

Sun StorEdge™ A3500 Array

Just the Facts



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Positioning

Introduction

The Sun StorEdge™ A3500 array offers a high level of storage density and scalable capacity for Sun's mission-critical enterprise customers, along with very high performance and excellent availability features. Expanding on the highly successful Sun StorEdge A3000 array, the Sun StorEdge A3500 storage array includes the following features:

- A space-saving, 19-inch rackmount cabinet which facilitates the highest density configurations
- Controller-based (hardware) RAID with excellent performance, reliability, availability, and serviceability (RAS)
- Flexible, scalable, high-capacity configurations, reaching 182 GB to 3.2 TB of storage with 18-GB drives and 364 GB to 6.5 TB of storage using 36-GB drives
- Dual hot-plug RAID controller boards in each controller module, enabling automatic controller failover
- Hot-pluggable disks, power supplies, and cooling systems for additional high availability
- Outstanding RAID 3 and 5 performance with flexible configurations for single or multiple hosts
 - Single-host connection with automatic controller failover
 - Daisy-chain support for the highest capacity configurations
 - Box sharing across two independent Solaris™ Operating Environment hosts
 - Multi-initiator support for Sun Enterprise™ clusters
- Simple setup and administration using Sun StorEdge RAID Manager command line or graphical user interfaces
- Simultaneous support of RAID levels 0, 1, 1+0, 3, and 5, and global hot spares
- Open UltraSCSI differential host interfaces for use on non-Sun/Solaris Operating Environment systems
- The Sun StorEdge A3500-Light array offers a low-cost, 145-GB, minimum entry point with dual, auto-failover controllers and mirrored cache

Product Family Placement

Customers' storage capacity requirements are growing at an unprecedented rate. In today's data centers, it is not uncommon to have requirements for multiple terabyte storage solutions. The Sun StorEdge A3500 array, with its 73.5-inch cabinet, provides a high-density storage solution. The maximum capacity exceeds 39 TB, using 18-GB drives and 36 controller modules. The Sun StorEdge A3500 array offers scalable configurations, with excellent performance and sophisticated availability features.

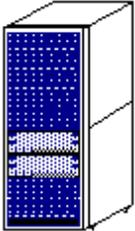
The Sun StorEdge A3500 array replaces the Sun StorEdge A3000 array. Like the Sun StorEdge A3000 array, the Sun StorEdge A3500 array is a controller-based (hardware) RAID solution. As such, it provides superior RAID 5 performance and minimal cost for data protection. RAID levels 0, 1, 1+0, and 3 are also supported.

The Sun StorEdge A3500 array offers sophisticated availability features. Sun StorEdge A3500 array data availability is 99.999 percent through the use of hot-plug controllers, disks, power, and cooling systems.



Hot-plug components allow the system to be serviced while it is still in use. Also, the Sun StorEdge A3500 array provides automatic controller failover. If a controller fails, I/O operations are automatically failed over to the second controller, and users continue to access their applications and data without any interruption.

The Sun StorEdge A3500 array can be configured to meet departmental storage requirements and will scale to the highest capacity data center requirements. Mission-critical applications—application and file service, database, OLTP, data warehousing, and decision support applications—will benefit from the robust availability features and high performance of the Sun StorEdge A3500 array.

Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500 Array	Sun StorEdge A5000 Array	Sun StorEdge T3 Array
			
Workgroup	Department to data center	Department to data center	Department to data center
Controller-based RAID (A1000) Host-based RAID (D1000)	Controller-based RAID	Host-based RAID	Controller-based RAID
Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment, HP-UX, AIX, Microsoft Windows NT
When to sell <ul style="list-style-type: none"> • Price/performance • Bridges gap between Sun StorEdge MultiPack systems and higher end products • For apps requiring less than 291 GB in a single array • Performance and flexibility for price-sensitive customers 	When to sell <ul style="list-style-type: none"> • RAS + price/performance • Dual-controller, cached architecture • High availability • Best performance for write-intensive apps • High-performance OLTP • SCSI or Fibre Channel host interface • Proven stability for mission-critical data 	When to sell <ul style="list-style-type: none"> • RAS + price/performance • Fibre Channel storage networking • Replaces SPARCstorage Array • High sequential performance • High-performance data warehousing and DSS • Campus-area remote mirroring • Flexible configurations (up to 500 m) 	When to sell <ul style="list-style-type: none"> • Fibre Channel storage networking • High sequential performance • Only true information sharing in the industry, allowing mainframe, UNIX, Microsoft Windows NT simultaneous, multi-platform access to the same data • RAS + price/performance • Mission-critical data



Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500 Array	Sun StorEdge A5000 Array	Sun StorEdge T3 Array
When NOT to sell <ul style="list-style-type: none"> • Applications requiring more than 291 GB in a single array • Customer requires Fibre Channel today 	When NOT to sell <ul style="list-style-type: none"> • Solaris Operating Environment user who wants FC-AL headroom today • Non-Solaris Operating Environment or Microsoft Windows NT operating environment 	When NOT to sell <ul style="list-style-type: none"> • Hardware RAID 5 required • Non-Solaris Operating Environment or Microsoft Windows NT host attach required 	When NOT to sell <ul style="list-style-type: none"> • Clustering is required

Sun StorEdge A3500 Array Key Messages

Sun StorEdge A3500 array is a scalable, high-performance, high-availability solution that uses a 73.5-inch tall expansion cabinet for high-density storage solutions. It leverages existing technologies (Sun StorEdge A3000 array controller modules, Sun StorEdge D1000 array-style disk trays, and 18- or 36-GB, 10000-rpm drives) to provide flexible, scalable, and high-capacity configurations. Designed for high availability, all components are redundant, support automatic failover, and are hot pluggable.

Each Sun StorEdge A3500 array includes the following:

- One or two 73.5-inch tall Sun StorEdge expansion cabinets, with two power sequencers per cabinet
- One to three Sun StorEdge A3500 array controller module(s), each with two controller boards for automatic failover
- Sun StorEdge RAID Manager software (version 6.1.1 for the Solaris Operating Environment and 6.20.21 for Microsoft Windows NT), including the RDAC driver which enables controller failover
- Five to fifteen Sun StorEdge D1000 disk trays, each with environmental service module (ESM) boards
- Up to twelve 1-inch 18-GB, 10000-rpm disks, or 36-GB, 10000-rpm disk drives per tray

Customers can order these basic system configurations:

- 1 x 5 (1 controller module, 5 disk trays) in a single cabinet
- 2 x 7 (2 controller modules, 7 disk trays) in a single cabinet
- 3 x 15 (3 controller modules, 15 disk trays) in dual cabinets
- Sun StorEdge A3500-Light array (1 controller module, 2 disk trays)
- Choice of fixed configurations or configure-to-order models

By offering more trays and a taller cabinet than the previous generation Sun StorEdge A3000 array, the Sun StorEdge A3500 array provides a higher density, higher capacity solution. With the larger number of drive trays and controller modules supported, higher capacity is achieved while still offering high performance and reliability. The minimum configuration is now the Sun StorEdge A3500-Light array model. Minimum and maximum capacities for each configuration are as follows:



Configuration	Minimum Capacity	Maximum Capacity
Sun StorEdge A3500-Light, 18-GB drives	145 GB	436 GB
1 x 5, 18-GB drives	182 GB	1092 GB
1 x 5, 36-GB drives	364 GB	2184 GB
2 x 7, 18-GB drives	364 GB	1528 GB
2 x 7, 36-GB drives	728 GB	3057 GB
3 x 15, 18-GB drives	546 GB	3276 GB
3 x 15, 36-GB drives	1092 GB	6552 GB

Daisy-chaining controller modules enables even higher capacity storage solutions. In summary, the Sun StorEdge A3500 array configurations provide the highest density storage, offering scalability, high capacity, excellent availability, and high performance in a remarkably small footprint.

Sun StorEdge A3500 Array Key Features and Benefits

Features

- Higher density 73.5-inch tall expansion cabinet
- These basic configurations:
 - 1 x 5 (1 controller module, 5 disk trays) in a single cabinet
 - 2 x 7 (2 controller modules, 7 disk trays) in a single cabinet
 - 3 x 15 (3 controller modules, 15 disk trays) in dual cabinets
 - Sun StorEdge A3500-Light array (1 controller module, 2 disk trays)
- Controller-based RAID
- Sun StorEdge RAID Manager software
- Microsoft Windows NT host support

Benefits

- Provides scalable high-capacity configurations in a narrow footprint
- Helps enable scalable capacity, high-performance configurations in a space-saving footprint
- Allows customer to design a storage solution with plenty of room for future growth
- Delivers high performance by decreasing CPU drain for I/O processing
- Dual active controllers provide high bandwidth and automatic failover to the second controller
- Easy configuration, management, and recovery of RAID implementation
- Simple-to-use graphical user interface (GUI) as well as command line interface (CLI) for scripting
- Investment protection
- High-performance, high-reliability storage for Microsoft Windows NT servers

Features

- RAID 0, 1, 1+0, 3, and 5
- 10000-rpm disk drives
- Dual hot-plug controllers, power supplies/cooling, power sequencers, and hot-plug disks
- 128- to 256-MB mirrored data cache memory per controller module
- Battery backup for cache memory
- Two UltraSCSI differential interfaces to the host
- UltraSCSI communication between controller boards in controller module
- UltraSCSI between controller boards and disk trays
- Environmental service module (ESM) in each disk tray
- Multi-initiator support for Sun Enterprise clusters
- Box sharing across independent controllers
- Daisy chaining of controller modules
- Open SCSI host interface

Benefits

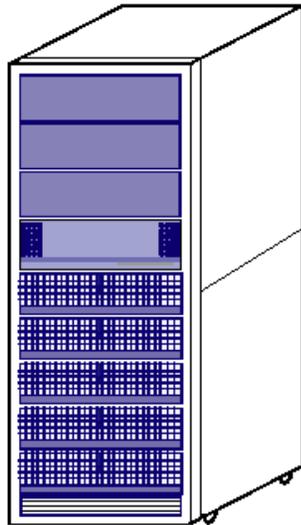
- High data availability for mission-critical array applications
- RAID 5 performance multiplies the power of the industry's most popular line of scalable UNIX servers: Sun Enterprise servers, SPARCserver™ and SPARCcenter™ systems
- Approximately 25 to 30 percent faster data access in OLTP applications than 7200-rpm disks
- Full redundancy provides high availability for a mission-critical data center. If one controller fails, I/O traffic automatically fails over to the other controller. Applications continue to run without interruption.
- Each controller module power supply can support the power requirements for both controller boards
- Hot-plug components permit immediate servicing without system down time
- Enables fast writes to the data cache
- Mirrored cache helps ensure data integrity
- Protects data written to cache for up to three days after a power failure
- Provides high bandwidth (up to 80 MB/sec.) data transfer across two host connections
- Improved cache mirroring performance
- Increased RAID performance
- Environmental monitoring and reporting for temperature, voltage, fan failure, power supply status, and a complete health check of each disk tray
- High availability and automatic failover of the host and disk array. Redundancy reduces the frequency and duration of outages.
- Allows two Solaris Operating Environment hosts to share the same Sun StorEdge A3500 array data center. Specific controller and LUNs assigned to each host (no controller failover).
- Increases storage capacity with fewer host connections
- Protects customers' storage subsystem investment by providing interoperability with other host environments



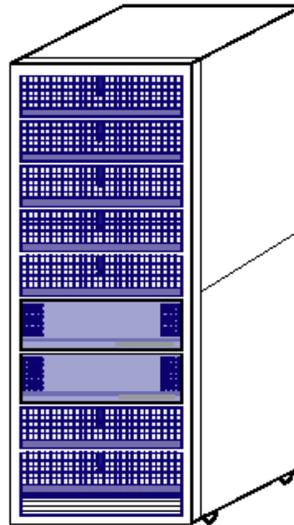
System Architecture

System Architecture Overview

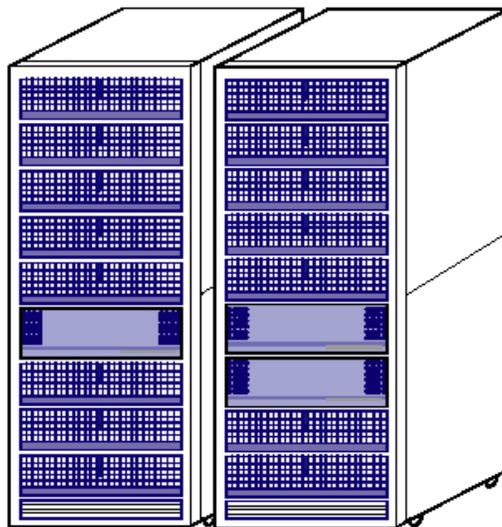
To provide scalable storage solutions, there are three basic Sun StorEdge™ A3500 array configurations with varying numbers of controllers and drive trays. Capacities are shown for 36-GB, 1-inch high, 10000-rpm disk configurations.



1 x 5 Configuration
Up to 2.1-TB disk capacity



2 x 7 Configuration
Up to 3.0-TB disk capacity



3 x 15 Configuration
Up to 6.5-TB disk capacity



Sun StorEdge A3500 Array Key Facts

To achieve higher density and higher capacity storage solutions, all Sun StorEdge A3500 array configurations use the 73.5-inch Sun StorEdge expansion cabinet.

High reliability, availability, and serviceability (RAS) features, including controller failover, RAID support, and redundant components:

- Each Sun StorEdge A3500 controller module contains two controller boards, two cooling units, two power supplies, and one battery back-up unit.
- The battery back-up unit includes redundant battery cells and charger circuits.
- The disk trays include dual fans and power supplies, and hot-pluggable disks.
- Each expansion cabinet uses two power sequencers, each connecting to separate wall outlets and separate power supplies.

The Sun StorEdge A3500 array data center is supported on the Solaris™ 2.5.1 Operating Environment or later releases with the required operating system patches. Configurations with 18-GB, 10000-rpm, 1-inch disks or 36-GB, 10000-rpm, 1-inch disks are supported on the Solaris 2.6 Operating Environment or higher.

Sun StorEdge Expansion Cabinet Key Facts

The 73.5-inch tall Sun StorEdge expansion cabinet is a standard 19-inch rack internally. It has room for a maximum of nine components: up to two controllers and seven disk trays. To support the 3 x 15 configuration, a second expansion cabinet is used.

Sun StorEdge Expansion Cabinet Technical Facts

The Sun StorEdge expansion cabinet measures:

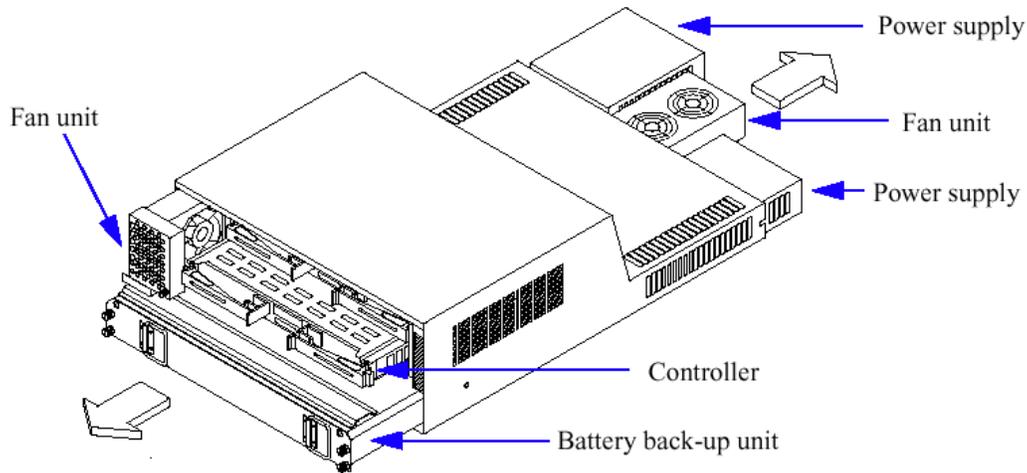
- Height: 187.9 cm (73.5 inches)
- Width: 61 cm (24 inches)
- Depth: 93 cm (36.5 inches)
- Internal dimensions conform to EIA RS-310C (RETMA) for 482-mm (19-inch) racks

Each Sun StorEdge expansion cabinet is equipped with two power sequencers to support separate power sources (for example, from separate wall outlets). Two independent 220-volt or 240-volt power sources are required. Each power sequencer is rated at a maximum 5.4 kW.



Sun StorEdge A3500 Controller Module Key Facts

The heart of the Sun StorEdge A3500 system is the Sun StorEdge A3500 controller module, an intelligent RAID controller with two active RAID controller boards. There are redundant power supplies, cooling units and backup batteries within the module.



Sun StorEdge A3500 Controller Module Technical Facts

The Sun StorEdge A3500 Intelligent RAID controller module contains the following:

- Two RAID controller boards (see "Sun StorEdge A3500 Controller Board" below)
- One battery backup unit, which provides a minimum three days of power backup for cache memory. The battery module uses redundant batteries and charger circuits. Battery shelf life is rated for two years.
- Two hot-plug power supplies rated at 240 volts, 1.0 Amp, and power-factor corrected (PFC). PFC smoothes out input current voltage.
- Redundant rear fans for the power supplies and redundant front fans for the controller boards.
- Five controller module LEDs, indicating module power status, power supply fault, fan fault, controller fault, and fast write cache enabled.

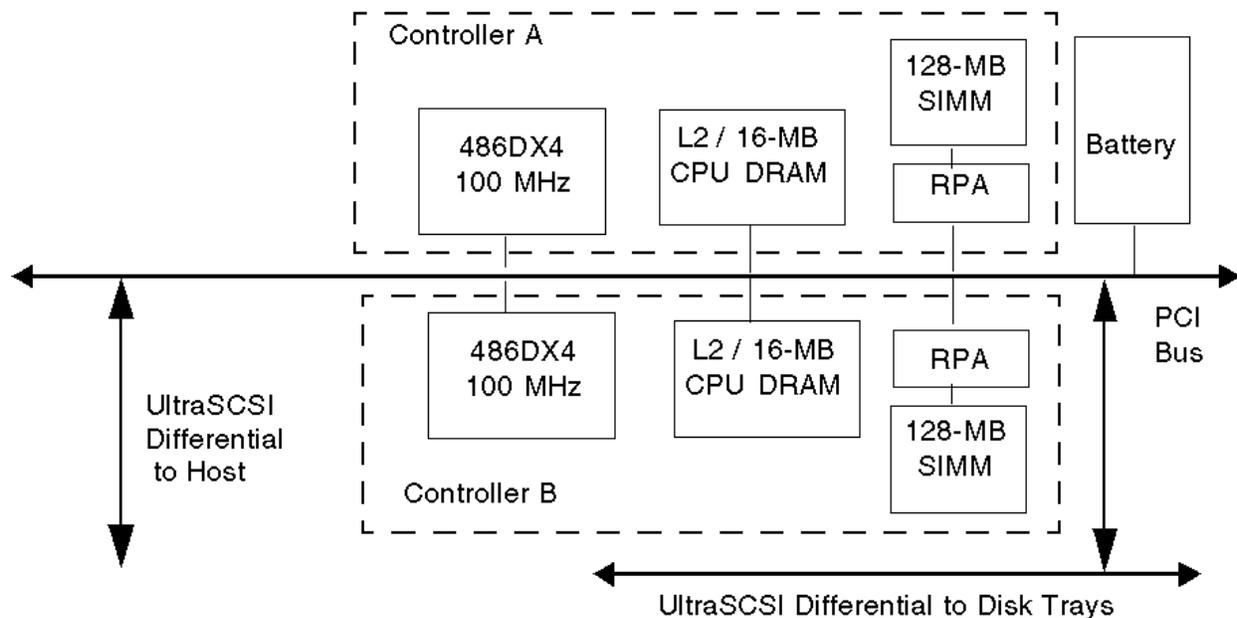
The Sun StorEdge A3500 controller module contains a backpanel circuit board where the module components interconnect.

- Two controller boards plug directly into the controller module backpanel, using a 600-pin TBC+ connector for all SCSI and subsystem interconnections.
- Two SCSI-In connectors attach to the UltraSCSI differential host bus adapters (aggregate 80 MB/sec. available data bandwidth using both channels).
- Two SCSI-Out connectors require two passive differential terminators, or are daisy-chained to another controller module. When daisy chaining controller modules, two terminators are required on the last controller module in the chain.
- Five drive tray interfaces are contained in each controller module. These are 8- or 16-bit, synchronous or asynchronous, differential UltraSCSI (40 MB/sec.).
- The battery module and power supplies also interface to the backpanel circuit board.



Sun StorEdge A3500 Controller Board Key Facts

The Sun StorEdge A3500 controller board includes a 486DX4 100-MHz processor and an upgradable 64-MB mirrored data cache.



Sun StorEdge A3500 Controller Board Technical Facts

- The intelligent Sun StorEdge A3500 controllers support RAID 0, 1, 1+0, 3, and 5. The controller microprocessor performs all RAID parity calculations. This improves system performance by reducing the CPU load and I/O traffic between the host and the array.
- The 100 MHz 486DX4 CPU on the controller board is a socketed PGA part. Each controller board also includes 16 MB of CPU memory and 512 KB of Level 2 cache.
- Each controller board ships with 64 MB (2 x 32-MB SIMMs) of data cache memory. A maximum of 128 MB per controller board is supported. Each board has four SIMM sockets for the data cache SIMMs, which are installed in pairs. To upgrade each controller to 128 MB, add an additional 64 MB (2 x 32 MB) per board. The data cache memory consists of thirty six 70-ns SIMMs organized in a 72-pin package. The data cache is controlled by the RAID Parity Assist (RPA) chipset.
- Each controller board has ten status LEDs visible from the controller module's front panel. The LEDs report controller fault, power on, controller heartbeat, and controller status (active/passive, SIMM failure, and so on).

Disk Tray and Hot-plug Disk Module Key Facts

The disk trays used in the Sun StorEdge A3500 subsystem are the same as the Sun StorEdge D1000 arrays. In the Sun StorEdge A3500 array, the trays are populated with either 9-, 18-, or 36-GB, 10000-rpm disks. The disk trays are easily serviceable, with hot-plug disk modules and hot-plug redundant power and cooling.



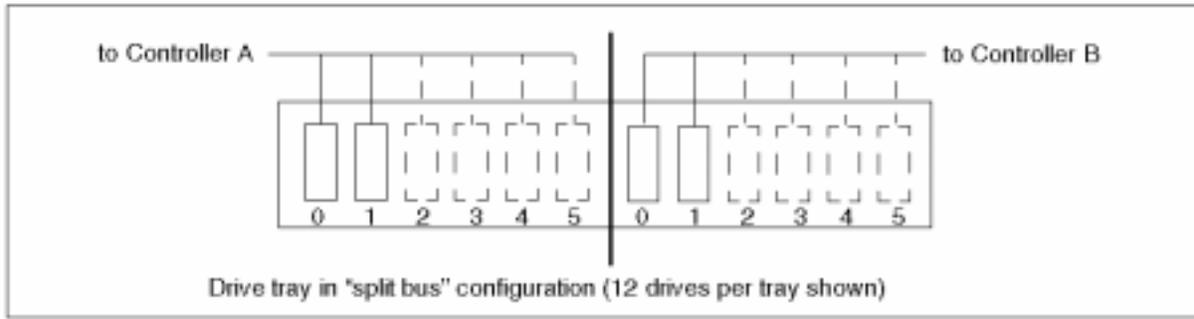
Disk Tray and Hot-plug Disk Module Technical Facts

- All drives are 10000 rpm, either the 1-inch, 18- or 36-GB disks.
- Each tray holds a maximum of twelve 1-inch, 18- or 36-GB disks. These are the same disk trays as the Sun StorEdge D1000 arrays.
- The 3.5-inch form factor drives are mounted in a plastic bracket for easy installation and removal from the tray.
- In the event of a power supply failure, a single power supply can handle the start-up power surge for all disks. In addition, a power supply can be replaced while the tray and disks are in operation. Each cooling unit can maintain operating temperatures in the event of a single fan failure.
- The drives use SCA-2 connectors in which the ground leads make contact first for hot-plug support. The drives plug directly into the disk tray backplane without any cabling, providing higher reliability.
- An environmental service module (ESM) board at the rear of the disk tray enables the host system to obtain environmental status information over the SCSI bus. The ESM board also provides status and control information for individual drive faults back to the host system.

Sun StorEdge A3500 Array Configuration	Disk and Tray Configurations	# of Disks per System	Total Capacity
A3500-Light	18 GB, minimum	8 disks	145 GB
1 x 5	18 GB, minimum	10 disks	182 GB
	18 GB, maximum	60 disks	1092 GB
	36 GB, minimum	10 disks	364 GB
	36 GB, maximum	60 disks	2184 GB
2 x 7	18 GB, minimum	20 disks	364 GB
	18 GB, maximum	84 disks	1528 GB
	36 GB, minimum	20 disks	728 GB
	36 GB, maximum	84 disks	3057 GB
3 x 15	18 GB, minimum	30 disks	546 GB
	18 GB, maximum	180 disks	3276 GB
	36 GB, minimum	30 disks	1092 GB
	36 GB, maximum	180 disks	6552 GB

- An "Option" switch on the drive tray determines whether all disks in the tray reside on a single bus or whether the "split bus" option is used. The 2 x 7 configurations include three trays in the split bus configuration, with the drives in a single tray logically divided between two busses. Both trays have a split bus configuration in the Sun StorEdge A3500-Light array.





The split bus tray permits the definition of RAID 5 LUNs that span across five trays. In the minimum 2 x 7 configuration, the three split bus trays are each populated with four drives, while the other four trays contain two drives each, for a total of 20 drives. In the case of the minimum 2 x 7 configuration, the split bus tray allows the default LUN configuration to include two 4+1 RAID 5 LUNs, one per controller. (See the default LUN configurations under the discussion of the Sun StorEdge RAID Manager, and also the configuration information in the *Sun StorEdge A3500 Hardware Configuration Guide*, 805-4981-10.)

Host Bus Adapter Key Facts

- For SBus-based hosts—UDWIS/S, SBus to differential UltraSCSI host bus adapter (X1065A)
- For PCI-based hosts—PCI UD2S, PCI differential UltraSCSI adapter (X6541A)

Host Bus Adapter Technical Facts

The UDWIS/S host bus adapter:

- Allows data transfer up to 40 MB/sec. per channel
- Is rated at an average of 10.5 watts (15 watts maximum)
- Measures 5.776 x 3.3 inch (146.70 x 83.82 mm)
- Weighs less than 1 lb. (0.45 kg)

The PCI Differential UltraSCSI Host Bus Adapter

- Allows data transfer up to 40 MB/sec. per channel
- Provides dual UltraSCSI channels per card.

To avoid a single point of failure and enhance availability, it is recommended that customers attach controllers in the same Sun StorEdge A3500 controller module to channels on different host bus adapter cards.

- Measures 7.5 inches long by 4 inches wide
- Uses the following input power from the host's PCI slot:
 - + 5.0VDC @ 3A max.
 - + 3.3VDC @ 130ma max.
 - + 12.0VDC @ 50ma max.
- Weighs less than 1 lb. (0.45 kg)



Requirements and Configuration

Sun StorEdge™ A3500 Array Configuration Guidelines

The Sun StorEdge™ A3500 array is supported on the following host platforms.

- Sun Enterprise™ 2 server
- Sun Enterprise 220R server
- Sun Enterprise 420R server
- Sun Enterprise 250 server
- Sun Enterprise 450 server
- Sun Enterprise 3X00 server
- Sun Enterprise 4X00 server
- Sun Enterprise 5X00 server
- Sun Enterprise 6X00 server
- Sun Enterprise 10000 server

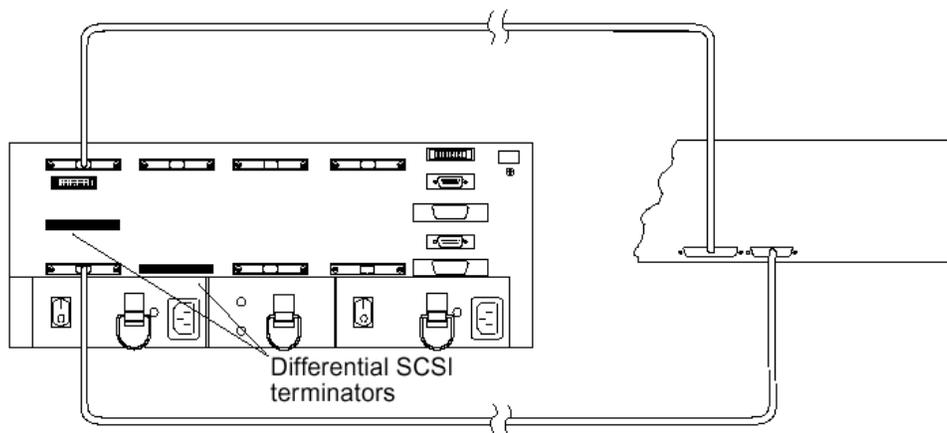
Supported Host Configurations

The Sun StorEdge A3500 array is supported in these configurations:

- Single host
- Daisy chain
- Box sharing—*independent controller*
- Multi-initiator

Refer also to the *Sun StorEdge A3500 Hardware Configuration Guide*. This guide contains detailed information about correct Sun StorEdge A3500 SCSI cabling, SCSI bus termination requirements, and power sequencing for each of these configurations.

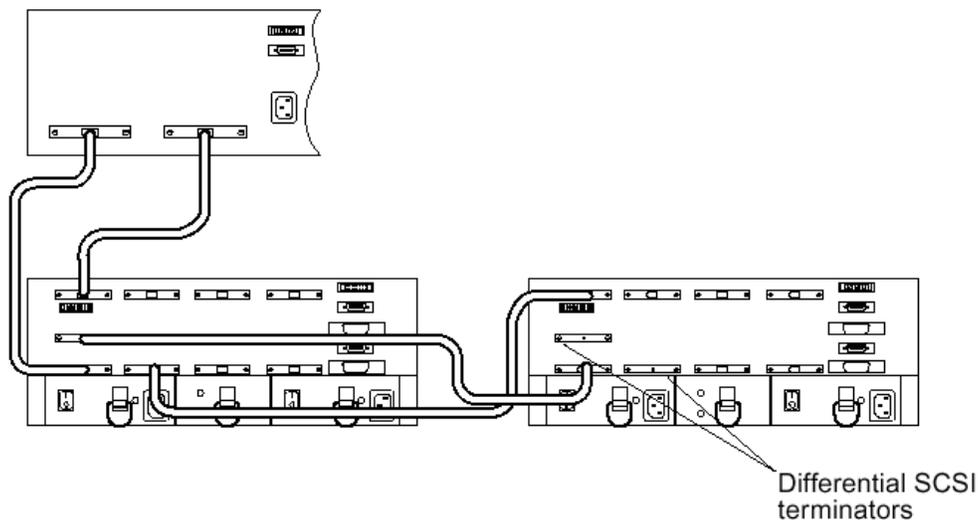
Single Host



This is the basic configuration. Each Sun StorEdge A3500 controller module interfaces to the host via two UltraSCSI differential host bus adapters. Order two host bus adapters for each controller module in the Sun StorEdge A3500 array (i.e., order two adapters for a 1 x 5 or A3500-Light configuration, four for a 2 x 7 configuration, and six for a 3 x 15 configuration).

The SCSI-Out ports on the Sun StorEdge A3500 controller module must both be terminated. (Refer to the *Sun StorEdge A3500 Hardware Configuration Guide*.)

Daisy-chained Configuration



Daisy chaining enables higher capacity storage solutions per host.

- Sun StorEdge A3500 controller modules can be daisy-chained in the same or separate cabinets. Up to a maximum of two controller modules may be daisy chained together.
- The controller modules in the 2 x 7 and 3 x 15 configurations are shipped as individual controllers. The customer may choose to daisy chain controller modules within these configurations, up to the limit of two controller modules in a daisy chain.

Some customers will require large, multiple-terabyte storage capacities. These customers will need to configure and daisy chain multiple Sun StorEdge A3500 controller modules. The maximum number of Sun StorEdge A3500 controller modules that is supported per host is given in the table below, along with the maximum storage capacity per host (based on the 1 x 5 maximum configuration).

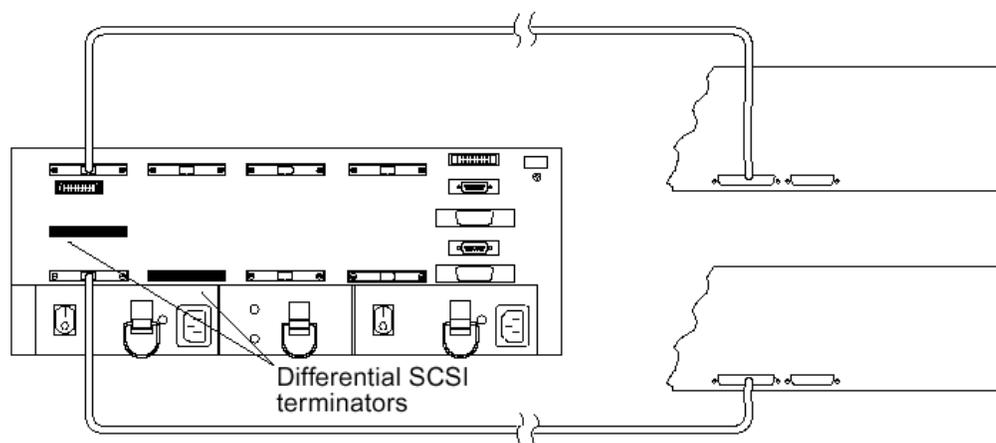
Platforms Supported	Max. # Controller Modules Single/Daisy Chain	18-GB		36-GB disks	
		Single	Daisy-Chain	Single	Daisy-Chain
Sun Enterprise 10000 server	21/21	22932	22932	45864	45864
Sun Enterprise 6500/6000 server	21/36	22932	39312	45864	78624



Platforms Supported	Max. # Controller Modules Single/Daisy Chain	18-GB		36-GB disks	
		Single	Daisy-Chain	Single	Daisy-Chain
Sun Enterprise 5500/5000 server	10/20	10920	21840	21840	43680
Sun Enterprise 4500/4000 server	10/20	10920	21840	21840	43680
Sun Enterprise 3500 server	6/12	6552	13104	13104	26208
Sun Enterprise 3000 server	4/8	4368	8736	8736	17472
Sun Enterprise 2 server	2/4	2,184	4,368	4368	8736
Sun Enterprise 450 server	3/4	3,276	4,368	6552	8736
Sun Enterprise 250 server	2/2	2,184	2,184	4368	4368
SPARCcenter 2000 system	6/12	not supported		not supported	
SPARCserver 1000 systems	6/12	not supported		not supported	
Microsoft Windows NT server	2/4	not supported		not supported	

- Order two UltraSCSI differential host bus adapters for each pair of daisy-chained Sun StorEdge A3500 controller modules.
- The last Sun StorEdge A3500 controller module in any daisy chain must have two terminators, one in each SCSI Out port. (Refer to the *Sun StorEdge A3500 Hardware Configuration Guide*.)

Box Sharing—Independent Controller

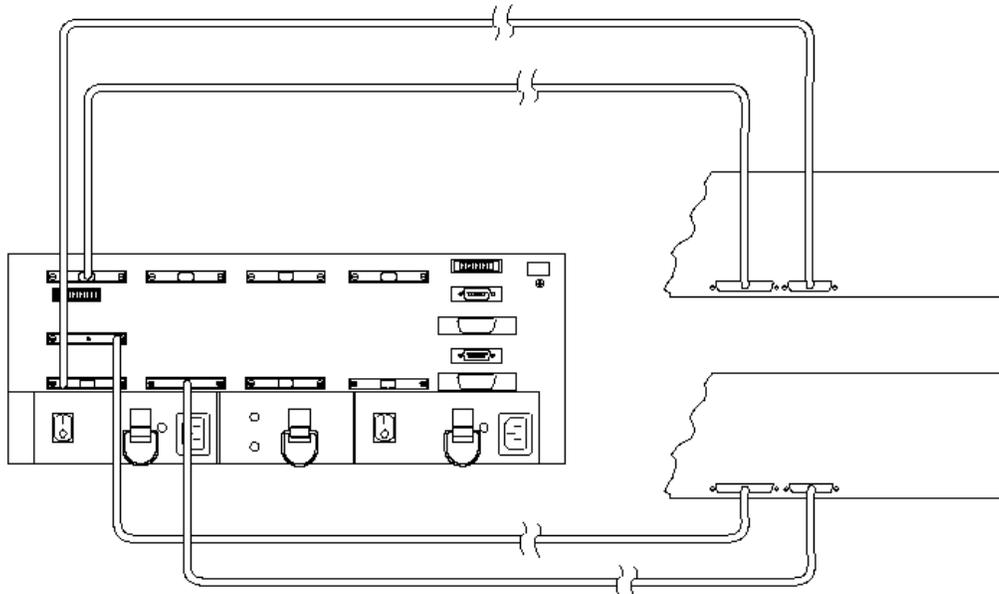


- Two host systems can share the same Sun StorEdge A3500 disk array.
- The two Solaris™ Operating Environment hosts are completely independent of each other and do not share LUNs. Each host is unaware of the other host's LUNs.



- If the Sun StorEdge A3500 array has a single controller module, each of the controller boards is assigned to one of the two independent hosts. In this case, there is no failover between controllers.

Multi-initiator Clustering



- Sun Enterprise clusters and the Sun StorEdge A3500 array in a multi-initiator configuration can provide a robust, high-availability, clustered solution. Two cluster nodes are attached to the same controller module in the Sun StorEdge A3500 disk array. The nodes share access to the controllers as well as to the LUNs assigned to the controllers. With the multi-initiator cluster configuration, both host and controller failover are supported.
- Daisy-chained controller modules are also supported in the multi-initiator cluster configuration.

Other Configuration Guidelines

The Sun StorEdge A3500 array includes two power sequencers in each cabinet for redundant power. When ordering Sun StorEdge A3500 systems, order two power cord kits as separate line items. For the Sun StorEdge A3500 array 3 x 15 configuration (which uses two expansion cabinets), order a total of four power cord kits.

The total length of all SCSI cables on any one bus should not exceed 25 meters. The Sun StorEdge A3500 array ships with two 12-meter UltraSCSI differential cables for each controller module in the configuration ordered. See the ordering information for part numbers of shorter cables. Cable lengths are as follows:

- External differential UltraSCSI cable, 12.0 meters
- UltraSCSI host bus adapter, 0.1 meter of internal cable length
- Sun StorEdge A3000 controller, 0.1 meter of internal cable length



Software Architecture

Sun StorEdge™ RAID Manager Key Facts

The Sun StorEdge™ RAID Manager software includes both graphical and command line interfaces for configuring, monitoring, and maintenance/tuning of the RAID configuration. For the Sun StorEdge A3500 array, version 6.1.1 or above is required. Included with the RAID Manager software is the redundant dual active controller (RDAC) driver, which enables automatic controller failover.

The graphical user interface (GUI) of the Sun StorEdge RAID Manager software displays this menu.



Application

- Configuration Application
- Status Application
- Recovery Application

Functions

- Design flexible RAID configurations
- Locate a drive group
- Create logical units (LUNs) and hot spares from unassigned drives
- Add LUNS to an existing drive group
- Delete LUNs in a drive group or a hot spare drive
- Real-time view of log files with system information about failures, parity checks, and system events
- Perform health check on RAID modules
- View the status of LUN reconstructions or change the LUN reconstruction rate
- On-line instructions for easy restoration of failed components in a RAID module
- Manual parity check/repair of LUNs
- Manual recovery of drives and controllers including failing, reconstructing, and reviving drives, formatting and reviving LUNs, and changing the status of controllers
- Automatic LUN reconstruction

Application

- Maintenance/Tuning Application
- About

Functions

- Change LUN reconstruction rate
- Balance LUNs between active controllers
- View/set cache parameters for each LUN
- Upgrade controller firmware
- Change/set automatic parity check
- Manage error log file
- Software version information

Sun StorEdge RAID Manager Technical Facts

- The Sun StorEdge RAID Manager software includes both graphical and command line interfaces for configuring and managing the RAID configurations.
- The Sun StorEdge RAID Manager software also includes the redundant dual active controller (RDAC) driver, a kernel-level driver that manages automatic controller failover. The RDAC driver sits logically above the SCSI driver in the Solaris™ Operating Environment kernel, and automatically re-routes active I/So to the remaining controller when a controller failure occurs.
- A RAID module is a set of associated drives, controllers, power supplies, and cooling fans.
- The Solaris Operating Environment sees each LUN as one virtual disk drive. With the Solaris 2.6 Operating Environment (Hardware: 5/98), each SCSI device driver can support a maximum of 32 LUNs, each capable of supporting 7 partitions. For the Sun StorEdge A3500 array, the Sun StorEdge RAID Manager software supports a maximum of 16 LUNs.
- A drive group is a logical grouping of drives. Drive groups are renumbered automatically on the next reconfiguration boot after configuration changes.
- Sun StorEdge RAID Manager uses the standard device code (cX tY dZ s0)
 - cX = host bus adapter with a maximum of 32 LUNS per host bus adapter and two daisy-chained RAID controller modules.
 - tY = the controller SCSI target ID. This is limited to 8 under Solaris 2.5.1 Operating Environment.
 - dZ = the LUN
 - s0 = slice number. With Sun StorEdge RAID Manager, the slice number is always "0."
- The RAID Manager supports global hot spares, which are disks that contain no data and act as a standby in case of a drive failure. Once a failed disk has been replaced, data is returned automatically to the original disk to preserve the original configuration and performance; the spare disk is then made available again as a global hot spare.
- The RAID Manager software allows the user to customize how data is cached:
 - Write caching—Data can be written from the host to the controller's cache by enabling Write Caching. This improves overall performance because the host considers the write operation complete once the data is written to cache. By default, write caching is enabled.
 - Write cache mirroring—When enabled, cached data is written to the cache memory of both controllers so that when a controller fails, the second controller completes all outstanding write operations.



- Cache without batteries—Users can enable write caching when the batteries are discharged.
- Fast writes to the data cache are enabled by default.
- Manual load balancing is provided to enable an administrator to balance the I/O load between controllers and improve overall system performance.
- The Recovery Guru in the RAID Manager GUI provides on-line instructions for easy restoration of failed components. The Recovery Guru provides step-by-step failure recovery instructions to simplify administration and minimize the possibility of error.
- Message/event logging is provided by default, and can be customized to meet customer needs.
- Parity checks are run automatically to verify that there are no parity errors. If any parity errors are found, the parity is automatically repaired and rewritten to disk.
- Simple network management protocol (SNMP) support is provided, enabling integration with network management tools such as Solstice Domain Manager™ (SunNet Manager™) and Sun Management Center 2.0 software.
- RAID Manager enables on-line rollover upgrades of the controller firmware. All LUNs are rolled over to one controller, the revision of the firmware is downloaded to the idle controller, and then the LUNs are rolled back
- The Sun StorEdge A3500 array comes pre-configured with default LUN configurations, which may be reconfigured to match the customer's specific requirements. In multiple controller configurations, the LUNS are divided evenly among the controllers to balance system performance. The following LUN configurations are the factory defaults:

Sun StorEdge A3500 Configuration	Disk Type and Configuration	Factory Default LUN Configurations (# of LUN x LUN type = # disks used)
A3500-Light	18-GB minimum configuration	2 x (2+2) = 8 (RAID 0+1)
1 x 5	18-GB minimum configuration	1 x (4+1) = 5 (RAID 5) 1 x (2+2) = 4 (RAID 0+1) 1 x GHS (global host spare) = 1 (GHS)
1 x 5	36-GB minimum configuration	1 x (4+1) = 5 (RAID 5) 1 x (2+2) = 4 (RAID 0+1) 1 x GHS (global host spare) = 1 (GHS)
1 x 5	18-GB maximum configuration	5 x (4+1) = 25 (RAID 5) 3x (5+5) = 30 (RAID 0+1) 5x GHS (global host spare) = 5 (GHS)
1 x 5	36-GB maximum configuration	5 x (4+1) = 25 (RAID 5) 3x (5+5) = 30 (RAID 0+1) 5x GHS (global host spare) = 5 (GHS)
2 x 7	18-GB minimum configuration	2 x (4+1) = 10 (RAID 5) 2 x (2+2) = 8 (RAID 0+1) 2 x GHS (global host spare) = 2 (GHS)
2 x 7	36-GB minimum configuration	2 x (4+1) = 10 (RAID 5) 2 x (2+2) = 8 (RAID 0+1) 2 x GHS (global host spare) = 2 (GHS)
2 x 7	18-GB maximum configuration	12 x (4+1) = 60 (RAID 5) 2 x (3+3) = 12 (RAID 0+1) 2 x (2+2) = 8 (RAID 0+1) 4 x GHS (global host spare) = 4 (GHS)



Sun StorEdge A3500 Configuration	Disk Type and Configuration	Factory Default LUN Configurations (# of LUN x LUN type = # disks used)
2 x 7	36-GB maximum configuration	12 x (4+1) = 60 (RAID 5) 2 x (3+3) = 12 (RAID 0+1) 2 x (2+2) = 8 (RAID 0+1) 4 x GHS (global host spare) = 4 (GHS)
3 x 15	18-GB minimum configuration	3 x (4+1) = 15 (RAID 5) 3 x (2+2) = 12 (RAID 0+1) 3 x GHS (global host spare) = 3 (GHS)
3 x 15	36-GB minimum configuration	3 x (4+1) = 15 (RAID 5) 3 x (2+2) = 12 (RAID 0+1) 3 x GHS (global host spare) = 3 (GHS)
3 x 15	18-GB maximum configuration	15 x (4+1) = 75 (RAID 5) 9 x (5+5) = 90 (RAID 0+1) 15 x GHS (global host spare) = 15 (GHS)
3 x 15	36-GB maximum configuration	15 x (4+1) = 75 (RAID 5) 9 x (5+5) = 90 (RAID 0+1) 15 x GHS (global host spare) = 15 (GHS)

Sun StorEdge A3500 Array Software Requirements

Solaris 2.5.1 Operating Environment or above with the required operating system patches.
Configurations with 18-GB, 1000-rpm, 1-inch disks or 36-GB, 10000-rpm, 1 inch disks are supported on Solaris 2.6 Operating Environment or higher.

Sun StorEdge RAID Manager 6.1.1 Update 1 or Update 2

Alternate Pathing/Dynamic Reconfiguration Support

The Sun StorEdge RAID Manager software allows the Sun StorEdge A3500 array to be mapped from one Sun Enterprise 10000 server domain to another without requiring a domain reboot. (RAID Manager 6.1.1 has an enhanced RDAC that checks for added devices.)

Solaris 2.6 Operating Environment adds alternate pathing support for disk and network controllers in Sun Enterprise servers (Sun Enterprise 3X00, 4X00, 5X00, and 6X00 servers). Since the Sun StorEdge A3500 array already includes controller failover functionality, alternate pathing and dynamic reconfiguration in Solaris 2.6 Operating Environment should not be used with the Sun StorEdge A3500 array on the Sun Enterprise 3X00, 4X00, 5X00, and 6X00 servers.

Other Supported Software

- VERITAS Volume Manager software versions 2.4, 2.5, 2.5.x, and 2.6
- Solstice DiskSuite™ software version 4.1
- Sun Cluster 2.1/2.2 software



VERITAS Volume Manager Software Support

The VERITAS Volume Manager (VxVM) software, formerly known as Sun StorEdge Volume Manager software, is supported with the Sun StorEdge A3500 array. However, certain cautions apply:

- **Installation**

Installation ordering is very sensitive. Sun StorEdge A3500 array installation procedures must be followed exactly as documented in the Sun StorEdge A3500 array Product Release Notes, the Sun StorEdge A3500 System Manual, and the Sun StorEdge RAID Manager manual.

- **Installation guide**

Deviation from the following sequence will likely cause incompatibility between Sun StorEdge A3500 array and VxVM software.

VxVM software should be installed only after the following steps have been completed:

1. Sun StorEdge A3500 array hardware is properly installed and connected to the host.
2. Sun StorEdge A3500 array software is properly installed.
3. Sun StorEdge A3500 array devices (LUNs) are properly configured using RAID Manager.
4. The host system is rebooted using the `-r` option. On reboot the RAID Manager software must recognize the configured LUNs and create the appropriate device nodes.

It is also important to modify startup scripts as necessary to help ensure that Sun StorEdge A3500FC array daemons are invoked prior to VxVM software.

- **Device naming**

Sun StorEdge A3500 array device (LUN) entries in `/etc/vfstab` which will be encapsulated using VxVM must use the standard Solaris Operating Environment device names (e.g., `/dev/rdsk/c3t4d0s0`). Do not use the device names generated by the Sun StorEdge RAID Manager (e.g., `/dev/rRAID_module01/0s0`).

- **Boot volumes**

For information on utilizing the Sun StorEdge A3500 array as a boot device, contact your sales representative for information.

- **Controller error recovery**

Follow Sun StorEdge A3500 array controller error recovery procedures in the documentation. Failure to do so will result in an incompatibility with VxVM.

- **Configuration**

Building VxVM RAID 5 volumes from Sun StorEdge A3500 array devices (LUNs) is not recommended, and in particular from Sun StorEdge A3500 array RAID 5 LUNs.

RAID Implementation

Hardware versus Software-based RAID

In any RAID storage product, RAID functionality may be implemented in hardware (on the array controller, as with the Sun StorEdge A3500 array), or it may be implemented in software on the host. The advantages of each method are described below.

In most configurations, controller-based RAID delivers higher performance than host-based RAID. For RAID 5, the system I/O bus traffic is lower because the controller does the parity calculations. This decreases host/array bus traffic and improves system I/O throughput. In the Sun StorEdge A3500 array,



an intelligent cache controller does all the multi-stripe I/O and performs prefetch. The controller converts small sequential I/O into full stripe I/O to even further improve RAID 5 performance. In host-based RAID systems, each read/write command requires multiple I/O requests to the disk, which increases bus traffic and impacts I/O performance for RAID 5.

The primary advantage of host-based software RAID is flexibility. In this type of RAID implementation, software on the host system controls the RAID configuration, as well as management and redundant data synchronization operations. This provides a high degree of flexibility, allowing many different RAID levels to be configured, and even allows RAID groups to span multiple disk controllers. Host software RAID also enables configurations to be easily changed over time, as customers' needs change.

RAID Levels Supported

The Sun StorEdge A3500 array is a controller-based (hardware) RAID subsystem that enables users to achieve the ideal balance of high data availability, performance, capacity, and cost. Furthermore the Sun StorEdge RAID Manager software makes it easy for users to configure, monitor, or reconstruct array configurations while the system is operating.

RAID Level	Characteristics
RAID 0—Striping	<ul style="list-style-type: none"> • Spreads data across multiple disk spindles for better performance • Can be tuned to optimize either random or sequential I/O performance • No redundant data protection, lower reliability than independent disks • Same low cost per usable megabyte as independent disks
RAID 1—Mirroring	<ul style="list-style-type: none"> • Maintains duplicate copies of data, so if a disk fails, data is available and applications keep running • Same performance as independent disks • Highest cost per usable megabyte
RAID 1+0—Mirroring and striping	<ul style="list-style-type: none"> • 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 3—Striping with parity on single disk	<ul style="list-style-type: none"> • Good for large sequential data transfers per I/O request, and low I/O request rates • When selecting RAID 3, the Sun StorEdge RAID Manager actually implements RAID 5, eliminating the typical RAID 3 bottleneck of parity information being written to a single disk
RAID 5—Striping with parity	<ul style="list-style-type: none"> • Provides data protection by storing parity information on all disks in the LUN, 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



High Availability (HA) with Sun StorEdge A3500 Array RAID Implementations

Features

- Independent disks, plus RAID levels 0, 1, 1+0, 3, and 5 are all available at the same time within the same array
- RAID groups may span multiple arrays
- RAID levels 5, 1, and 1+0 yield predicted steady-state uptimes in excess of 99.999 percent per array and mean time between data loss (MTBDL) in the millions of hours.
- Hot spares are automatically swapped in to replace any failed disk in a RAID 5, 1, or 1+0 group
- RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns.

Benefits

- Can easily match data layouts to meet users' specific requirements for capacity, performance, high availability, and cost
- Greater flexibility; allows creation of fully redundant configurations
- High availability, so customers can be confident that data will be available when needed and that it will not be lost
- Continuous redundant data protection even if a disk fails; maintenance can be deferred for days, weeks, or even months when needed
- Users can tune performance for their specific applications

RAID Technical Facts

- Each array may have several hot spare drives. If a drive in a RAID 5, 1, or 1+0 volume fails, a hot-spare drive is assigned and the Sun StorEdge RAID Manager detects the failure and automatically rebuilds the data from the failed drive onto a hot spare drive.
- Striped data organizations (RAID 0, 1+0, 3, and 5) can be tuned to optimize for either random or sequential I/O performance.
- To optimize for random performance, the I/O load must be evenly balanced across the disk spindles. This is done by setting the stripe width as large or larger than the typical application I/O request. For example, if the typical I/O request is 8 KB, setting the stripe width to 64 KB might be appropriate. This tends to evenly distribute I/O requests across all the disk spindles in the LUN.
- Sequential performance is optimized when data is spread out so that each application I/O spans all the drives in the RAID group. This requires setting the stripe width so that it is small relative to the size of the typical I/O request. For example, in a RAID group with four data disks, if typical application I/O size is 8 to 16 KB, a stripe width of 2 KB may be best.



System Specifications

RAID 5 Performance (3 x 15 Configuration, 12 x 18-GB drives/tray, 4+1 RAID 5 LUNs, 12 LUNs)

Sequential Read	189 MB/sec., sustained
Sequential Write	168 MB/sec., sustained
Random Writes 2-KB Block Size	100% cache 7605 IOPS, burst
Random Writes, 2-KB Block Size	4764 IOPS, sustained
Random Reads, 2-KB Block Size	18,042 IOPS, sustained

Sun StorEdge™ A3500 Array Drive Module Performance

Drive Specifications	18 GB 10000 rpm	36 GB 10000 rpm
Capacity (formatted, in bytes)	18,113,808,384 (512 bytes/sector)	36,420,074,496 (512 bytes/sector)
Average Seek Read (ms)	7.5	7.5
Average Seek Write (ms)	8.5	8.5
Average Latency (ms)	3.0	3.0
Burst Data Rate (MB/sec.)	40	40
Data Transfer Rate (MB/sec.)	22.7	19
Rotational Speed (rpm)	10000	10000
Buffer (KB)	512	512

Sun StorEdge A3500 Array System Electrical Specifications (2 x 7 configuration with 20 x 18.2-GB drives)

Input Voltage	200 - 240 VAC, single phase 50/60 Hz
Input Current	24 Amps (PDU rating)
Power Output	1390 watts (see chart below for other configurations)
VA	~1544 VA
Heat Output	4744 BTU (see chart below for other configurations)
Plug Type - U.S.	NEMA L6-30P for 200-240 VAC
Plug Type - International	IEC 309, 32A, 250V



Sun StorEdge A3500 Controller Module Electrical Specifications

Input Voltage	200-140 VAC 50/60 Hz
Input Current	1.0 Amp
Power Output	150 watts
VA	157 VA
Heat Output	510 BTU

Sun StorEdge A3500 Array Drive Tray Electrical Specifications

Input Voltage	100-240 VAC 50/60 Hz
Input Current	24 Amps
Power Output	260 watts
VA	~300 VA
Heat Output	1092 BTU

Sun StorEdge A3500 Array Heat Output and Power Consumption

Configurations	30 Degrees C*	40 Degrees C*
Sun StorEdge-Light, min. (18 GB)	1602 BTU (469 W)	1803 BTU (528 W)
Sun StorEdge-Light, max. (18 GB)	2847 BTU (834 W)	3048 BTU (893 W)
1 x 5, 18 GB min.	2206 BTU (646 W)	2709 BTU (794 W)
1 x 5, 36 GB min.	2206 BTU (646 W)	2709 BTU (794 W)
1 x 5, 18 GB max.	6472 BTU (1896 W)	6975 BTU (2044 W)
1 x 5, 36 GB max.	6472 BTU (1896 W)	6975 BTU (2044 W)
2 x 7, 18 GB min.	4039 BTU (1183 W)	4744 BTU (1390 W)
2 x 7, 36 GB min.	4039 BTU (1183 W)	4744 BTU (1390 W)
2 x 7, 18 GB max.	9500 BTU (2783 W)	10204 BTU (2990 W)
2 x 7, 36 GB max.	9500 BTU (2783 W)	10204 BTU (2990 W)
3 x 15, 18 GB min.	6618 BTU (1939 W)	8126 BTU (2381 W)
3 x 15, 36 GB min.	6618 BTU (1939 W)	8126 BTU (2381 W)
3 x 15, 18 GB max.	19417 BTU (5689 W)	20925 BTU (6131 W)
3 x 15, 36 GB max.	19417 BTU (5689 W)	20925 BTU (6131 W)

Note: * The temperature-dependent power difference is due to the variable speed fans in the Sun StorEdge A3500 tray. The temperatures of 30 and 40 degrees Centigrade refer to the air flow temperature passing through the Sun StorEdge A3500 fan.



Sun StorEdge A3500 Array Environmental Specifications

Temperature Range (dry bulb)	
Operating	5 to 35 degrees C (41 to 95 degrees F), 10 to 32 degrees C (50 to 90 degrees F) if removable tape media is installed in the Sun StorEdge A3500 array cabinet
Non-operating	-10 to 60 degrees C (-14 to 140 degrees F)
Relative Humidity	
Operating	20% to 80% RH @ 27 C, maximum wet bulb non-condensing
Non-operating	93% RH non-condensing
Altitude	
Operating	3 km (10,000 feet)
Non-operating	12 km (40,000 feet)

Sun StorEdge A3500 System Physical Specifications

Height	187.9 cm / 73.5 in.
Width (single rack)	61 cm / 24 in.
Depth (single rack)	93 cm / 36.5 in.
Weight (rack and 2 sequencers)	159 kg / 350 lb.
Clearance and Service Area	
• Front	122 cm / 48 in.
• Back	92 cm / 36 in.
Sides (side access required for some service procedure)	92 cm / 36 in.



Controller (with Bezel) Physical Specifications

Height	176.3 mm / 6.94 in.
Width	445 mm / 17.50 in.
Depth	609.6 mm / 24.00 in.
Weight	
• Enclosure	13.6 kg / 30 lb.
• Controller Module	37.2 kg / 82 lb.
• Power Supply	1.5 kg / 3.3 lb.
• Fan	0.9 kg / 2.0 lb.
• Battery	10.9 kg / 24 lb.
• 1 Controller Board	2.9 kg / 6.5 lb.
Bezel Thickness	0.375 to 0.875 in.

Disk Tray Physical Specifications

Height	175 mm / 6.9 in.
Width	445 mm / 17.5 in.
Depth	525 mm / 20.7 in.
Weight (2 power modules)	17.25 kg / 38 lb. without drives; 26 kg / 57 lb. with drives

Sun StorEdge A3500 Array System Regulation

System Regulation	Specifications
Safety	UL1950, CSA C22 No.950 EN60950 (TUV) CB Scheme (to IEC 950 and Nordic deviations)
RFI/EMI	VCCI Class 1 FCC Class A DOC Class A EN55022 Class A EN61000-3-2
Immunity	EN50082-1 Sun Specification 990-1151-xx
Product Label	FCC Class A VCCI Class 1 Industry Canada Class A UL Mark cUL Mark TUV Mark CE Mark



Ordering Information

Sun StorEdge A3500 Array, 18-GB, 10000-rpm Disk Configurations

Order Number	Description
SG-XARY380A-1092G	1092-GB Sun StorEdge A3500 array fixed configuration including one controller module, five disk trays with 60 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet with two 2-meter UltraSCSI cables
SG-ARY380A-182G	182-GB Sun StorEdge A3500 array configure-to-order base configuration including five disk trays with 10 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY382A-364G	364-GB Sun StorEdge A3500 array configure-to-order base configuration including seven disk trays with 20 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY384A-546G	546-GB Sun StorEdge A3500 array configure-to-order base configuration including fifteen disk trays with 30 x 18-GB, 10000-rpm disks mounted in two Sun StorEdge 72-inch expansion cabinets

Sun StorEdge A3500 Array, 36-GB, 10000-rpm Disk Configurations

Order Number	Description
SG-XARY390A-2184G	1456-GB Sun StorEdge A3500 array fixed configuration including one controller module, five disk trays with 60 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet with two 2-meter UltraSCSI cables
SG-ARY391A-364G	364-GB Sun StorEdge A3500 array configure-to-order base configuration including five disk trays with 10 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY393A-728G	728-GB Sun StorEdge A3500 array configure-to-order base configuration including seven disk trays with 20 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet



Order Number	Description
SG-ARY395A-1092G	1092-GB Sun StorEdge A3500 array configure-to-order base configuration including fifteen disk trays with 30 x 36-GB, 10000-rpm disks mounted in two Sun StorEdge 72-inch expansion cabinets

Sun StorEdge A3500 Array, Configurations for the Sun Enterprise™ 10000 Server

The array part numbers in this section are specifically configured for the Sun Enterprise™ 10000 server. These are preconfigured and pretested with the server prior to delivery. All configurations are factory installed only.

Sun StorEdge A3500 Array, 18-GB, 10000-rpm Disk Configurations for the Sun Enterprise 10000 Server

Order Number	Description
SG-ARY380A4-182G	182-GB Sun StorEdge A3500 array includes one SCSI controller module and five disk trays with 10 x 18-GB, 10000-rpm disks (minimum configuration, 1 x 5 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 12-meter UltraSCSI cables
SG-ARY380A4-1092G	1092-GB Sun StorEdge A3500 array includes one SCSI controller module and five disk trays with 60 x 18-GB, 10000-rpm disks (maximum configuration, 1 x 5 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 12-meter UltraSCSI cables
SG-ARY382A4-364G	364-GB Sun StorEdge A3500 array includes two SCSI controller modules and seven disk trays with 20 x 18-GB, 10000-rpm disks (minimum configuration, 2 x 7 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with four 12-meter UltraSCSI cables
SG-ARY384A4-546G	546-GB Sun StorEdge A3500 array includes three SCSI controller modules and fifteen disk trays with 30 x 18-GB, 10000-rpm disks (minimum configuration, 3 x 15 x 18-GB disks) mounted in two Sun StorEdge 72-inch expansion cabinets with six 12-meter UltraSCSI cables



Sun StorEdge A3500 Array, 36-GB, 10000-rpm Disk Configurations for the Sun Enterprise 1000 Server

Order Number	Description
SG-ARY391A4-364G	364-GB Sun StorEdge A3500 array includes one SCSI controller module and five disk trays with 10 x 36-GB, 10000-rpm disks (minimum configuration, 1 x 5 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 12-meter UltraSCSI cables
SG-ARY390A4-2184G	2184-GB Sun StorEdge A3500 array includes one SCSI controller module and five disk trays with 60 x 36-GB, 10000-rpm disks (maximum configuration, 1 x 5 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 12-meter UltraSCSI cables
SG-ARY393A4-728G	728-GB Sun StorEdge A3500 array includes two SCSI controller modules and seven disk trays with 20 x 36-GB, 10000-rpm disks (minimum configuration, 2 x 7 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with four 12-meter UltraSCSI cables
SG-ARY395A4-1092G	1092-GB Sun StorEdge A3500 array includes three SCSI controller modules and fifteen disk trays with 30 x 36-GB, 10000-rpm disks (minimum configuration, 3 x 15 x 36-GB disks) mounted in two Sun StorEdge 72-inch expansion cabinets with six 12-meter UltraSCSI cables

Ordering Process—Sun StorEdge A3500 Fixed Configurations

Step 1: Choose one:

SG-XARY380A-1092G	1 x 5 maximum configuration with 18-GB, 10000-rpm disks
SG-XARY390A-2184G	1 x 5 maximum configuration with 36-GB, 10000-rpm disks

Step 2: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 3: Choose options



Ordering Process—Sun StorEdge A3500 Configure-to-Order

Step 1: Choose one:

SG-ARY380A-182G	Base configuration with five trays, 10 x 18-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY382A-364G	Base configuration with seven trays, 20 x 18-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY384A-546G	Base configuration with fifteen trays, 30 x 18-GB, 10000-rpm disks and two Sun StorEdge racks
SG-ARY391A-364G	Base configuration with five trays, 10 x 36-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY393A-728G	Base configuration with seven trays, 20 x 36-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY395A-1092G	Base configuration with fifteen trays, 30 x 36-GB, 10000-rpm disks and two Sun StorEdge racks

Step 2: Order controllers:

6537A	SCSI controller. Order one per 5-tray configuration, two per 7-tray configuration, and three per 15-tray configuration.
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Step 3: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 4: Choose options



Ordering Process—Sun StorEdge A3500 Array for Sun Enterprise 10000 Server Configurations

Step 1: Choose one:

SG-ARY380A4-182G	1 x 5 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY380A4-1092G	1 x 5 maximum configuration with 18-GB, 10000-rpm disks
SG-ARY382A4-364G	2 x 7 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY384A4-546G	3 x 15 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY391A4-364G	1 x 5 minimum configuration with 36-GB, 10000-rpm disks
SG-ARY390A4-2184G	1 x 5 maximum configuration with 36-GB, 10000-rpm disks
SG-ARY393A4-728G	2 x 7 minimum configuration with 36-GB, 10000-rpm disks
SG-ARY395A4-1092G	3 x 15 minimum configuration with 36-GB, 10000-rpm disks

Step 2: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 3: Choose options



Options

Sun StorEdge A3500 Array Options

Order Number	Option Description	Comments
X7020A	Sun StorEdge A3000 array 64-MB add-on cache memory	Order two 64 MB add-on memory—one for each of two controller boards.
NF-INST-SSA	Sun StorEdge ArrayStart SM Onsite Installation (Contact SunService representative to order)	Recommended one installation contract per Sun StorEdge A3500
Host Bus Adapters		
X1065A	UDWIS/S—SBus Ultra differential F/W Intelligent SCSI host adapter (40 MB/sec.)	Order two per controller module
X6541A	UD2S—PCI dual-channel differential UltraSCSI host adapter (40 MB/sec.)	Order at least one per controller module; to avoid SPOF, configure controllers to channels on different HBA cards or order additional cards
Disk and Tray Options		
X5238A	18-GB, 10000-rpm UltraSCSI disk	Add-on drive for 12 x 18-GB trays
X5243A	36-GB, 1000-rpm UltraSCSI disk	Add-on drive for 12 x 36-GB trays
SG-XARY154A-72G	Sun StorEdge D1000 rackmount tray with 4 x 18-GB, 10000-rpm disks	
SG-XARY173A-145G	Sun StorEdge D1000 rackmount tray with 4 x 36-GB, 10000-rpm disks	
Sun StorEdge A3500 Array Accessories		
X6537A	Sun StorEdge A3500 controller module	
SG-XARY030A	Sun StorEdge expansion cabinet	For A3500-Light
X9818A	Front door assembly for 72-inch Sun StorEdge rack	
X3858A	Power cord—U.S.	Order two per rack
X3859A	Power cord—International	Order two per rack
X3830A	4-meter, 68-pin to UHDC differential SCSI cable	For PCI systems
X3831A	10-meter, 68-pin to UHDC differential SCSI cable	For PCI systems
X979A	12-meter UltraSCSI external cable	
ARRAYNT-6221-B	Volume management software for Microsoft Windows NT hosts	



Upgrades

Sun StorEdge™ A3500FC Array Upgrade Paths

Sun-to-Sun and competitive upgrades to the Sun StorEdge™ A3500FC arrays provide excellent trade-in values for older SPARCstorage™ Array 1XX, 2XX, RSM™ 200 series, RSM 2000, or Sun StorEdge A3000 system arrays, making it more cost-effective to migrate to the latest technology. On August 29, 2000, the Installed Base Business (IBB) organization will be introducing new upgrade offerings in conjunction with the announcement of the new percentage-base model, Sun Upgrade Allowance Program (Sun UAP). This new model will simplify the upgrades process by providing a "trade-in" value as a percentage allowance that can be applied to the list price of a regular Sun system configuration.

Upgrade-Specific Configuration Notes

With the introduction of the new Sun Upgrade Allowance Program on August 29, 2000, there will be specific ordering instructions when ordering upgrades using the new model. The Return Materials Authorization (RMA) Kit, part number UG-RMA, must be quoted and ordered on the same sales order as a separate line item at no charge. This kit is mandatory and contains detailed information for the customer on how to return the older equipment.

Upgrade Ordering

New allowance codes for the Sun StorEdge A3500FC array will be announced on August 29, 2000.



Service and Support

The SunSpectrumSM 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 SolarisTM Operating Environment software, and telephone support for SunTM 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 SM Mission-critical Support	SUNSPECTRUM GOLD SM Business-critical Support	SUNSPECTRUM SILVER SM Systems Support	SUNSPECTRUM BRONZE SM 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
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart SM installation service	Yes	No	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Skills assessment	Yes	No	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	Option
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
7-day/12-hour on-site coverage	No	Option	No	No
5-day/24-hour on-site coverage	No	Option	No	No



FEATURE	SUNSPECTRUM PLATINUM Mission-critical Support	SUNSPECTRUM GOLD Business-critical Support	SUNSPECTRUM SILVER Systems Support	SUNSPECTRUM BRONZE Self Support
Coverage / Response Time (cont.)				
Customer-defined priority setting	Yes	Yes	Yes	Option
• 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
2-hour on-site response	Yes	Option	Option	N/A
Additional contacts	Option	Option	Option	Option
Premier Support Features				
Mission-critical support team	Yes	For urgent problems	No	No
Sun Vendor Integration Program (SunVIP SM)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Hardware Support Delivery				
Replacement hardware parts	On-site technician	On-site technician	On-site technician	Courier
Two day parts delivery	N/A	N/A	N/A	Yes
Overnight parts delivery	N/A	N/A	N/A	Option
Same-day parts delivery	Yes	Yes	Yes	Option
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 Operating Environment 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 SM license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier SM Service	Yes	Yes	Yes	Yes



Warranty

The warranty on the array hardware is two years. In addition, the Sun StorEdge A3500 array carries a one-year, on-site warranty. Software warranty is 90 days.

Education

- Support Readiness Training
- IQ Kit Sales Guide
- IQ Kit Tech Guide
- SunU

Professional Services

Sun StorEdge ArrayStartSM Service

Sun StorEdge ArrayStartSM service provides an installation and custom-configuration service that quickly gets mission-critical data-center applications up and running. For one fixed fee, this service includes consultation for determining the configuration that best meets the customer's needs, installation of the hardware and RAID management software, and configuration to the appropriate RAID profile determined during the consultation.

Solstice DiskSuiteTM to VERITAS Volume Manager Software Data Migration

A Sun Professional Service consultant will deliver four days of onsite consulting services to assist customers who wish to migrate their mission-critical data from existing storage system to an array. This service will help customers complete the transition with minimal downtime and without risking loss of their valuable data. Specially trained Sun consultants will use their extensive data-migration expertise to complete the service in the most cost- and time-effective manner available. Sun consultants will also fully integrate and optimize the Sun StorEdge A3500 array into the customer's computing environment.

If desired, customers can choose tasks from the following list to customize the service to meet their specific business needs:

- Design and configuration planning
- Capacity planning
- Performance tuning and optimization

Travel and expenses incur an additional charge for delivery requiring more than 50 miles of travel. When this service is desired by the customer, the account manager will contact the SunPSSM Data and Storage Management Competency Practice to schedule delivery of the service.



Glossary

Active termination, regulated	Terminates the SCSI bus with a series of resistors tied to +5 volts. The terminator is labeled <i>Regulated</i> but is often referred to as an <i>Active Terminator</i>
Bandwidth	A measure of the capacity of a communication channel, usually specified in MB/sec.
CLI	Command line interface.
Data cache	64 MB to 128 MB of cache memory (per controller board) 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.
Fast/wide SCSI	Data transfer rate of 20 MB/sec. 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.
GUI	Graphical user interface. The Sun StorEdge™ RAID Manager 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.
RDAC	Redundant disk array controller. The RDAC driver is included in the RAID Manager software, and manages the rerouting of active I/O operations when a controller fails.
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. Different RAID levels provide different capacity, performance, high availability, and cost characteristics.
RAID module	A set of drives, controllers, power supplies and cooling.
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.
RAID Manager	The software that allows the customer to configure and manage the Sun StorEdge A3500 array.
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.



Throughput	A measure of sequential I/O performance, quoted in MB/sec. See IOPS.
Volume	In the VERITAS 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 VERITAS Volume Manager 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.
UltraSCSI	Data transfer rate of 40 MB/sec. 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				
– <i>Sun StorEdge™ A3500 Array, Just the Facts</i>	Reference guide for the <i>Sun StorEdge A3500 Array (this document)</i>	Sales Tool	SunWIN, Reseller Web	88754
– <i>Sun StorEdge A3500 Disk Array Customer Presentation</i>	Customer Presentation with Notes	Sales Tool	SunWIN	89073
Training				
– <i>Performance Tuning and Configuration White Paper</i>	Ongoing Training for SE and SSE	Training	SunWIN	76868
– <i>Transfer of Information Video</i>	Ongoing Training for SE and SSE	Training	SunWIN	ME 1935-0
Product Literature				
– <i>Sun StorEdge A3500 Array Data Sheet</i>	Two-page Color Data Sheet	Sales Tool	SunWIN, Field Distribution	87288 DE852-0
– <i>Storage Reference Card</i>	Sun Product Reference Card	Sales Tool	SunWIN	73691
Product Update Information				
– <i>Sun Product Intro: New 18-GB, 10000-rpm Disks and Repricing for Sun StorEdge A1000, D1000, and A3500 Arrays</i>	Sun Introduction with Pricing	Sales Tool	SunWIN, Reseller Web	104445
– <i>Product Update Bulletin: Sun StorEdge A3500 Product Updates</i>	Product Update	Sales Tool	SunWIN	96339
– <i>Product Update Bulletin: Sun StorEdge A3500 Boot Capability</i>	Product Update	Sales Tool	SunWIN	97281, 98192
– <i>Product Update Bulletin: Sun StorEdge A3500/A1000 Microsoft Windows NT Certification</i>	Product Update	Sales Tool	SunWIN	99695



Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
– <i>Sun Product Intro - Sun StorEdge A3500-Light Upgrades; Transition of Sun StorEdge A3000 Upgrades, 1/26/99</i>	Product Update	Sales Tool	SunWIN	98877
– <i>Product Update Bulletin: A3500-Light Now Supported in Enterprise 5500/6500 System and 68-inch Enterprise Expansion Cabinets, 4/14/99</i>	Product Update	Sales Tool	SunWIN	102412
– <i>Product: Sun StorEdge A3500-Light Now Supported on Sun Cluster 2.1, 1/22/99</i>	Product Update	Sales Tool	SunWIN	98664
– <i>Product Update Bulletin: Sun StorEdge A3500 Configure-to-order Process, 6/99</i>	Product Update	Sales Tool	SunWIN	105821
– <i>Product Update Bulletin: Availability of Sun StorEdge D1000/A1000/A3500 Configurations with 18-GB/10000-rpm Disks, 6/99</i>	Product Update	Sales Tool	SunWIN	106230
External Web Site				
– <i>Sun StorEdge A3500 Array Information Site</i>	http://www.sun.com/storage/A3500			
Internal Web Site				
– <i>Sun StorEdge Products, References</i>	http://webhome.ebay/networkstorage/products/A3500			

