line interface	• Sun StorEdge SRC/P Storage Manager software makes setting up and managing RAID arrays fast and easy, even for non-UNIX® administrators
• Unbundled software release CD (at GA) – Device driver for Solaris 2.6 and 7 operating environments – Host system firmware update – Controller firmware – Sun StorEdge SRC/P Storage Manager software – Installation and user documentation	
• Solstice DiskSuite™ or Sun StorEdge Volume Manager™ software can be used to create/manage arrays that span two or more Sun StorEdge SRC/P controllers or other arrays	• Improves system/data availability by eliminating controllers as single points of failure • All attached storage (internal disks and external arrays) can be managed in a uniform fashion through a common interface
• Sun StorEdge SRC/P arrays can span drives on all three controller channels	• Improves system throughput and response time under heavy workloads • Improves system/data availability by eliminating SCSI buses, cables, and disk backplanes/drive enclosures as single points of failure
• RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns	• Users can tune for best performance for their specific applications
• Support for online RAID reconfiguration	• System managers have the flexibility of adapting storage to changing needs without disrupting system services
• Support for hot sparing • Hot spare is automatically swapped in to replace any failed disk in a RAID-1, 1+0, 5, or 5+0 RAID group	• The Sun StorEdge SRC/P controller can automatically failover to the hot spare drive and rebuild any RAID 1, 1+0, 5, or 5+0 array, quickly returning the system to peak performance after a drive failure without any interruption to system services • Continuous redundant data protection even if a disk fails
• Schedulable drive rebuilds	• Allows system managers greater flexibility in delivering system services; rebuilds can be deferred to off-peak hours
• Support for drive hot swapping	• Failed drives can be replaced without disrupting system services

Features	Benefits
• Support for online physical drive migration	• Allows healthy drives to be relocated to a new drive bay to reduce system downtime
• Controller firmware downloadable/flash upgradeable from the host system using Sun StorEdge SRC/P Storage Manager	• Easy to keep firmware up to the latest revision
• Power-on self test; support for OpenBoot™ diagnostics and SunVTS™	• Enables fast, easy problem identification and diagnosis for maximum system uptime
• Supported by Sun Enterprise SyMON™ software	
• Performance monitoring and data logging	
• On-line drive fault detection and reporting	
• Event logging	
• Online drive testing (new drives)	
• RAID configuration written through to the disks, rather than stored in the controller	• Easy to restore full operation if the Sun StorEdge SRC/P controller is swapped out; arrays remain intact and data is quickly accessible
• On-board NVRAM for storing controller configurationinformation	• Easy to restore full operation quickly after a system shutdown or power failure; no need to manually restore all controller settings

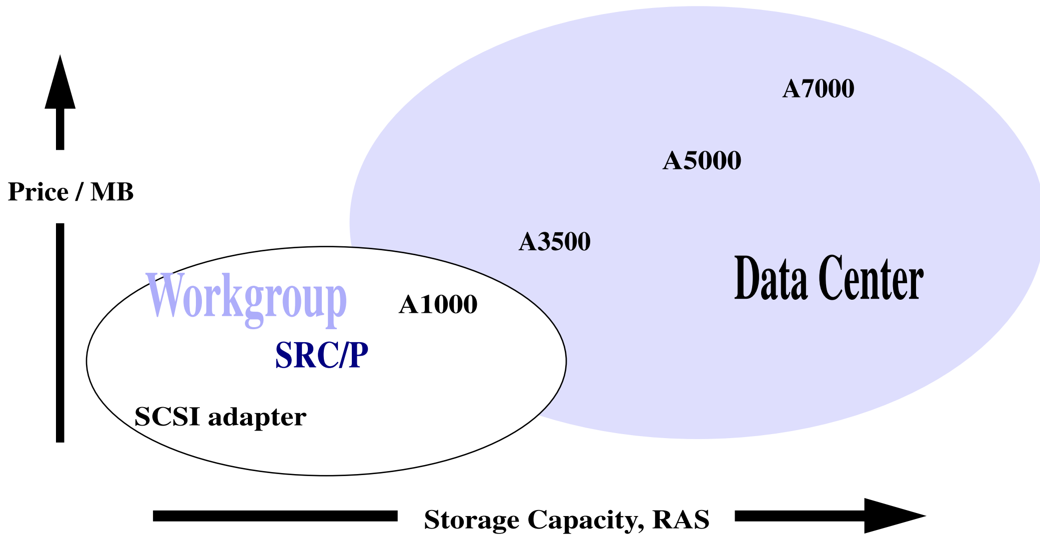
Sun StorEdge SRC/P Intelligent SCSI RAID Controller Target Markets

- Sun direct end-user customers and reseller customers (all Geos)
- Sun Enterprise 250 and 450 workgroup server customers
- Small- to medium-scale database servers, file servers, and transaction-oriented business application servers (CMS, ERP, e-commerce)
- All industries, government, and educational institutions

Product Availability

General Availability (GA) for the X-options for this product is May 25, 1999. The configured options will not be available until early Q1FY00.

Product Family Positioning



The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system fits into the Sun workgroup server storage product lineup between host-controlled internal UltraSCSI disks and the Sun StorEdge A1000 RAID storage array.

Sun StorEdge SRC/P Versus UltraSCSI Host Bus Adapter

With its 64 MB of battery-protected data cache memory and intelligent caching algorithms, the Sun StorEdge SRC/P Intelligent SCSI RAID Controller (SRC/P) system provides significantly greater disk I/O throughput than simple SCSI host bus adapters for nearly any application. When disk striping is required to boost system performance under heavy loads, the performance advantages of the SRC/P system's hardware RAID become even more pronounced. In addition, with three disk I/O channels per card, the Sun StorEdge SRC/P controller can deliver more disk IOPS (I/O transfers per second) and more total data throughput per PCI slot than any available single or dual channel controller cards—even more than Fibre Channel.

Sun StorEdge SRC/P Versus Sun StorEdge A1000 Array

For many RAID applications, the Sun StorEdge SRC/P controller offers equal or higher disk I/O performance than the Sun StorEdge A1000 array. By placing the RAID controller intelligence on the PCI bus instead of at the other end of the SCSI bus, the Sun StorEdge SRC/P controller reduces the hand-off time and latency for host data read requests. This design also reduces the number of request and data handling steps in retrieving data from the disks, thus further reducing read latency. Likewise, since the controller's write cache memory is closer to the host system bus, write latency for write-back operations is also reduced.

For customers whose total storage requirements can be met by the internal drives of the Sun Enterprise 250 or 450 server, the Sun StorEdge SRC/P controller eliminates the need to find space for an external storage box. It also reduces cost by eliminating the need for components such as external enclosures, power supplies, and fans. For many workgroup server applications, the Sun StorEdge SRC/P controller offers higher performance and a lower cost per megabyte than the Sun StorEdge A1000 array.

The Sun StorEdge A1000 array is the answer for customers who require clustered servers with shared access to storage. The Sun StorEdge SRC/P controller does not at present support multihost access to shared disks; the Sun StorEdge A1000 array, supported by Sun™ Cluster 2.1 software, does. In addition, even with clustering supported, the Sun StorEdge SRC/P controller could only operate in write-through mode when disks are shared between two controllers. This is necessary in order to maintain complete data integrity in the event of a power failure. This restriction significantly reduces overall disk I/O performance for write-intensive applications. Since the Sun StorEdge A1000 array controller and write cache are shared by both host systems, the problems associated with maintaining cache data integrity when operating in write-back mode are eliminated.

The Sun StorEdge A1000 array also offers a better solution for customers who need to store large amounts of data (greater than 1 TB). Since the Sun StorEdge SRC/P controller only supports single-ended SCSI devices, UltraSCSI-capable Sun StorEdge MultiPack systems must be no more than two meters from the host server. Physical placement of more than nine Sun StorEdge MultiPack systems within such close proximity to the server can be challenging.

Detailed Product Comparison

Features	**Dual UltraSCSI + Sun StorEdge MultiPack**	**Sun StorEdge SRC/P Controller**	**Sun StorEdge A1000 Array**	**Sun StorEdge A5000 Array**
Host bus adapter type	32-bit, 33-MHz PCI	64-bit, 33-MHz PCI	32-bit, 33-MHz PCI	64-bit, 33-MHz PCI
Max. host bus (PCI) I/O data rate	132 MB/sec.	264 MB/sec.	132 MB/sec.	264 MB/sec.
# Disk I/O buses per HBA	2	3	2	1
Disk I/O bus type	Single-ended UltraSCSI	Single-ended UltraSCSI	Differential UltraSCSI	Fibre Channel
Disk I/O bus data rate, max.	40 MB/sec.	40 MB/sec.	40 MB/sec.	100 MB/sec.
HBA data throughput, max.	80 MB/sec.	120 MB/sec.	80 MB/sec.	100 MB/sec.
Max. # drives per disk I/O bus	6@40 MB/sec. 12@20 MB/sec.	6@40 MB/sec. 12@20 MB/sec.	24@40 MB/sec.	66
Max. # drives per HBA	12@40 MB/sec. 24@20 MB/sec.	18@40 MB/sec. 36@20 MB/sec.	48@40 MB/sec.	66
Max. storage capacity per HBA	2 x 6 x 18 GB = 216 GB	3 x 6 x 18 GB = 324 GB	4 x 8 x 18 GB = 576 GB	4 x 14 x 18 = 1008 GB
Max. HBAs per Sun Enterprise 450 server	10	6	7	4
Sun Enterprise 450 server max. raw disk I/O bandwidth	584 MB/sec.	690 MB/sec.	532 MB/sec.	400 MB/sec.
Max. drives per Sun Enterprise 450 server	120@40 MB/sec.	126@40 MB/sec.	168@40 MB/sec.	132
Max. storage capacity per Sun Enterprise 450 server	2.2 TB	2.3 TB	2.0 TB	2.0 TB
List price/GB @100 GB	US$120	US$157	US$174	US$514
List price/GB @200 GB	US$115	US$142	US$169	US$484
Max. HBAs per Sun Enterprise 250 server	4	3	4	2
Sun Enterprise 250 server max. raw disk I/O bandwidth	212 MB/sec.	333 MB/sec.	212 MB/sec.	200 MB/sec.
Max. drives per Sun Enterprise 250 server	48@40 MB/sec.	72@40 MB/sec.	96@40 MB/sec.	66

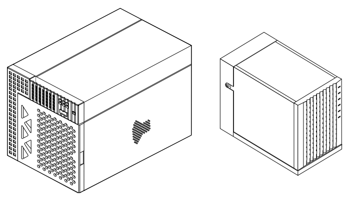
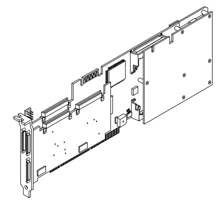
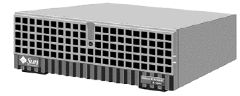
Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
Max. storage capacity per Sun Enterprise 250 server	864 GB	1.3 TB	1.2 TB	1.0 TB
RAID-0 performance (6 drive stripes, 12 drives total) • 64-KB seq. read (MB/sec.) • 64-KB seq. read (MB/sec.)	 — —	 — —	 — —	 — —
RAID-5 performance (6 drive stripes, 12 drives total) • 2-KB random read (IOPS) • 2-KB random read (IOPS)	 — —	 — —	 — —	 — —
• Support for system boot disk	Yes	TBD	No	No
• On-board microprocessor handles all disk I/O and RAID calculations	No	Yes	Yes	No
• ECC and battery protected I/O data cache memory	No	Yes, 64 MB	Yes, 16-MB upgradeable to 64 MB	No
• On-board battery backup – # hours of cache data protection – Battery monitor with battery-low/battery-fail indicator – On-board battery charger – Batteries recharge time, max.	N/A	Standard 48 hours Yes Yes 3 hours	Standard 72 hours	N/A
Key to notations below: S = Sun StorEdge SRC/P Storage Manager R = RAID Manager		V = Sun StorEdge Volume Manager D = Solstice DiskSuite		
• Supported RAID managers – Sun StorEdge SRC/P Storage Manager (S) – RAID Manager (R) – Sun StorEdge Volume Manager (V) – Solstice DiskSuite (D)	• V or D	• S or S + V or D	• R or R + V or D	• V
• Supports RAID 0, 1, 1+0, 5 • Supports RAID 3 • Supports RAID 5+0 • Supports multi-modes (different RAID levels for different drives)	• V, D • No • No • V, D	• S, V, D • No • S • S, V, D	• R, V, D • No • No • R, V, D	• V • No • No • V

Positioning

Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
• Simple GUI operator interface • GUI supported on local graphics console • Remote network GUI console	• V, D • V, D • V, D	• S, V, D • S, V, D • S, V, D	• R, V, D • R, V, D • R, V, D	• V • V • V
• Solaris operating environment command line interface	• V, D	• S, V, D	• R, V, D	• LUXadm, V
• Striping across multiple controllers • Striping across multiple channels of one controller • Variable stripe lengths	• V, D • V, D • V, D	• V, D • S, V, D • S, V, D	• V, D • R, V, D • R, V, D	• V • V • V
• Min. size of logical storage unit per physical disk – P = disk partition – E = entire disk • Multiple logical units per physical disk	• V = P D = P • V, D	• S = E • V = P • D = P • V, D	• R = P • V = P • D = P • R, V, D	• V = P • V
• Max. # logical storage units (LUNs) per controller/HBA – RAID 0 (stripe) – RAID 1 (mirror) – RAID 5 (stripe+parity) – Any combination	 • D =>32 • D =>32 • D =>32 • D =>32	 • S = 18 • S = 18 • S = 12 • S = 18	 • R = 16/32 • R = 16/32 • R = 16/32 • R = 16/32	 • V => 32 • V => 32 • V => 32 • V => 32
• Support for hot sparing – Global hot spares only – Assignable hot spares – Multiple hot spares	• V, D • V, D • V, D	• S, V, D • S (1 max.) • V, D • V, D	• R, V, D • R • V, D • R, V, D	• V • V • V
• Automatic transparent drive rebuild capability • Schedulable drive rebuild	• V, D • V, D	• S, V, D • S, V, D	• R, V, D • R, V, D	• V • V
• Support for online capacity expansion (no reboot required)	• V, D	• S, V, D	• V, D	• V
• Support for drive hot swapping	• V, D	• S, V, D	• R, V, D	• V
• Write cache can be set for write-through or write-back modes of operation • Read ahead caching/ predictive read caching • Online switching of caching policies (write-back, write-through) • No rebooting required after changes to cache management policies	• N/A • N/A • N/A • N/A • N/A	• Yes • Yes • Yes • Yes • Yes	• Yes • Yes • Yes • Yes • Yes	• N/A • N/A • N/A • N/A • N/A
• RAID controller firmware stored in flash memory; downloadable/ upgradeable from the host	• N/A	• Yes	• Yes	• N/A

Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
• Array information stored on disk	• V, D	• S, V, D	• R, V, D	• V
• Power-on self test • OpenBoot diagnostics support • SunVTS support • Sun Enterprise SyMON software support • Performance monitoring and data logging • Drive fault detection and reporting • Online drive testing (new drives)	• Yes • Yes • Yes • Yes • V, D • Yes • Yes	• Yes • Yes • Yes • Yes • S, V, D • Yes • Yes	• Yes • Yes • Yes • Yes • V, D • Yes • Yes	• Yes • Yes • Yes • Yes • V • Yes • Yes

When to Sell, When Not to Sell

UltraSCSI Host Adapter	Sun StorEdge SRC/P Intelligent SCSI RAID Controller	Sun StorEdge A1000 array
		
When to Sell • When storage requirements are less than 400 GB per system, a*nd* – When lowest cost is more important than maximum performance – When the application is not disk I/O intensive (web caching) – When the system is lightly loaded (greater than 50% CPU utilization) – When disk I/O is mostly random large block reads (image files) – Low-end cluster configuration using Sun StorEdge MultiPack systems	**When to Sell** • When storage requirements are less than 1 TB per system, a*nd* – When maximum disk I/O performance is required – When the customer wants “in-the-box” RAID for Sun Enterprise 250 or 450 servers – When clustering or dual-host access to storage is not required – When RAID 0, 1+0, 5, or 5+0 is required – When disk I/O is heavy, random, small block reads and writes – When system workload is light but expected to grow rapidly	**When to Sell** • When storage requirements are greater than 1 TB per system • When clustering with dual-host access to storage is required • When external disks are required and rackmounting or RAS are important
When NOT to Sell • Customer wants hardware RAID • Heavy disk I/O activity • Greater than 400-GB storage capacity is required	**When NOT to Sell** • Customer wants a cluster • Disk I/O is minimal or mostly large blocks • Storage requirement greater than 1 TB	**When NOT to Sell** • Customer wants “in-the-box” RAID • Single server environment • Lowest price/MB is important

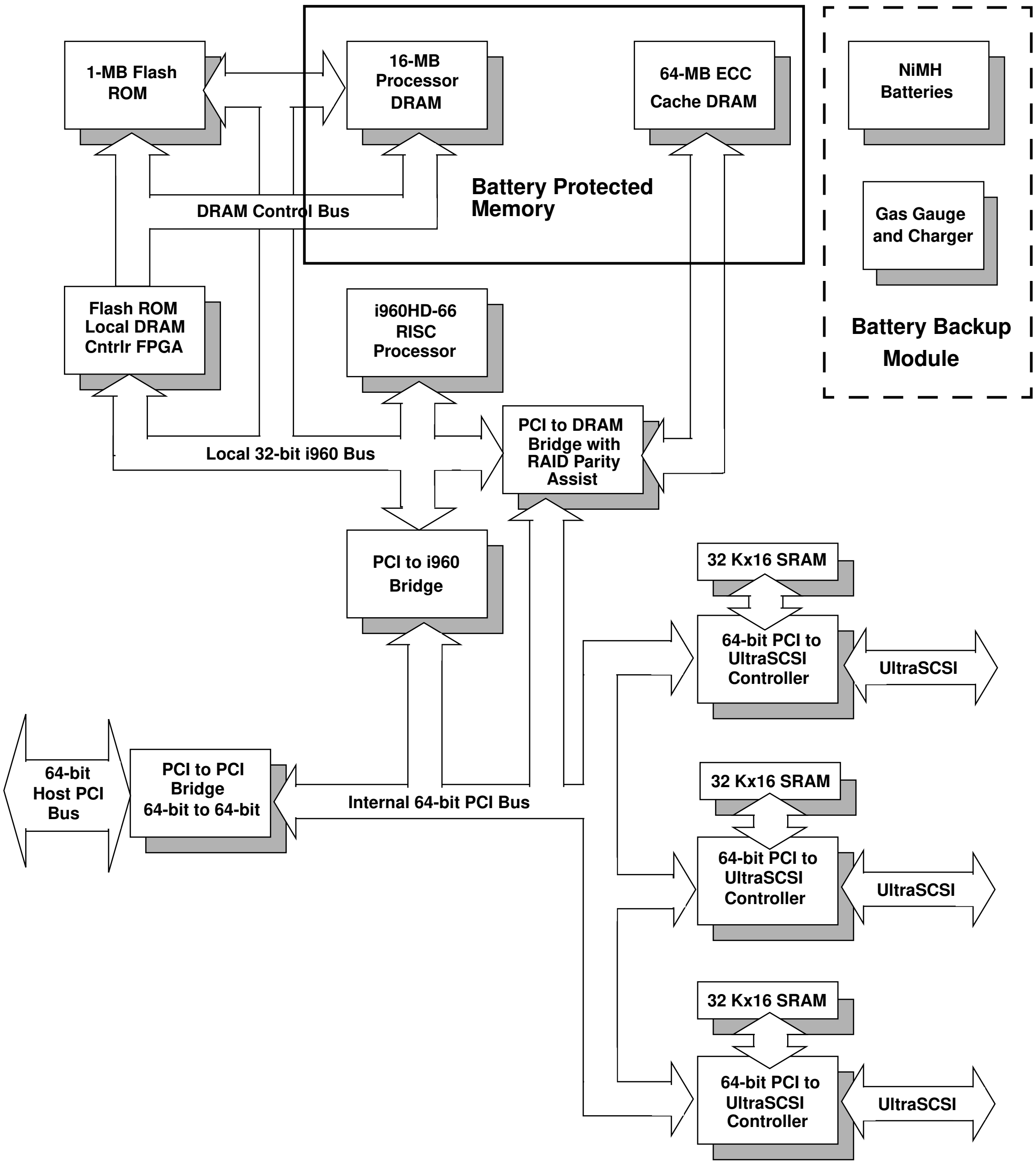


Figure 2. Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system architecture

Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System Limitations/ Exclusions

Limitation/Exclusion	Comments
• Not supported on Sun Enterprise Ultra™ 5S or 10S servers	• Electrical incompatibility
• Not supported on Sun Enterprise™ servers	• Physical incompatibility
• Not supported on Sun workstations	• Not generally a workstation requirement
• No support for Sun StorEdge™ A1000 or D1000 arrays	• Incompatible SCSI implementation
• No support for tape drives or CD-ROMs	• Supported by lower cost SCSI controllers
• No support for 5400-rpm or older disk drives	• Limited demand and therefore not supported
• No support for daisy chaining of Sun StorEdge MultiPack systems	• Limited demand and therefore not supported
• No support for clustering, dual-hosting, or dual datapaths	• Sun StorEdge A1000 array offers a more effective solution for clusters
• SCSI channels cannot be used to support both internal and external devices at the same time	• SCSI bus length limitation
• No support for Solaris™ 2.5.1 operating environment	• Development cost, time-to-market, limited demand
• No support for booting at GA	• Device driver must/will be included in next Solaris operating environment release
• No support for RAID 3	• Limited demand, not available with this product
• Not compatible with RM6	• No RM6-compatible SCSI RAID controller available

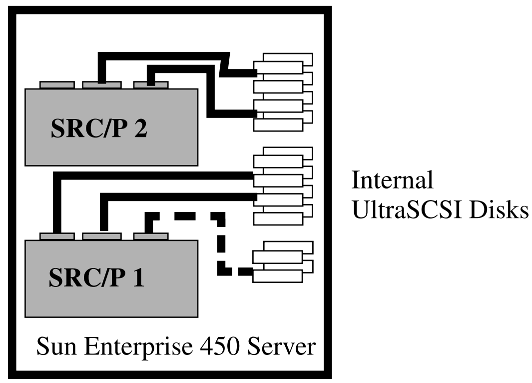
RAID Level Definitions

RAID Level	Characteristics
• RAID 0—Striping	• Spreads data across multiple disk spindles for better performance • Can be tuned to optimize either random or sequential I/O performance • No data redundancy protection, lower reliability than independent disks; if any drive in the disk group fails, all data in the disk group is lost • Same low cost per usable megabyte as independent disks
• RAID 1—Mirroring	• Maintains duplicate copies of data, so if a disk fails, data is available and applications keep running • Same performance as independent disks for writes, slightly better read performance • Highest cost per usable megabyte
• RAID 1+0—Striping across multiple mirrored drive pairs	• Combines performance of striping with data protection of mirroring • Duplicate copies of striped data remain available even if a disk fails • Same cost per usable megabyte as mirroring
• RAID 5—Striping with Parity	• Provides data protection by storing parity information on all disks in the drive group, so data can be reconstructed if a single disk fails; good for applications with high I/O request rates. • Stripes data across multiple disk spindles to optimize random or sequential performance • Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0 • Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks
• RAID 5+0—Striping across multiple RAID-5 arrays	• Combines performance of striping with data protection of RAID 5 • Provides data protection by storing parity information on all disks in the drive group, so data can be reconstructed if a single disk fails; good for applications with high I/O request rates • Stripes data across multiple disk spindles to optimize random or sequential performance • Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0 • Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks, but higher performance than RAID 5

Supported Configurations

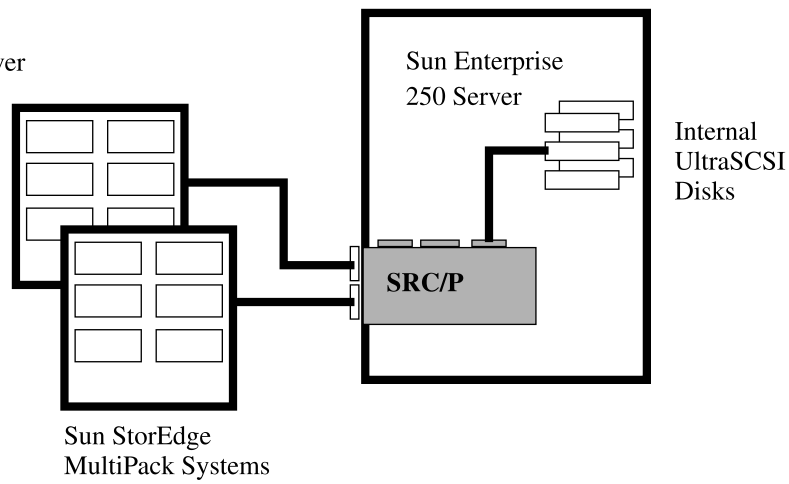
6602A

Sun Enterprise 450 Server with two 6602A Internal 8-Bay RAID Storage Options



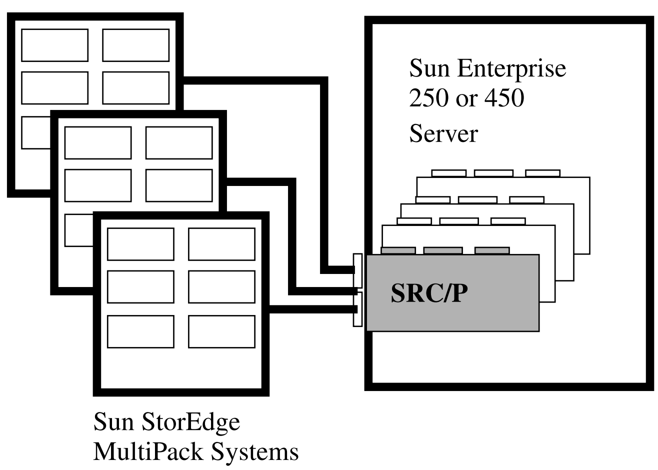
6603A

Sun Enterprise 250 Server with 6603A RAID Storage Option



6542A

Sun Enterprise 250 or 450 Server with 6542A SRC/P RAID Controller



RAID Option	Max. Options per System	Supported Disk Storage	Max. Supported per Option
Sun Enterprise™ 450 server			
(X)6602A	2	• 5214A 4.2-GB, 7200-rpm UltraSCSI • 5229A 9.1-GB, 7200-rpm UltraSCSI • 5234A 9.1-GB, 10,000-rpm UltraSCSI • 5237A 18.2-GB, 10,000-rpm UltraSCSI • Any combination of internal drives • 6-drive F/W Sun StorEdge™ MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	8 (see note 1) 8 (see note 1) 8 (see note 1) 8 (see note 1) 8 (see note 1) 1 (see note 2) 1 (see note 2) 1 (see note 2)
(X)6542A	6	• 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	3 3 3
Sun Enterprise 250 server			
(X)6603A	1 (see note 3)	• 5214A 4.2-GB, 7200-rpm UltraSCSI • 5229A 9.1-GB, 7200-rpm UltraSCSI • 5232A 18-GB, 7200-rpm UltraSCSI • 5234A 9.1-GB, 10,000-rpm UltraSCSI • 5237A 18.2-GB, 10,000-rpm UltraSCSI • Any combinations of internal drives • 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	6 6 6 6 6 6 2 2 2
(X)6542A	3	• 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	3 3 3

[1] Up to 12 internal drives can be supported with one 6602A by installing an X3833A internal SCSI cable (sold separately). This configuration will be supported once boot drives are supported (See Product Availability).

[2] One or two additional Sun StorEdge MultiPack storage units can be supported by disconnecting one or both internal SCSI cables from the controller's internal connectors.

[3] This option supported once boot drives are supported (See Product Availability).

Electrical Specifications

Uses the following input DC power from the host's PCI slot:

- +5.0VDC +/-5% @ 3.27A max.

Environmental Specifications

Temperature Ranges (dry bulb)	
• Operating	0 to 40 degrees C (32 to 104 degrees F)
• Non-operating	0 to 40 degrees C (32 to 104 degrees F)
Relative Humidity	
• Operating	10% to 90% RH, maximum wet bulb, non-condensing
• Non-operating	10% to 90% RH, maximum wet bulb, non-condensing
Altitude	
• Operating	3 km (10,000 feet)

Controller Physical Specifications

Length	31.2 cm / 12.283 in.
Height	10.67 cm / 4.2 in.
Component height	
• Primary side	14.48 mm / 0.570 in.
• Reverse side	2.67 mm / .105 in.
• Weight	0.53 kg / 1.2 lb.

Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System Regulatory Conformance

System Regulation	Specifications
Safety	UL Recognition per UL1950 cUL er CSA C22.2 No. 950 CB scheme to EN 60950
RFI/EMI	VCCI Class B FCC Class B Industry Canada Class B EN55022 Class B
Immunity	EN55082-1
Product Label	FCC Class B VCCI Class B UL Recognition mark CE mark

System Management

System Requirements

Support Requirement	Sun Enterprise™ 450 server	Sun Enterprise 250 Server
Solaris™ operating environment version	Solaris 2.6 Hardware: 2/98[1] Solaris 7[2]	Solaris 2.6 Hardware:2/98[1] Solaris 7[2]
System OBP version	3.12.12	3.12.12
SunVTS™ version	2.1.3, 3.0, 3.1, 3.2	2.1.3, 3.0, 3.1, 3.2

[1] Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system cannot support boot drive under Solaris 2.6 operating environment.

[2] No Sun StorEdge SRC/P controller boot support under Solaris 7 operating environment until mid-FY00.

Layered Software Support

Support Requirement	Sun Enterprise 450 Server	Sun Enterprise 250 Server
Sun Enterprise SyMON™ software version[1]	2.0.1	2.0.1
Solstice DiskSuite™ software version	4.2	4.2
Sun StorEdge Volume Manager™ software version	2.6, 3.0	2.6, 3.0

[1] Sun Enterprise SyMON 2.0.1 software will be available in May 1999. If the user's version of Solaris operating environment does not include Sun Enterprise SyMON 2.0.1 software, that software is available at: `http://www.sun.com/symon`.

Option Number Summary

Note: *Configured options (such as 6602A and 6542A) are not available until early Q1FY00. X-options are available on May 25, 1999.*

Part Number	Description	Option Includes
6602A	Sun StorEdge™ SRC/P 8-bay RAID storage option for Sun Enterprise 450 server; factory installed • Supports 8 internal drives (4 drives on each of 2 SCSI buses) • Third SCSI bus can be used to support first 4 internal drives or a Sun StorEdge MultiPack	• Sun StorEdge SRC/P RAID card, memory, battery • 8-disk backplane for the Sun Enterprise™ 450 server • Internal cables • Software Supplement CD [1] Note: 8-disk backplane (in 6602A) is the same backplane used in X6601A; internal SCSI data cable is different
X6602A	Sun StorEdge SRC/P 8-bay RAID storage option for Sun Enterprise 450 server • Field-installed version	• Sun StorEdge SRC/P RAID card, memory, battery • 8-disk backplane for the Sun Enterprise 450 server • Internal cables • Sun StorEdge SRC/P controller installation guide • Software Supplement CD [1] • ESD kit
6542A	SCSI Hardware RAID controller, PCI; factory installed • Three external SCSI ports support Sun StorEdge MultiPack systems	• Sun StorEdge SRC/P RAID card, memory, battery • 2 X3832A external 2-meter SCSI cables • Sun StorEdge SRC/P User's Guide • Software Supplement CD [1]
X6542A	SCSI Hardware RAID controller, PCI • Field-installed version	• Sun StorEdge SRC/P RAID card, memory, battery • 2 X3832A external 2-meter SCSI cables • Sun StorEdge SRC/P User's Guide • Sun StorEdge SRC/P Installation Guide • Software Supplement CD [1] • ESD kit
X3832A	2-meter external SCSI data cable, offset VHDCI connectors to 68-pin. Compatible with 6602A, 6603A, and 6542A	• 2-meter external SCSI cable
530-2744	Sun Enterprise 450 server internal 8-disk SCSI data cable, for Sun StorEdge SRC/P controller	• Internal SCSI ribbon cable, Sun StorEdge SRC/P controller to 8-disk backplane

[1] The SRC/P Software Supplement CD includes the Sun StorEdge SRC/P Intelligent SCSI RAID Controller User's Guide.

How to Configure Sun StorEdge SRC/P Controller

The Sun Enterprise 250 server can be configured with SRC/P to control up to nine external Sun StorEdge MultiPack devices. SRC/P can be configured on the Sun Enterprise 450 server to control combinations of internal disks and external storage MultiPack devices. The Sun Enterprise 450 server can be configured with SRC/P to control up to 16 internal disk drives or up to 18 external Sun StorEdge MultiPack devices.

On the Sun Enterprise 450 server, in addition to the internal drives controlled by SRC/P, users need to install at least one boot drive in one of the first four internal Sun Enterprise 450 drive bays. This requirement will exist until boot drive capability is available from a drive controlled by SRC/P.

Note: *Configured options (such as 6602A and 6542A) are not available until early Q1FY00. X-options are available on May 25, 1999.*

To Control the Following Storage Devices	Order Part Number	Number to Order
For Sun Enterprise 250 Servers (A26-AA)		
• Two Sun StorEdge MultiPack systems	(X)6542A	1
• Three Sun StorEdge MultiPack systems	(X)6542A X3832A	1 1
• Nine Sun StorEdge MultiPack systems	(X)6542A X3832A	3 3
For Sun Enterprise 450 Servers (A25-BA)		
• Up to eight internal disk drives	(X)6602A	1
• Up to 16 internal disk drives	(X)6602A	2
• Up to eight internal disk drives and one Sun StorEdge MultiPack device	(X)6602A X3832A	1 1
• Up to 16 internal disk drives and two Sun StorEdge MultiPack devices	(X)6602A X3832A	2 2
• Two Sun StorEdge MultiPack devices	(X)6542A	1
• Three Sun StorEdge MultiPack devices	(X)6542A X3832A	1 1
• 18 Sun StorEdge MultiPack devices	(X)6542A X3832A	6 6
• Eight internal disks and 15 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	1 5 5
• Eight internal disks and 17 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	1 5 7
• 16 internal disks and 12 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	2 4 4
• 16 internal disks and 14 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	2 4 6

To Control the Following Storage Devices	Order Part Number	Number to Order
For Installed Sun Enterprise 450 Servers		
• To add eight new internal RAID disk drives on an installed Sun Enterprise 450 server	X6602A	1
• To adds 16 new internal RAID disk drives on an installed Sun Enterprise 450 server	X6602A	2
• To adds one Sun StorEdge MultiPack device to a Sun StorEdge SRC/P Controller system in an installed Sun Enterprise 450 server	X3832A	1
• To convert 8 existing internal disk drives to hardware RAID. This conversion option applies to Sun Enterprise 450 servers with (X)6601A as the installed 8-disk expansion bay.	X6542A #530-2744	1 1

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ operating environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise™ Services representatives for program and feature availability in their areas.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Personal technical account support	Yes	Yes	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7-day/24-hour telephone coverage	Yes	Yes	Option	No
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
Customer-defined priority setting	Yes	Yes	Yes	No
• Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
• Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
• Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
Additional contacts	Option	Option	Option	Option

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Enhanced Support Features				
Mission-critical support team	Yes	Yes	No	No
Sun Vendor Integration Program (SunVIP℠)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve℠ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ Service	Yes	Yes	Yes	Yes

Glossary

Active termination, regulated	Terminates the SCSI bus with a series of resistors tied to +5 Volts. The terminator is labeled *Regulated* but is often referred to as an *Active Terminator.*
Bandwidth	A measure of the capacity of a communication channel, usually specified in Megabytes per second (MB/s).
CLI	Command line interface.
Data cache	64 MB of cache memory for fast writes to cache and read ahead cache operations. Cache memory permits intermediate storage of read and write data without physically reading/writing to the disk, increasing overall performance.
Device name	Software device address that identifies the controller/LUN, such as cXtYdZs0, where X is the host bus adapter, Y is the controller, and Z is the LUN. s0 slice number is used by the system, not by RAID Manager.
Disk array	A subsystem that contains multiple disk drives, designed to provide performance, high availability, serviceability, or other benefits.
Drive group	A physical set of drives in the RAID module. Drive groups are defined during configuration.
Fast write	Allows disk write commands to be safely acknowledged to the host before the data is actually written to the disk media. This can be enabled/disabled through RAID Manager software.
Fast/wide SCSI	Data transfer rate of 20 MB per second. Wide devices can be connected to a standard SCSI interface but the extra data lines need to be terminated.
Full-duplex	Data transmission in both directions at the same time. See also Half-duplex and Simplex.
GB	Gigabyte. A disk GB is 1 billion (1,000,000,000) bytes. A memory GB is 1,073,741,824 bytes (2 to the 30^{th} power).
GUI	Graphical user interface. The Sun StorEdge SRC/P Storage Manager™ software provides a powerful, easy-to-use GUI.
Half-duplex	Refers to an interface, such as SCSI, that can transmit data in only one direction at a time. See also Full-duplex and Simplex.
Host adapter	A card that connects a peripheral device to the computer system's I/O bus.
Hot plug	The ability to remove, replace, or add a device while current I/O processes continue.

Hot spare	A drive in an array that is held in reserve to replace any other drive that fails. After a reconstruction, the hot spare drive is returned to the standby status.
Hot swap	A specific case of hot plug which involves replacing a device with another of the same size, type, and layout, without any notification to the operating environment.
IOPS	Input/output operations per second. A measure of I/O performance, this is usually used to quote random I/O performance. See Throughput.
LUN	Logical unit number. A LUN is a set of physical drives in a RAID configuration which are seen by the operating system as one virtual drive.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.
MTBDL	Mean time between data loss. In a RAID system, this is the average expected time between two rapid disk failures that would cause irreparable data loss.
Parity	Additional information stored along with the data that allows the controller to reconstruct lost data on RAID 3 or 5 LUNs if a single drive fails.
Reconstruction	Process used to restore a degraded RAID 1, 3, or 5 LUN to its original state after replacing a single failed drive.
RAID	Redundant array of independent disks. A RAID is a set of disk drives that appears to be a single logical disk drive to an application such as a database or file system. RAID technology increases system performance by spreading disk I/O operations across multiple simultaneously active disks. It increases data availability by introducing data redundancy. Different RAID levels provide different capacity, performance, high availability, and cost characteristics.
RAS	Reliability, availability, and serviceability. Features that enhance these attributes, including hot-pluggable capability and redundancy, are important for keeping mission-critical applications and data on-line.
Sun StorEdge SRC/P Storage Manager	The software that allows the customer to configure and manage the Sun StorEdge SRC/P controller.
SCA	Single connector attachment. A SCSI disk connector technology co-invented by Sun Microsystems. The SCA provides all SCSI, power, and control signals in a single connector, and enables easy servicing and highly reliable, pluggable disk drives.
SCSI address	The octal representation of the unique address (0–7) assigned to a narrow device; or hex representation of the unique address (0–15) assigned to a wide SCSI device.
Simplex	Transmission in one preassigned direction only. See also Full-duplex and Half-duplex.

SNMP	Simple network management protocol. SNMP enables RAID events to be remotely monitored by designated network management stations.
Striping	Spreading, or interleaving, logically contiguous blocks of data across multiple independent disk spindles. The amount of data written on each disk before moving to the next drive is the stripe width.
TB	Terabyte. A disk terabyte is 1 trillion (1,000,000,000,000) bytes. A memory terabyte is 1,099,511,627,776 bytes (2 to the 40^{th} power).
Throughput	A measure of sequential I/O performance, quoted in MB per second. See IOPS.
Volume	In the Sun StorEdge Volume Manager™ software, a volume is a virtual disk partition into which a file system, DBMS, or other application can place data. A volume can physically be a single disk partition or multiple disk partitions on one or more physical disk drives. Applications that use volumes do not need to be aware of their underlying physical structure. The Sun StorEdge Volume Manager software handles mapping of virtual partition addresses to physical addresses.
Warm plug	The ability to remove, replace or add a device while power is still applied but all I/O processes are suspended.
Write back	A method postponing data to be written to a slow device such as a disk drive by temporarily saving the data in a cache. The data can then be written at a time when the device would otherwise be idle. In addition, the data can be processed through techniques such as elevator sorting, so that the write operations will go faster.
Write through	The opposite of write-back. In write-through mode, data must be written to the final destination before a write operation is completed.
UltraSCSI	Data transfer rate of 40 MB per second per channel.
XOR	eXclusive OR. A binary mathematical operation performed on data to produce parity information. In RAID levels 3 and 5, parity is generated from the user data, stored, and used to regenerate lost data if a drive failure occurs.

Materials Abstract

All materials are available on SunWIN, except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Sales Tools				
– *Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System—Just the Facts*	Reference Guide for the *Sun StorEdge SRC/P Controller System*	Sales Tool	SunWIN, Reseller Web	104278
– *Sun Intro*	Sun Introduction with Pricing and Q&A	Sales Tool	SunWIN, Reseller Web	104274
Product Literature				
– *Sun StorEdge SRC/P Data Sheet*	Two-page Color Data Sheet	Sales Tool	SunWIN, Reseller Web	103418
External Web Site				
– *Hardware RAID Web Page*	`http://www.sun.com/servers/workgroup/hwraid`			

Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System

Just the Facts

Copyrights

Positioning

Introduction

In the highly competitive enterprise workgroup server market, a large and growing proportion of performance-sensitive customers are taking advantage of low-cost hardware RAID storage controller cards to improve the data availability, system throughput, and price/performance of their distributed application servers and database servers. Hardware RAID controllers are an economical way for customers to improve data security and availability without suffering the performance penalty imposed by host-based software RAID. They also deliver controller-based RAID performance advantages economically and space efficiently, by providing RAID functionality via the host systems' internal SCSI disk drives instead of external storage arrays.

The economy and performance advantages offered by hardware RAID controllers is so widely accepted in the server market that many customers consider hardware RAID an absolute requirement for their server purchases. Sun recognizes the growing customer demand for low-cost hardware RAID capability for workgroup servers and has responded to this need by introducing the Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system.

Product Overview

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller (SRC/P) system is a high-performance disk storage controller for Sun Enterprise™ 250 and 450 workgroup servers. It gives Sun's workgroup server customers the performance and data protection advantages of the latest RAID storage technology for a very attractive price. This system supports non-RAID SCSI disk operations as well as RAID levels 0, 1, 1+0, 5, and 5+0.

This 64-bit PCI card supports internal UltraSCSI disk drives or external Sun StorEdge™ MultiPack storage units on each of three 40 MB per second SCSI channels. Its powerful on-board microprocessor offloads many routine storage I/O operations and all RAID management activities from the host system, enabling the host system CPUs to do more productive work. In addition, its 64 MB of on-board, battery-protected, data cache memory and intelligent caching algorithms speed up many disk read and write operations, reducing system response time and increasing overall throughput.

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system will be offered in three standard configurations:

- The first option supports the Sun Enterprise 450 server's internal disks. It includes the Sun StorEdge SRC/P controller, an eight-slot disk backplane, internal cables, and the Sun StorEdge SRC/P software. Two of these options will support up to 16 internal disks. With an optional third internal SCSI bus cable installed, one SRC/P controller option will support 12 internal disks (in the four standard drive bays plus eight option bays), allowing all 20 internal drives to be supported in RAID arrays. (Note: Installation of a third internal SCSI bus cable will not be supported on the Sun Enterprise 450 server at GA.)
- The second option, which supports Sun Enterprise 250 server internal disks, includes the controller, Sun Enterprise 250 server internal cables, Sun StorEdge SRC/P software, and two external SCSI cables. The system's six internal drives are supported by one of the controller's SCSI channel, while the remaining channels can be used to support Sun StorEdge MultiPack storage. (Note: Internal drive support on the Sun Enterprise 250 server will not be available at GA.)

- The third option can be used to support Sun StorEdge MultiPack storage units on all three controller channels. Up to six of these options can be supported on the Sun Enterprise 450 server, providing up to 2 TB of high performance RAID storage capacity. Up to three Sun StorEdge SRC/P controllers can be supported on the Sun Enterprise 250 server, for a maximum RAID storage capacity of 1 TB. This Sun StorEdge SRC/P option will also support Sun StorEdge MultiPack storage on future Sun workgroup servers.

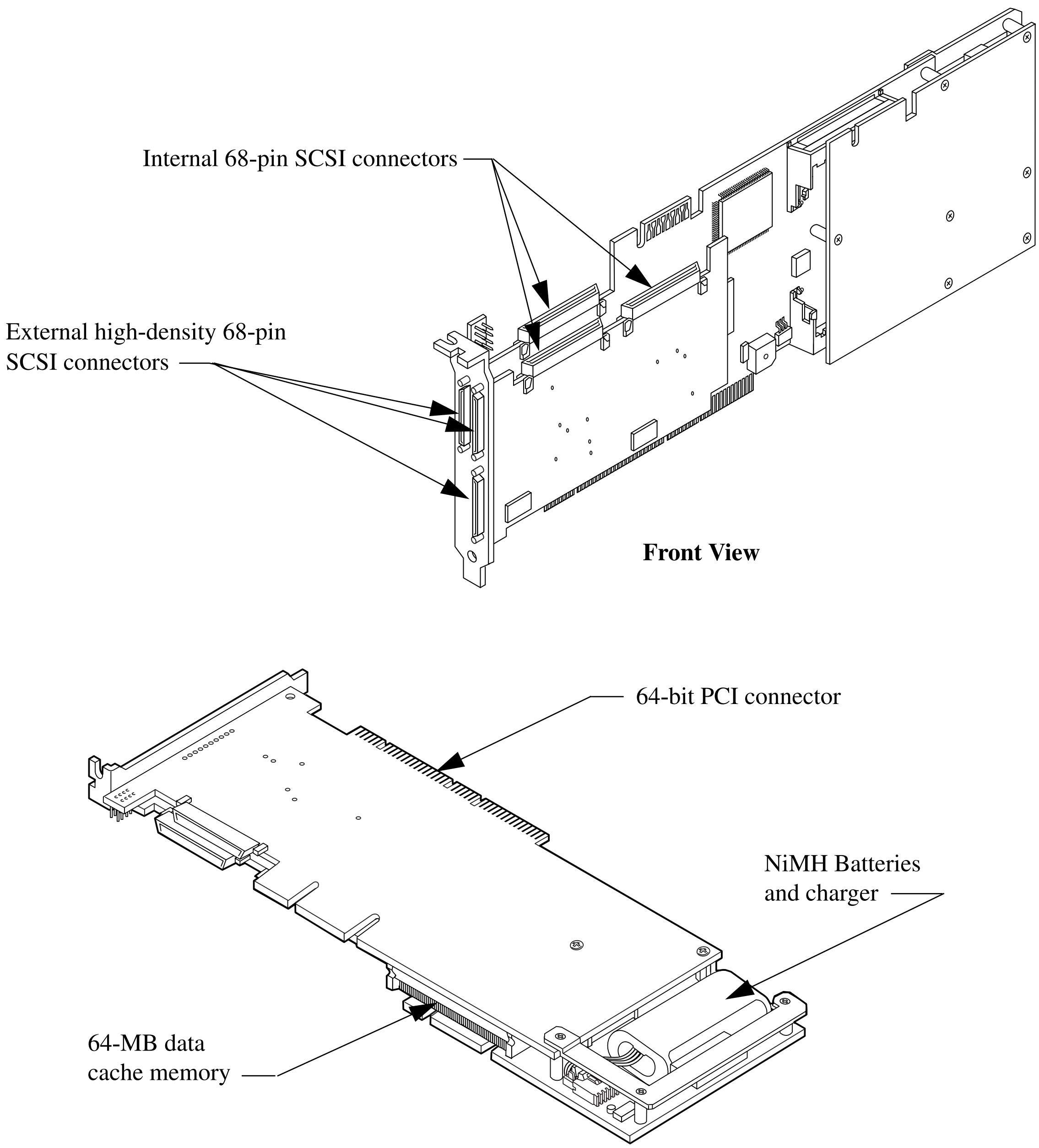


Figure 1. Sun StorEdge SRC/P Intelligent SCSI RAID Controller system physical views

Sun StorEdge SRC/P Storage Manager™ Software

The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system comes with device drivers for Solaris™ 2.6 and Solaris 7 operating environments, controller operating firmware, and a controller management interface, called Sun StorEdge SRC/P Storage Manager™ software. The Sun StorEdge SRC/P Storage Manager software provides an easy to use graphical interface for installing, configuring, and managing SRC/P RAID storage. With the Sun StorEdge SRC/P Storage Manager software, system administrators can:

- Setup Sun StorEdge SRC/P controllers and their disks
- Flash update controller firmware
- Verify proper controller, cabling, and disk installation and operation
- Create, configure, and delete RAID 0, 1, or 5 arrays or RAID 1+0 or 5+0 array groups
- Designate a hot spare disk and set up the controller to automatically recover any supported RAID 1, 1+0, 5, or 5+0 array from a disk failure
- Set and change controller caching policies for each RAID array
- Monitor disk and controller status and view event logs
- Review performance data collected by the Sun StorEdge SRC/P controller
- View the status of the memory battery backup unit and run periodic battery maintenance routines
- Manually restore an array after a disk failure
- Swap out a failed drive and install a replacement disk

The Sun StorEdge SRC/P Storage Manager runs on the host server and can display output on the system local graphics console or on a network attached X-windows graphical display. A single Sun StorEdge SRC/P Storage Manager instance can manage all Sun StorEdge SRC/P controllers in the system.

In addition to the graphical interface, Sun StorEdge SRC/P Storage Manager software provides a Solaris operating environment command line interface.

Sun StorEdge SRC/P Controller System Features and Benefits

Features	Benefits
• PCI 2.1 compliant, PCI card with long form factor, single PCI slot width (including battery pack)	• Fits in any 64-bit PCI slot in Sun Enterprise 250 or 450 servers
• 64-bit, 33-MHz PCI card	• Fits in any 64-bit PCI slot in Sun Enterprise 250 or 450 servers
• Supports 64-bit PCI transfers	• Fast data transfers to memory
• 264 MB/sec. maximum PCI data transfer rate	• Efficient use of the PCI bus bandwidth
• Three independent single-ended UltraSCSI buses	• Configuration flexibility
– Each bus will support either internal or external devices (not both)	
– 40 MB/sec. peak throughput per bus	• Meets or exceeds the capabilities of the supported disk drives

Features	Benefits
– Three internal ultra-wide (40 MB/sec.) ports (one on each SCSI bus)	• Can support up to 12 internal disks in Sun Enterprise 450 server or 6 internal drives in Sun Enterprise 250 server
– Three external SCSI-3 (F/W capable) ports (one on each channel); auto-negotiated port speeds	• Supports up to three Sun StorEdge MultiPack disk systems with either 7200-rpm F/W or UltraSCSI drives
• Supports single-ended UltraSCSI SCSI disks (F/W SCSI drives supported in Sun StorEdge MultiPack systems)	• Compatible with internal UltraSCSI disk drives and Sun StorEdge MultiPack disk storage systems • Provides excellent storage capacity and performance for low cost/MB
• On-board microprocessor handles all disk I/O	• Significantly reduces system overhead for disk intensive workloads; frees main system CPUs to do productive work
• Provides hardware acceleration for RAID 0, 1, 1+0, 5, and 5+0	• Supports all of the popular RAID levels, for performance and data availability
• Supports independent disks and different RAID levels for different drives and drives groups attached to the same controller	• Makes it easy to optimize storage for multiple concurrent applications • Makes it easy to match data layouts to meet users' specific requirements for capacity, performance, high availability, and cost
• 64-MB, on-board, ECC-protected I/O data cache memory (additional memory slots on the board are not supported at this time)	• Large-capacity, dedicated data cache memory supports high performance I/O; ECC protection provides data integrity
• Implements read-ahead and predictive caching	• Boosts system read performance
• Cache can be set for write-through or write-back modes of operation	• Write-through mode provides maximum data protection; write-back mode significantly accelerates disk write operations
• Online switching of cache management policies (WB, WT) • No rebooting required after changes to cache management policies	• The ability to switch from write-back to write-through mode online enables data integrity if the battery charge is low without disrupting system operation
• On-board battery backup provides 48 hour cache memory data protection	• Battery backup protects write data cached in the controller against power failure; enables faster data I/O with full data protection
• On-board battery charger plus fast recharge batteries, maximum three hour recharge time	• Allows quicker returns to write-back mode of operation after battery discharges, accelerating system performance
• Battery monitor with battery-low/battery-fail indicator	• Alerts system manager to change cache policy to write-through mode when battery-backup is compromised

Features	Benefits
• Controller installation, configuration, and management is handled through Sun StorEdge SRC/P Storage Manager software – Simple graphical X-windows interface – Solaris operating environment command line interface	• Sun StorEdge SRC/P Storage Manager software makes setting up and managing RAID arrays fast and easy, even for non-UNIX® administrators
• Unbundled software release CD (at GA) – Device driver for Solaris 2.6 and 7 operating environments – Host system firmware update – Controller firmware – Sun StorEdge SRC/P Storage Manager software – Installation and user documentation	
• Solstice DiskSuite™ or Sun StorEdge Volume Manager™ software can be used to create/manage arrays that span two or more Sun StorEdge SRC/P controllers or other arrays	• Improves system/data availability by eliminating controllers as single points of failure • All attached storage (internal disks and external arrays) can be managed in a uniform fashion through a common interface
• Sun StorEdge SRC/P arrays can span drives on all three controller channels	• Improves system throughput and response time under heavy workloads • Improves system/data availability by eliminating SCSI buses, cables, and disk backplanes/drive enclosures as single points of failure
• RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns	• Users can tune for best performance for their specific applications
• Support for online RAID reconfiguration	• System managers have the flexibility of adapting storage to changing needs without disrupting system services
• Support for hot sparing • Hot spare is automatically swapped in to replace any failed disk in a RAID-1, 1+0, 5, or 5+0 RAID group	• The Sun StorEdge SRC/P controller can automatically failover to the hot spare drive and rebuild any RAID 1, 1+0, 5, or 5+0 array, quickly returning the system to peak performance after a drive failure without any interruption to system services • Continuous redundant data protection even if a disk fails
• Schedulable drive rebuilds	• Allows system managers greater flexibility in delivering system services; rebuilds can be deferred to off-peak hours
• Support for drive hot swapping	• Failed drives can be replaced without disrupting system services

Features	Benefits
• Support for online physical drive migration	• Allows healthy drives to be relocated to a new drive bay to reduce system downtime
• Controller firmware downloadable/flash upgradeable from the host system using Sun StorEdge SRC/P Storage Manager	• Easy to keep firmware up to the latest revision
• Power-on self test; support for OpenBoot™ diagnostics and SunVTS™	• Enables fast, easy problem identification and diagnosis for maximum system uptime
• Supported by Sun Enterprise SyMON™ software	
• Performance monitoring and data logging	
• On-line drive fault detection and reporting	
• Event logging	
• Online drive testing (new drives)	
• RAID configuration written through to the disks, rather than stored in the controller	• Easy to restore full operation if the Sun StorEdge SRC/P controller is swapped out; arrays remain intact and data is quickly accessible
• On-board NVRAM for storing controller configurationinformation	• Easy to restore full operation quickly after a system shutdown or power failure; no need to manually restore all controller settings

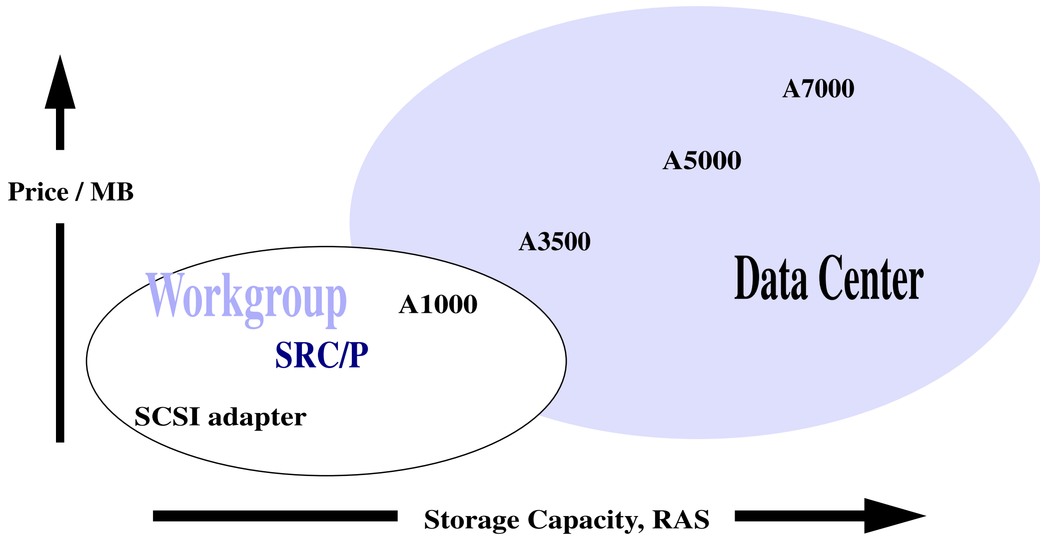
Sun StorEdge SRC/P Intelligent SCSI RAID Controller Target Markets

- Sun direct end-user customers and reseller customers (all Geos)
- Sun Enterprise 250 and 450 workgroup server customers
- Small- to medium-scale database servers, file servers, and transaction-oriented business application servers (CMS, ERP, e-commerce)
- All industries, government, and educational institutions

Product Availability

General Availability (GA) for the X-options for this product is May 25, 1999. The configured options will not be available until early Q1FY00.

Product Family Positioning



The Sun StorEdge SRC/P Intelligent SCSI RAID Controller system fits into the Sun workgroup server storage product lineup between host-controlled internal UltraSCSI disks and the Sun StorEdge A1000 RAID storage array.

Sun StorEdge SRC/P Versus UltraSCSI Host Bus Adapter

With its 64 MB of battery-protected data cache memory and intelligent caching algorithms, the Sun StorEdge SRC/P Intelligent SCSI RAID Controller (SRC/P) system provides significantly greater disk I/O throughput than simple SCSI host bus adapters for nearly any application. When disk striping is required to boost system performance under heavy loads, the performance advantages of the SRC/P system's hardware RAID become even more pronounced. In addition, with three disk I/O channels per card, the Sun StorEdge SRC/P controller can deliver more disk IOPS (I/O transfers per second) and more total data throughput per PCI slot than any available single or dual channel controller cards—even more than Fibre Channel.

Sun StorEdge SRC/P Versus Sun StorEdge A1000 Array

For many RAID applications, the Sun StorEdge SRC/P controller offers equal or higher disk I/O performance than the Sun StorEdge A1000 array. By placing the RAID controller intelligence on the PCI bus instead of at the other end of the SCSI bus, the Sun StorEdge SRC/P controller reduces the hand-off time and latency for host data read requests. This design also reduces the number of request and data handling steps in retrieving data from the disks, thus further reducing read latency. Likewise, since the controller's write cache memory is closer to the host system bus, write latency for write-back operations is also reduced.

For customers whose total storage requirements can be met by the internal drives of the Sun Enterprise 250 or 450 server, the Sun StorEdge SRC/P controller eliminates the need to find space for an external storage box. It also reduces cost by eliminating the need for components such as external enclosures, power supplies, and fans. For many workgroup server applications, the Sun StorEdge SRC/P controller offers higher performance and a lower cost per megabyte than the Sun StorEdge A1000 array.

The Sun StorEdge A1000 array is the answer for customers who require clustered servers with shared access to storage. The Sun StorEdge SRC/P controller does not at present support multihost access to shared disks; the Sun StorEdge A1000 array, supported by Sun™ Cluster 2.1 software, does. In addition, even with clustering supported, the Sun StorEdge SRC/P controller could only operate in write-through mode when disks are shared between two controllers. This is necessary in order to maintain complete data integrity in the event of a power failure. This restriction significantly reduces overall disk I/O performance for write-intensive applications. Since the Sun StorEdge A1000 array controller and write cache are shared by both host systems, the problems associated with maintaining cache data integrity when operating in write-back mode are eliminated.

The Sun StorEdge A1000 array also offers a better solution for customers who need to store large amounts of data (greater than 1 TB). Since the Sun StorEdge SRC/P controller only supports single-ended SCSI devices, UltraSCSI-capable Sun StorEdge MultiPack systems must be no more than two meters from the host server. Physical placement of more than nine Sun StorEdge MultiPack systems within such close proximity to the server can be challenging.

Detailed Product Comparison

Features	**Dual UltraSCSI + Sun StorEdge MultiPack**	**Sun StorEdge SRC/P Controller**	**Sun StorEdge A1000 Array**	**Sun StorEdge A5000 Array**
Host bus adapter type	32-bit, 33-MHz PCI	64-bit, 33-MHz PCI	32-bit, 33-MHz PCI	64-bit, 33-MHz PCI
Max. host bus (PCI) I/O data rate	132 MB/sec.	264 MB/sec.	132 MB/sec.	264 MB/sec.
# Disk I/O buses per HBA	2	3	2	1
Disk I/O bus type	Single-ended UltraSCSI	Single-ended UltraSCSI	Differential UltraSCSI	Fibre Channel
Disk I/O bus data rate, max.	40 MB/sec.	40 MB/sec.	40 MB/sec.	100 MB/sec.
HBA data throughput, max.	80 MB/sec.	120 MB/sec.	80 MB/sec.	100 MB/sec.
Max. # drives per disk I/O bus	6@40 MB/sec. 12@20 MB/sec.	6@40 MB/sec. 12@20 MB/sec.	24@40 MB/sec.	66
Max. # drives per HBA	12@40 MB/sec. 24@20 MB/sec.	18@40 MB/sec. 36@20 MB/sec.	48@40 MB/sec.	66
Max. storage capacity per HBA	2 x 6 x 18 GB = 216 GB	3 x 6 x 18 GB = 324 GB	4 x 8 x 18 GB = 576 GB	4 x 14 x 18 = 1008 GB
Max. HBAs per Sun Enterprise 450 server	10	6	7	4
Sun Enterprise 450 server max. raw disk I/O bandwidth	584 MB/sec.	690 MB/sec.	532 MB/sec.	400 MB/sec.
Max. drives per Sun Enterprise 450 server	120@40 MB/sec.	126@40 MB/sec.	168@40 MB/sec.	132
Max. storage capacity per Sun Enterprise 450 server	2.2 TB	2.3 TB	2.0 TB	2.0 TB
List price/GB @100 GB	US$120	US$157	US$174	US$514
List price/GB @200 GB	US$115	US$142	US$169	US$484
Max. HBAs per Sun Enterprise 250 server	4	3	4	2
Sun Enterprise 250 server max. raw disk I/O bandwidth	212 MB/sec.	333 MB/sec.	212 MB/sec.	200 MB/sec.
Max. drives per Sun Enterprise 250 server	48@40 MB/sec.	72@40 MB/sec.	96@40 MB/sec.	66

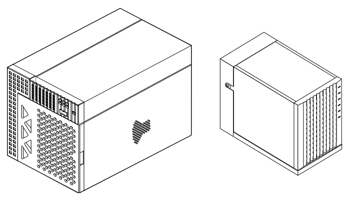
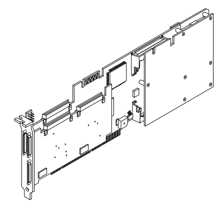
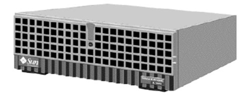
Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
Max. storage capacity per Sun Enterprise 250 server	864 GB	1.3 TB	1.2 TB	1.0 TB
RAID-0 performance (6 drive stripes, 12 drives total) • 64-KB seq. read (MB/sec.) • 64-KB seq. read (MB/sec.)	 — —	 — —	 — —	 — —
RAID-5 performance (6 drive stripes, 12 drives total) • 2-KB random read (IOPS) • 2-KB random read (IOPS)	 — —	 — —	 — —	 — —
• Support for system boot disk	Yes	TBD	No	No
• On-board microprocessor handles all disk I/O and RAID calculations	No	Yes	Yes	No
• ECC and battery protected I/O data cache memory	No	Yes, 64 MB	Yes, 16-MB upgradeable to 64 MB	No
• On-board battery backup – # hours of cache data protection – Battery monitor with battery-low/battery-fail indicator – On-board battery charger – Batteries recharge time, max.	N/A	Standard 48 hours Yes Yes 3 hours	Standard 72 hours	N/A
Key to notations below: S = Sun StorEdge SRC/P Storage Manager R = RAID Manager		V = Sun StorEdge Volume Manager D = Solstice DiskSuite		
• Supported RAID managers – Sun StorEdge SRC/P Storage Manager (S) – RAID Manager (R) – Sun StorEdge Volume Manager (V) – Solstice DiskSuite (D)	• V or D	• S or S + V or D	• R or R + V or D	• V
• Supports RAID 0, 1, 1+0, 5 • Supports RAID 3 • Supports RAID 5+0 • Supports multi-modes (different RAID levels for different drives)	• V, D • No • No • V, D	• S, V, D • No • S • S, V, D	• R, V, D • No • No • R, V, D	• V • No • No • V

Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
• Simple GUI operator interface • GUI supported on local graphics console • Remote network GUI console	• V, D • V, D • V, D	• S, V, D • S, V, D • S, V, D	• R, V, D • R, V, D • R, V, D	• V • V • V
• Solaris operating environment command line interface	• V, D	• S, V, D	• R, V, D	• LUXadm, V
• Striping across multiple controllers • Striping across multiple channels of one controller • Variable stripe lengths	• V, D • V, D • V, D	• V, D • S, V, D • S, V, D	• V, D • R, V, D • R, V, D	• V • V • V
• Min. size of logical storage unit per physical disk – P = disk partition – E = entire disk • Multiple logical units per physical disk	• V = P D = P • V, D	• S = E • V = P • D = P • V, D	• R = P • V = P • D = P • R, V, D	• V = P • V
• Max. # logical storage units (LUNs) per controller/HBA – RAID 0 (stripe) – RAID 1 (mirror) – RAID 5 (stripe+parity) – Any combination	• D =>32 • D =>32 • D =>32 • D =>32	• S = 18 • S = 18 • S = 12 • S = 18	• R = 16/32 • R = 16/32 • R = 16/32 • R = 16/32	• V => 32 • V => 32 • V => 32 • V => 32
• Support for hot sparing – Global hot spares only – Assignable hot spares – Multiple hot spares	• V, D • V, D • V, D	• S, V, D • S (1 max.) • V, D • V, D	• R, V, D • R • V, D • R, V, D	• V • V • V
• Automatic transparent drive rebuild capability • Schedulable drive rebuild	• V, D • V, D	• S, V, D • S, V, D	• R, V, D • R, V, D	• V • V
• Support for online capacity expansion (no reboot required)	• V, D	• S, V, D	• V, D	• V
• Support for drive hot swapping	• V, D	• S, V, D	• R, V, D	• V
• Write cache can be set for write-through or write-back modes of operation • Read ahead caching/ predictive read caching • Online switching of caching policies (write-back, write-through) • No rebooting required after changes to cache management policies	• N/A • N/A • N/A • N/A • N/A	• Yes • Yes • Yes • Yes • Yes	• Yes • Yes • Yes • Yes • Yes	• N/A • N/A • N/A • N/A • N/A
• RAID controller firmware stored in flash memory; downloadable/ upgradeable from the host	• N/A	• Yes	• Yes	• N/A

Positioning

Features	Dual UltraSCSI + Sun StorEdge MultiPack	Sun StorEdge SRC/P Controller	Sun StorEdge A1000 Array	Sun StorEdge A5000 Array
• Array information stored on disk	• V, D	• S, V, D	• R, V, D	• V
• Power-on self test • OpenBoot diagnostics support • SunVTS support • Sun Enterprise SyMON software support • Performance monitoring and data logging • Drive fault detection and reporting • Online drive testing (new drives)	• Yes • Yes • Yes • Yes • V, D • Yes • Yes	• Yes • Yes • Yes • Yes • S, V, D • Yes • Yes	• Yes • Yes • Yes • Yes • V, D • Yes • Yes	• Yes • Yes • Yes • Yes • V • Yes • Yes

When to Sell, When Not to Sell

UltraSCSI Host Adapter	Sun StorEdge SRC/P Intelligent SCSI RAID Controller	Sun StorEdge A1000 array
		
When to Sell • When storage requirements are less than 400 GB per system, a*nd* – When lowest cost is more important than maximum performance – When the application is not disk I/O intensive (web caching) – When the system is lightly loaded (greater than 50% CPU utilization) – When disk I/O is mostly random large block reads (image files) – Low-end cluster configuration using Sun StorEdge MultiPack systems	**When to Sell** • When storage requirements are less than 1 TB per system, a*nd* – When maximum disk I/O performance is required – When the customer wants “in-the-box” RAID for Sun Enterprise 250 or 450 servers – When clustering or dual-host access to storage is not required – When RAID 0, 1+0, 5, or 5+0 is required – When disk I/O is heavy, random, small block reads and writes – When system workload is light but expected to grow rapidly	**When to Sell** • When storage requirements are greater than 1 TB per system • When clustering with dual-host access to storage is required • When external disks are required and rackmounting or RAS are important
When NOT to Sell • Customer wants hardware RAID • Heavy disk I/O activity • Greater than 400-GB storage capacity is required	**When NOT to Sell** • Customer wants a cluster • Disk I/O is minimal or mostly large blocks • Storage requirement greater than 1 TB	**When NOT to Sell** • Customer wants “in-the-box” RAID • Single server environment • Lowest price/MB is important

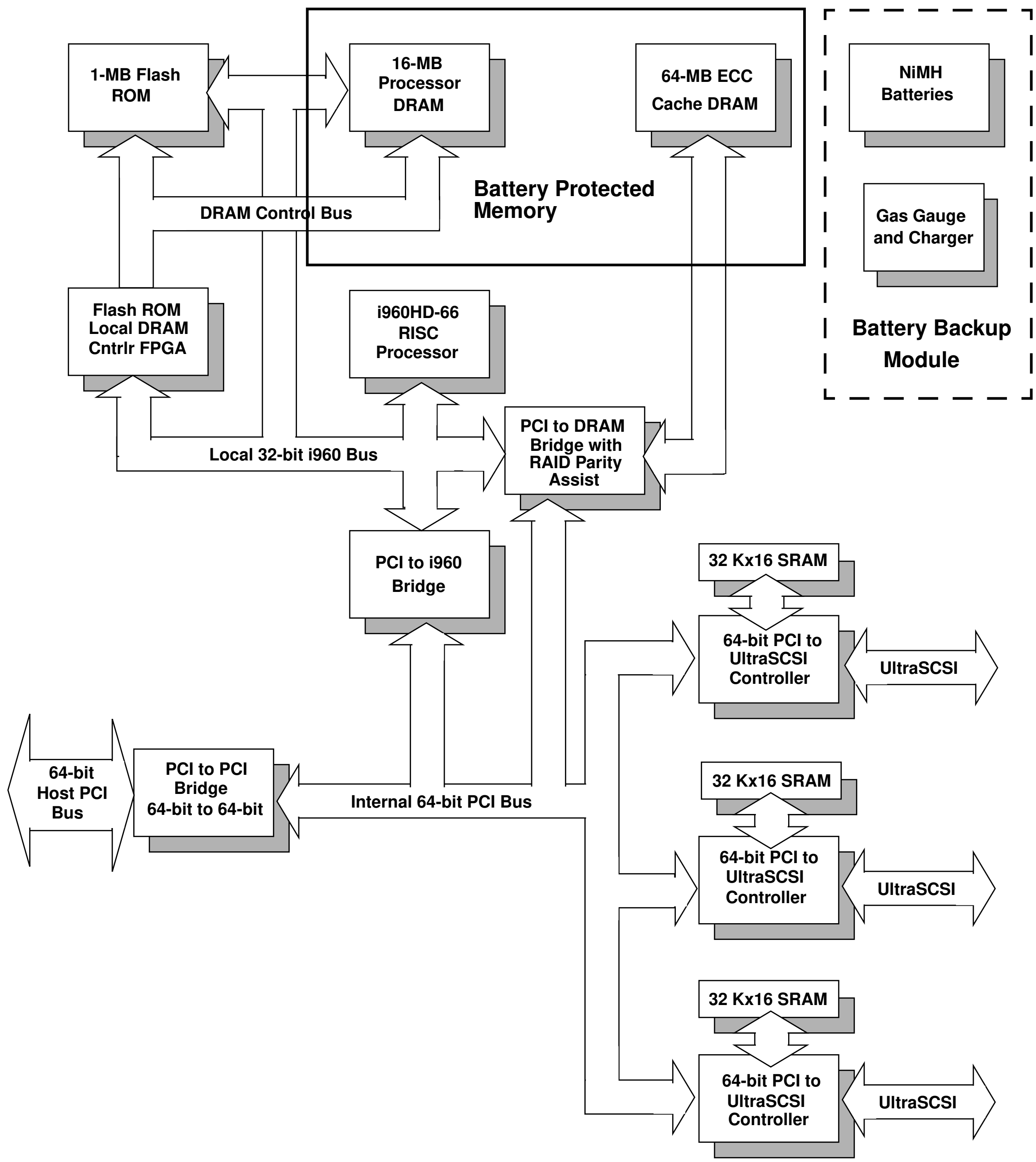


Figure 2. Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system architecture

Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System Limitations/ Exclusions

Limitation/Exclusion	Comments
• Not supported on Sun Enterprise Ultra™ 5S or 10S servers	• Electrical incompatibility
• Not supported on Sun Enterprise™ servers	• Physical incompatibility
• Not supported on Sun workstations	• Not generally a workstation requirement
• No support for Sun StorEdge™ A1000 or D1000 arrays	• Incompatible SCSI implementation
• No support for tape drives or CD-ROMs	• Supported by lower cost SCSI controllers
• No support for 5400-rpm or older disk drives	• Limited demand and therefore not supported
• No support for daisy chaining of Sun StorEdge MultiPack systems	• Limited demand and therefore not supported
• No support for clustering, dual-hosting, or dual datapaths	• Sun StorEdge A1000 array offers a more effective solution for clusters
• SCSI channels cannot be used to support both internal and external devices at the same time	• SCSI bus length limitation
• No support for Solaris™ 2.5.1 operating environment	• Development cost, time-to-market, limited demand
• No support for booting at GA	• Device driver must/will be included in next Solaris operating environment release
• No support for RAID 3	• Limited demand, not available with this product
• Not compatible with RM6	• No RM6-compatible SCSI RAID controller available

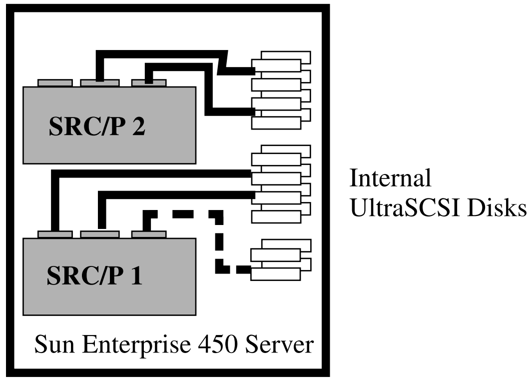
RAID Level Definitions

RAID Level	Characteristics
• RAID 0—Striping	• Spreads data across multiple disk spindles for better performance • Can be tuned to optimize either random or sequential I/O performance • No data redundancy protection, lower reliability than independent disks; if any drive in the disk group fails, all data in the disk group is lost • Same low cost per usable megabyte as independent disks
• RAID 1—Mirroring	• Maintains duplicate copies of data, so if a disk fails, data is available and applications keep running • Same performance as independent disks for writes, slightly better read performance • Highest cost per usable megabyte
• RAID 1+0—Striping across multiple mirrored drive pairs	• Combines performance of striping with data protection of mirroring • Duplicate copies of striped data remain available even if a disk fails • Same cost per usable megabyte as mirroring
• RAID 5—Striping with Parity	• Provides data protection by storing parity information on all disks in the drive group, so data can be reconstructed if a single disk fails; good for applications with high I/O request rates. • Stripes data across multiple disk spindles to optimize random or sequential performance • Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0 • Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks
• RAID 5+0—Striping across multiple RAID-5 arrays	• Combines performance of striping with data protection of RAID 5 • Provides data protection by storing parity information on all disks in the drive group, so data can be reconstructed if a single disk fails; good for applications with high I/O request rates • Stripes data across multiple disk spindles to optimize random or sequential performance • Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0 • Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks, but higher performance than RAID 5

Supported Configurations

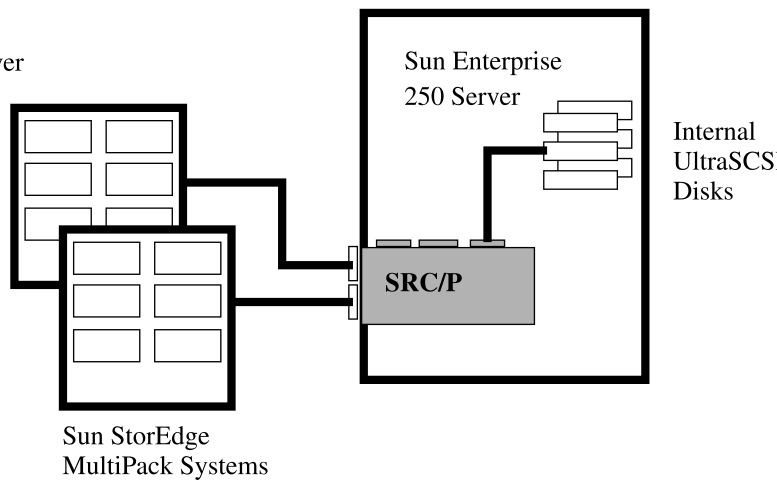
6602A

Sun Enterprise 450 Server with two 6602A Internal 8-Bay RAID Storage Options



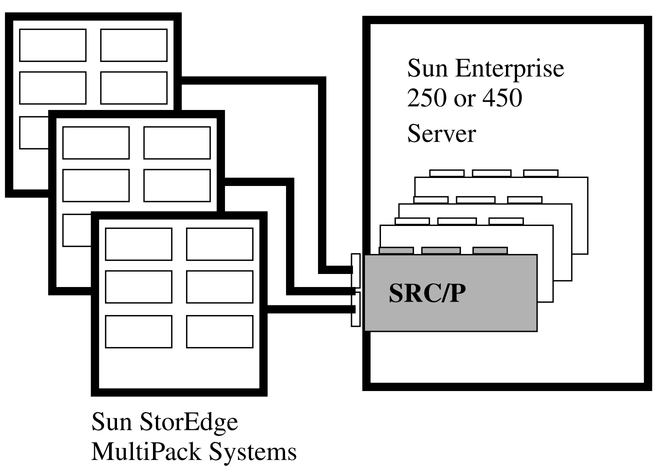
6603A

Sun Enterprise 250 Server with 6603A RAID Storage Option



6542A

Sun Enterprise 250 or 450 Server with 6542A SRC/P RAID Controller



RAID Option	Max. Options per System	Supported Disk Storage	Max. Supported per Option
Sun Enterprise™ 450 server			
(X)6602A	2	• 5214A 4.2-GB, 7200-rpm UltraSCSI • 5229A 9.1-GB, 7200-rpm UltraSCSI • 5234A 9.1-GB, 10,000-rpm UltraSCSI • 5237A 18.2-GB, 10,000-rpm UltraSCSI • Any combination of internal drives • 6-drive F/W Sun StorEdge™ MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	8 (see note 1) 8 (see note 1) 8 (see note 1) 8 (see note 1) 8 (see note 1) 1 (see note 2) 1 (see note 2) 1 (see note 2)
(X)6542A	6	• 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	3 3 3
Sun Enterprise 250 server			
(X)6603A	1 (see note 3)	• 5214A 4.2-GB, 7200-rpm UltraSCSI • 5229A 9.1-GB, 7200-rpm UltraSCSI • 5232A 18-GB, 7200-rpm UltraSCSI • 5234A 9.1-GB, 10,000-rpm UltraSCSI • 5237A 18.2-GB, 10,000-rpm UltraSCSI • Any combinations of internal drives • 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	6 6 6 6 6 6 2 2 2
(X)6542A	3	• 6-drive F/W Sun StorEdge MultiPack (7200-rpm drives) • 6-drive UltraSCSI Sun StorEdge MultiPack-2 • 12-drive F/W Sun StorEdge MultiPack (7200-rpm drives)	3 3 3

[1] Up to 12 internal drives can be supported with one 6602A by installing an X3833A internal SCSI cable (sold separately). This configuration will be supported once boot drives are supported (See Product Availability).

[2] One or two additional Sun StorEdge MultiPack storage units can be supported by disconnecting one or both internal SCSI cables from the controller's internal connectors.

[3] This option supported once boot drives are supported (See Product Availability).

Specifications

Electrical Specifications

Uses the following input DC power from the host's PCI slot:

- +5.0VDC +/-5% @ 3.27A max.

Environmental Specifications

Temperature Ranges (dry bulb)	
• Operating	0 to 40 degrees C (32 to 104 degrees F)
• Non-operating	0 to 40 degrees C (32 to 104 degrees F)
Relative Humidity	
• Operating	10% to 90% RH, maximum wet bulb, non-condensing
• Non-operating	10% to 90% RH, maximum wet bulb, non-condensing
Altitude	
• Operating	3 km (10,000 feet)

Controller Physical Specifications

Length	31.2 cm / 12.283 in.
Height	10.67 cm / 4.2 in.
Component height	
• Primary side	14.48 mm / 0.570 in.
• Reverse side	2.67 mm / .105 in.
• Weight	0.53 kg / 1.2 lb.

Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System Regulatory Conformance

System Regulation	Specifications
Safety	UL Recognition per UL1950 cUL er CSA C22.2 No. 950 CB scheme to EN 60950
RFI/EMI	VCCI Class B FCC Class B Industry Canada Class B EN55022 Class B
Immunity	EN55082-1
Product Label	FCC Class B VCCI Class B UL Recognition mark CE mark

Specifications

System Management

System Requirements

Support Requirement	Sun Enterprise™ 450 server	Sun Enterprise 250 Server
Solaris™ operating environment version	Solaris 2.6 Hardware: 2/98[1] Solaris 7[2]	Solaris 2.6 Hardware:2/98[1] Solaris 7[2]
System OBP version	3.12.12	3.12.12
SunVTS™ version	2.1.3, 3.0, 3.1, 3.2	2.1.3, 3.0, 3.1, 3.2

[1] Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ system cannot support boot drive under Solaris 2.6 operating environment.

[2] No Sun StorEdge SRC/P controller boot support under Solaris 7 operating environment until mid-FY00.

Layered Software Support

Support Requirement	Sun Enterprise 450 Server	Sun Enterprise 250 Server
Sun Enterprise SyMON™ software version[1]	2.0.1	2.0.1
Solstice DiskSuite™ software version	4.2	4.2
Sun StorEdge Volume Manager™ software version	2.6, 3.0	2.6, 3.0

[1] Sun Enterprise SyMON 2.0.1 software will be available in May 1999. If the user's version of Solaris operating environment does not include Sun Enterprise SyMON 2.0.1 software, that software is available at: `http://www.sun.com/symon.`

Option Number Summary

Note: *Configured options (such as 6602A and 6542A) are not available until early Q1FY00. X-options are available on May 25, 1999.*

Part Number	Description	Option Includes
6602A	Sun StorEdge™ SRC/P 8-bay RAID storage option for Sun Enterprise 450 server; factory installed • Supports 8 internal drives (4 drives on each of 2 SCSI buses) • Third SCSI bus can be used to support first 4 internal drives or a Sun StorEdge MultiPack	• Sun StorEdge SRC/P RAID card, memory, battery • 8-disk backplane for the Sun Enterprise™ 450 server • Internal cables • Software Supplement CD [1] Note: 8-disk backplane (in 6602A) is the same backplane used in X6601A; internal SCSI data cable is different
X6602A	Sun StorEdge SRC/P 8-bay RAID storage option for Sun Enterprise 450 server • Field-installed version	• Sun StorEdge SRC/P RAID card, memory, battery • 8-disk backplane for the Sun Enterprise 450 server • Internal cables • Sun StorEdge SRC/P controller installation guide • Software Supplement CD [1] • ESD kit
6542A	SCSI Hardware RAID controller, PCI; factory installed • Three external SCSI ports support Sun StorEdge MultiPack systems	• Sun StorEdge SRC/P RAID card, memory, battery • 2 X3832A external 2-meter SCSI cables • Sun StorEdge SRC/P User's Guide • Software Supplement CD [1]
X6542A	SCSI Hardware RAID controller, PCI • Field-installed version	• Sun StorEdge SRC/P RAID card, memory, battery • 2 X3832A external 2-meter SCSI cables • Sun StorEdge SRC/P User's Guide • Sun StorEdge SRC/P Installation Guide • Software Supplement CD [1] • ESD kit
X3832A	2-meter external SCSI data cable, offset VHDCI connectors to 68-pin. Compatible with 6602A, 6603A, and 6542A	• 2-meter external SCSI cable
530-2744	Sun Enterprise 450 server internal 8-disk SCSI data cable, for Sun StorEdge SRC/P controller	• Internal SCSI ribbon cable, Sun StorEdge SRC/P controller to 8-disk backplane

[1] The SRC/P Software Supplement CD includes the Sun StorEdge SRC/P Intelligent SCSI RAID Controller User's Guide.

How to Configure Sun StorEdge SRC/P Controller

The Sun Enterprise 250 server can be configured with SRC/P to control up to nine external Sun StorEdge MultiPack devices. SRC/P can be configured on the Sun Enterprise 450 server to control combinations of internal disks and external storage MultiPack devices. The Sun Enterprise 450 server can be configured with SRC/P to control up to 16 internal disk drives or up to 18 external Sun StorEdge MultiPack devices.

On the Sun Enterprise 450 server, in addition to the internal drives controlled by SRC/P, users need to install at least one boot drive in one of the first four internal Sun Enterprise 450 drive bays. This requirement will exist until boot drive capability is available from a drive controlled by SRC/P.

Note: *Configured options (such as 6602A and 6542A) are not available until early Q1FY00. X-options are available on May 25, 1999.*

To Control the Following Storage Devices	Order Part Number	Number to Order
For Sun Enterprise 250 Servers (A26-AA)		
• Two Sun StorEdge MultiPack systems	(X)6542A	1
• Three Sun StorEdge MultiPack systems	(X)6542A X3832A	1 1
• Nine Sun StorEdge MultiPack systems	(X)6542A X3832A	3 3
For Sun Enterprise 450 Servers (A25-BA)		
• Up to eight internal disk drives	(X)6602A	1
• Up to 16 internal disk drives	(X)6602A	2
• Up to eight internal disk drives and one Sun StorEdge MultiPack device	(X)6602A X3832A	1 1
• Up to 16 internal disk drives and two Sun StorEdge MultiPack devices	(X)6602A X3832A	2 2
• Two Sun StorEdge MultiPack devices	(X)6542A	1
• Three Sun StorEdge MultiPack devices	(X)6542A X3832A	1 1
• 18 Sun StorEdge MultiPack devices	(X)6542A X3832A	6 6
• Eight internal disks and 15 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	1 5 5
• Eight internal disks and 17 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	1 5 7
• 16 internal disks and 12 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	2 4 4
• 16 internal disks and 14 Sun StorEdge MultiPack devices	(X)6602A (X)6542A X3832A	2 4 6

To Control the Following Storage Devices	Order Part Number	Number to Order
For Installed Sun Enterprise 450 Servers		
• To add eight new internal RAID disk drives on an installed Sun Enterprise 450 server	X6602A	1
• To adds 16 new internal RAID disk drives on an installed Sun Enterprise 450 server	X6602A	2
• To adds one Sun StorEdge MultiPack device to a Sun StorEdge SRC/P Controller system in an installed Sun Enterprise 450 server	X3832A	1
• To convert 8 existing internal disk drives to hardware RAID. This conversion option applies to Sun Enterprise 450 servers with (X)6601A as the installed 8-disk expansion bay.	X6542A #530-2744	1 1

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ operating environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise™ Services representatives for program and feature availability in their areas.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Personal technical account support	Yes	Yes	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7-day/24-hour telephone coverage	Yes	Yes	Option	No
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
Customer-defined priority setting	Yes	Yes	Yes	No
• Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
• Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
• Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
Additional contacts	Option	Option	Option	Option

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Enhanced Support Features				
Mission-critical support team	Yes	Yes	No	No
Sun Vendor Integration Program (SunVIP℠)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve℠ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ Service	Yes	Yes	Yes	Yes

Glossary

Active termination, regulated	Terminates the SCSI bus with a series of resistors tied to +5 Volts. The terminator is labeled *Regulated* but is often referred to as an *Active Terminator.*
Bandwidth	A measure of the capacity of a communication channel, usually specified in Megabytes per second (MB/s).
CLI	Command line interface.
Data cache	64 MB of cache memory for fast writes to cache and read ahead cache operations. Cache memory permits intermediate storage of read and write data without physically reading/writing to the disk, increasing overall performance.
Device name	Software device address that identifies the controller/LUN, such as cXtYdZs0, where X is the host bus adapter, Y is the controller, and Z is the LUN. s0 slice number is used by the system, not by RAID Manager.
Disk array	A subsystem that contains multiple disk drives, designed to provide performance, high availability, serviceability, or other benefits.
Drive group	A physical set of drives in the RAID module. Drive groups are defined during configuration.
Fast write	Allows disk write commands to be safely acknowledged to the host before the data is actually written to the disk media. This can be enabled/disabled through RAID Manager software.
Fast/wide SCSI	Data transfer rate of 20 MB per second. Wide devices can be connected to a standard SCSI interface but the extra data lines need to be terminated.
Full-duplex	Data transmission in both directions at the same time. See also Half-duplex and Simplex.
GB	Gigabyte. A disk GB is 1 billion (1,000,000,000) bytes. A memory GB is 1,073,741,824 bytes (2 to the 30th power).
GUI	Graphical user interface. The Sun StorEdge SRC/P Storage Manager™ software provides a powerful, easy-to-use GUI.
Half-duplex	Refers to an interface, such as SCSI, that can transmit data in only one direction at a time. See also Full-duplex and Simplex.
Host adapter	A card that connects a peripheral device to the computer system's I/O bus.
Hot plug	The ability to remove, replace, or add a device while current I/O processes continue.

Hot spare	A drive in an array that is held in reserve to replace any other drive that fails. After a reconstruction, the hot spare drive is returned to the standby status.
Hot swap	A specific case of hot plug which involves replacing a device with another of the same size, type, and layout, without any notification to the operating environment.
IOPS	Input/output operations per second. A measure of I/O performance, this is usually used to quote random I/O performance. See Throughput.
LUN	Logical unit number. A LUN is a set of physical drives in a RAID configuration which are seen by the operating system as one virtual drive.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.
MTBDL	Mean time between data loss. In a RAID system, this is the average expected time between two rapid disk failures that would cause irreparable data loss.
Parity	Additional information stored along with the data that allows the controller to reconstruct lost data on RAID 3 or 5 LUNs if a single drive fails.
Reconstruction	Process used to restore a degraded RAID 1, 3, or 5 LUN to its original state after replacing a single failed drive.
RAID	Redundant array of independent disks. A RAID is a set of disk drives that appears to be a single logical disk drive to an application such as a database or file system. RAID technology increases system performance by spreading disk I/O operations across multiple simultaneously active disks. It increases data availability by introducing data redundancy. Different RAID levels provide different capacity, performance, high availability, and cost characteristics.
RAS	Reliability, availability, and serviceability. Features that enhance these attributes, including hot-pluggable capability and redundancy, are important for keeping mission-critical applications and data on-line.
Sun StorEdge SRC/P Storage Manager	The software that allows the customer to configure and manage the Sun StorEdge SRC/P controller.
SCA	Single connector attachment. A SCSI disk connector technology co-invented by Sun Microsystems. The SCA provides all SCSI, power, and control signals in a single connector, and enables easy servicing and highly reliable, pluggable disk drives.
SCSI address	The octal representation of the unique address (0–7) assigned to a narrow device; or hex representation of the unique address (0–15) assigned to a wide SCSI device.
Simplex	Transmission in one preassigned direction only. See also Full-duplex and Half-duplex.

SNMP	Simple network management protocol. SNMP enables RAID events to be remotely monitored by designated network management stations.
Striping	Spreading, or interleaving, logically contiguous blocks of data across multiple independent disk spindles. The amount of data written on each disk before moving to the next drive is the stripe width.
TB	Terabyte. A disk terabyte is 1 trillion (1,000,000,000,000) bytes. A memory terabyte is 1,099,511,627,776 bytes (2 to the 40^{th} power).
Throughput	A measure of sequential I/O performance, quoted in MB per second. See IOPS.
Volume	In the Sun StorEdge Volume Manager™ software, a volume is a virtual disk partition into which a file system, DBMS, or other application can place data. A volume can physically be a single disk partition or multiple disk partitions on one or more physical disk drives. Applications that use volumes do not need to be aware of their underlying physical structure. The Sun StorEdge Volume Manager software handles mapping of virtual partition addresses to physical addresses.
Warm plug	The ability to remove, replace or add a device while power is still applied but all I/O processes are suspended.
Write back	A method postponing data to be written to a slow device such as a disk drive by temporarily saving the data in a cache. The data can then be written at a time when the device would otherwise be idle. In addition, the data can be processed through techniques such as elevator sorting, so that the write operations will go faster.
Write through	The opposite of write-back. In write-through mode, data must be written to the final destination before a write operation is completed.
UltraSCSI	Data transfer rate of 40 MB per second per channel.
XOR	eXclusive OR. A binary mathematical operation performed on data to produce parity information. In RAID levels 3 and 5, parity is generated from the user data, stored, and used to regenerate lost data if a drive failure occurs.

Materials Abstract

All materials are available on SunWIN, except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Sales Tools				
– *Sun StorEdge SRC/P Intelligent SCSI RAID Controller™ System—Just the Facts*	Reference Guide for the *Sun StorEdge SRC/P Controller System*	Sales Tool	SunWIN, Reseller Web	104278
– *Sun Intro*	Sun Introduction with Pricing and Q&A	Sales Tool	SunWIN, Reseller Web	104274
Product Literature				
– *Sun StorEdge SRC/P Data Sheet*	Two-page Color Data Sheet	Sales Tool	SunWIN, Reseller Web	103418
External Web Site				
– *Hardware RAID Web Page*	`http://www.sun.com/servers/workgroup/hwraid`			