Sun StorEdge™ T3 Array

Just the Facts

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Introduction

Figure 1. The Sun StorEdge™ T3 array

The Sun StorEdge™ T3 array represents a new and advanced generation of modular, reliable storage systems that allow businesses to scale storage capacity, performance, and availability seamlessly at business needs grow.

The Sun StorEdge T3 advanced systems architecture meets the demands of a wide range of applications but is particularly well suited for database, NFS, web serving, and e–mail applications, as well as a variety of workloads. Its unique modular design combines advanced hardware RAID controller technology, hot–swappable systems components, and industry–standard Fibre Channel technology. These features provide high–performance, redundant data paths between disks and servers and create a scalable storage system that can address even the most stringent availability requirements.

The Sun StorEdge T3 arrays are offered in two configurations, each providing different levels of availability, software, and services. The two Sun StorEdge T3 storage array systems are:

- The Sun StorEdge T3 array for the workgroup with a single RAID controller offers a reliable and cost–effective storage system with 163–GB or 327–GB capacity. This is available in tabletop or rack–ready versions.
- The Sun StorEdge T3 array for the enterprise offers redundant RAID controllers for high–availability enterprise and datacenter environments. The enterprise models are fully redundant, with hot–swappable hardware components and with capacities ranging from 327 GB up to 2.6 TB per cabinet. This pair of arrays is available in tabletop, rack–ready, or rack–installed configurations with two, four, or eight arrays.

The Sun StorEdge T3 array includes array management software that allows large numbers of arrays to be centrally administered. Management functions include the Sun StorEdge Component Manager software, which allows administrators to configure, monitor, control, and diagnose the Sun StorEdge T3 storage system from a single graphical interface. This capability allows an organization to grow its storage capacity without increasing administration costs and complexity.

In addition to providing advanced hardware and software components, the Sun StorEdge T3 array for the enterprise models include an enhanced services package, which allows customers to rapidly implement complex, reliable, and monitored storage environments. This extended service package helps ensure the use of sound storage installation and configuration practices, thereby allowing Sun to put the support infrastructure in place that is required to maintain the most demanding enterprise and datacenter environments.

Features

- Scalable, Fibre Channel hardware RAID storage
- High–availability, dual–controller design on Sun StorEdge T3 array for the enterprise systems
- Easy–to–use Sun StorEdge Component Manager 2.1 software for array configuration and central administration
- Installation, configuration, and support services included with Sun StorEdge T3 for the enterprise models
- VERITAS Volume Manager with dynamic multipathing (DMP) 3.0.4 included with Sun StorEdge T3 for the enterprise models (Tier 2 license)
- Comprehensive rackmounting options for Sun StorEdge expansion cabinets, Sun Enterprise server cabinets, and third–party cabinets
- 7–port Fibre Channel arbitrated loop FC–AL hub

Features and Benefits

The Sun StorEdge T3 storage arrays have attractive features that make these units the products of choice for forward–moving customers.

Features	**Benefits**
• Three–way scalability	• Configurable system components for capacity, IOPS/bandwidth, and availability
• Full Fibre Channel architecture	• High performance and redundancy for demanding applications; Sun StorEdge T3 array architecture takes advantage of 100 MB/second Fibre Channel arbitrated loop (FC–AL) host interface and dual 100 MB/second back–end FC–AL drive loops
• Volume management included with Sun StorEdge T3 array for the enterprise models	• All storage management tools necessary to manage the Sun StorEdge T3 array for the enterprise are included
• Highly scalable tabletop, rack–ready, or factory rackmounted configurations	• Flexible installation allows capacities to scale from 163 GB for table top models to over 2.6 TB for single–cabinet configuration
• Continuous data availability	• Fully redundant, hot–swappable hardware components (all major FRUs) – Online reconfiguration – Dual redundant power and cooling – Mirrored cache – Integrated battery backup for cache protection – No internal cabling – Dual power cords on each array

Features	Benefits
• Field–replaceable units (FRUs) are easy to identify, access, and hot–swap	• Improves serviceability, decreasing downtime and potential errors • All six system components are FRUs: RAID controller, unit interconnect cards, disk drives, power/cooling units, chassis, and media interface adapter (MIA)
• Individual servers currently support up to 20 TB of attached storage with planned support for up to 88 TB	• Massive scalability for your most demanding storage requirements
• Hardware RAID controller	• Data protection, performance, availability, and ease of configuration
• Sun StorEdge T3 arrays are Sun Remote Service (SRS) Event Monitoring and Management Service 2.0 ready	• In Sun Enterprise Services, service orders are generated when systems problems are first detected, decreasing time to resolve problems or potential problems
• 2–year SunSpectrum Gold℠ service contract included with Sun StorEdge T3 for the enterprise models	• 24x7 remote system monitoring with 4–hour, on–site response time
• Installation and configuration through the Sun StorEdge ArrayStart℠ service included with Sun StorEdge T3 for the enterprise models	• Experienced systems engineers help ensure proper installation and configuration
• Hardware RAID controller with dedicated XOR parity engine	• High–performance, low–latency RAID 5 performance
• VERITAS dynamic multipathing (DMP)	• Increased availability through automatic host loop failover

Product Family Placement

The Sun StorEdge T3 array is an open, modular network system for simple, reliable, and scalable storage. This array is Sun's introduction of a new, economical, yet powerful and scalable, storage system that delivers advanced data services to the storage network. The Sun StorEdge T3 system, the first product in the Sun StorEdge T3 family of networked storage products, maximizes performance in data warehousing, decision support, and high–performance computing environments. Its unique design is based on a simple building block concept, combining advanced RAID technology with industry–standard, Fibre Channel technology in a modular package. Combining building blocks creates a high–performance, highly available network storage system that can be centrally administered. The scalability of the Sun StorEdge T3 array allows your storage system to grow as your storage needs grow.

The primary target markets include service providers (e–mail, web caching, workgroup, collaborative, and file and print) and departmental collaborative design. See Target Markets, below, for more information.

The Sun StorEdge T3 array complements Sun's current Fibre Channel products. In contrast to the Sun StorEdge A5X00 host–based RAID arrays, the Sun StorEdge T3 array has built–in intelligence with a

RAID controller and native failover capabilities. The Sun StorEdge T3 array also offers competitive performance features at a low cost per megabyte of storage.

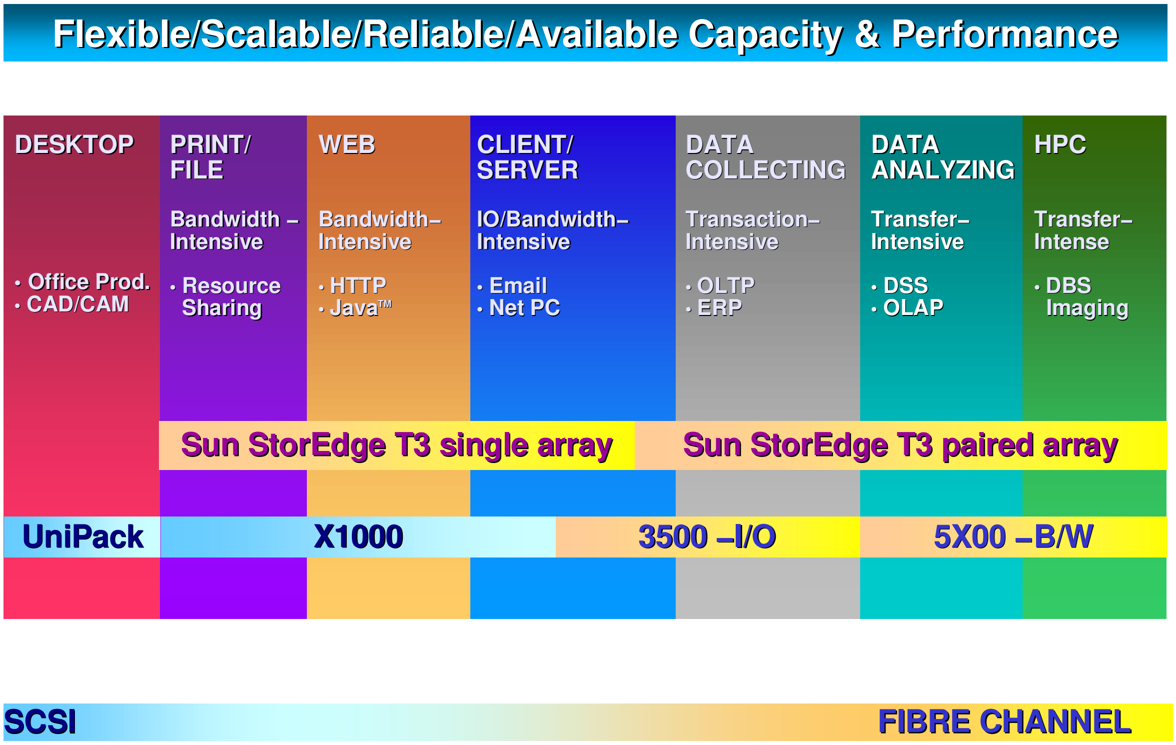


Figure 2. Sun StorEdge T3 array market positioning

Key Messages

The Sun StorEdge T3 array delivers these key benefits:

- Three–way scalability
- Ease of use
- High performance
- High reliability, availability, and serviceability (RAS)
- Available with storage management software compliant with the Jiro™ technology.

Three–Way Scalability

The Sun StorEdge T3 array design provides *three–way scalability* for capacity, performance, and availability. Customers can scale upwards in the following ways:

- Add controller units or expansion units (available in future releases) to increase storage with 18–GB or 36–GB disk capacities

  A Sun StorEdge T3 *controller unit* array has a RAID controller card. A Sun StorEdge T3 *expansion unit* array has no RAID controller card.

- Add controller units to increase bandwidth, IOPS, and availability

To configure for capacity only, customers can add one expansion unit to a single controller unit. Controller and expansion units with 18.2–GB drives, for example, provide incremental increases of

163 GB per unit. The performance of a single controller is about 4,400 IOPS (100 percent reads, 8−KB blocks) with a bandwidth of 93 MB per second.

To add capacity *and* configure for IOPS, availability, and bandwidth, customers can add controller units. Rackmounted configurations of up to eight controller units are possible. A second controller unit not only provides full redundancy, but increases performance to 8,800 IOPS (100 percent reads, 8−KB blocks) with a bandwidth of 123 MB/second. Two, four, and eight multi−paired controller unit configurations are currently available.

Ease of Use

The open, modular architecture of the Sun StorEdge T3 array makes it easy to install, configure, service, and administer:

- All major components are easily accessible either at the front or rear of the unit.
- All components except the system chassis which includes the passive midplane board can be hot−swapped. Hot−swap, field−replaceable units (FRUs) include nine preconfigured RAID disk drives, two power/cooling units, two unit interconnect cards, and the RAID controller card.
- Interconnectivity between units is easily accomplished using the interconnect cables on each unit interconnect card. No re−cabling within the units is required.
- The RAID controller card has built−in network services, Telnet, FTP, and HTTP through a 10BASE−T Ethernet network connection for an administrative interface.
- Sun StorEdge Component Manager software provides a friendly graphical user interface for managing the Sun StorEdge T3 controller unit array physical enclosure.
- Software support for VERITAS Volume Manager software allows enhanced management of disk volumes. (VERITAS Volume Manager software is included with all Sun StorEdge T3 array for the enterprise configurations)

High Performance

The Sun StorEdge T3 array provides performance strengths that exceed many of Sun’s current disk arrays with respect to data−intensive file services and HPC and DW/DSS applications. Here are some performance highlights:

- 93+ MB per second reads from disk per controller unit with RAID 5 (8 + 1 volumes)
- 77+ MB per second writes to disk per controller unit with RAID 5 (8 + 1 volumes)
- 4,400 IOPS (100 percent reads from cache, 8−KB block size)
- 264 MB per second sustained internal throughput per controller unit

High Reliability, Availability, and Serviceability (RAS)

The RAS features of the Sun StorEdge T3 array are impressive:

- Reliability features include automatic failover between RAID controllers with mirrored cache.
- Availability features include redundant hot−swap components (all major FRUs), no internal cabling, N+1 power, dual power cords, and integrated battery backup for cache protection.
- Serviceability features include SNMP monitoring; failure detection, reporting, and recovery for all FRUs; hot−swap capability for all FRUs; and support for online reconfiguration through an independent Ethernet interface.
- The Sun StorEdge T3 array can be remotely monitored using the Sun Remote Services 2.0 Event Monitoring and Management service

Storage Management Software

Sun StorEdge™ Component Manager software is included with the Sun StorEdge T3 array. Sun StorEdge Component Manager software is a server–installed, Java™ technology–based application for managing attached Sun StorEdge arrays and their hardware components. Sun StorEdge Component Manager software will be compliant with Jiro technology, the storage industry's first standards–based environment for making storage networks interoperable and manageable.

This software allows the user to perform unique control directives on some of the components (for example powering off a disk). In addition, Sun StorEdge Component Manager software affords constant monitoring of the Sun StorEdge T3 arrays or Sun StorEdge A5X00 enclosures and is capable of providing alarm notification and remote reporting (via e–mail, files, and system logging) upon detection of abnormal activities or conditions within a designated storage enclosure.

Note: *Sun StorEdge Component Manager software does not manage the logical organization of stored data.*

Sun StorEdge Component Manager software is a Java technology–based storage management software plug–in that is accessible from the Sun StorEdge Management Console software. Sun StorEdge Management Console software serves as a storage management framework for Java technology–based management plug–ins, making it easier to operate, administer, and maintain storage area networks. The management GUI gives system administrators and service personnel a centralized point for storage administration. Sun StorEdge Management Console software enhances the reliability, availability, and serviceability (RAS) of storage assets. The Sun StorEdge Management Console software implements elements of the specification for the Jiro open storage management platform to enable automated management services and interoperability across heterogeneous storage area networks.

Administrators and service personnel of supported arrays can use Sun StorEdge Component Manager software's GUI to:

- Monitor enclosures by using hardware polling, alarm notification, event logging, and remote reporting for abnormal conditions and activities
- Display the status of enclosures, enclosure components, and their associated properties
- Exercise control directives on some enclosure components, such as powering off a disk, or enabling or disabling a RAID controller

New Features of Sun StorEdge Component Manager Software

The 2.1 release of Sun StorEdge Component Manager software includes support for the Sun StorEdge T3 array, along with enhanced support for the Sun StorEdge A5X00 array. In addition, a diagnostics interface has been added for the Sun StorEdge T3 array.

Administrators and service personnel of Sun StorEdge T3 arrays may use Sun StorEdge Component Manager 2.1 software on the Solaris™ Operating Environment and on the Windows NT operating environment to:

- Monitor enclosures by using hardware polling, alarm notification, event logging, and remote reporting for abnormal conditions and activities
- Display the status of enclosures, enclosure components, and their associated properties through photorealistic views
- Exercise control directives on some enclosure components, for example, powering off a disk
- Configure LUNs
- Obtain block I/O statistics for array controllers

Support for the Sun StorEdge A5X00 arrays on the Solaris Operating Environment has also been enhanced to include these features:

- Faster enclosure discovery
- The system monitors for bad Fibre Channel loops; if one is discovered and there is another path to the disks, the system has the capability to disable the Fibre Channel port on the loop
- Global setting for polling interval

This release also forwards alarm notifications to Sun Management Center software via the Sun StorEdge Management Console 1.1 software.

Other features include:

- Threading discovery and dynamic report/update
- The system can discover enclosures asynchronously and also during the start of the Sun StorEdge Component Manager software
- All polling intervals are now in the Sun StorEdge Component Manager software's configuration panel instead of in each enclosure configuration panel for ease of use

Product Availability

• Revenue Release	April 3, 2000
• First order date	July 11, 2000
• General Availability	July 11, 2000

Additional Features Planned

Feature	Planned for
• Sun Cluster 2.2 software	Q1FY01
• Support for:	
– Microsoft Windows NT server 4.0	Q1FY01
– IBM−AIX 4.3.3	Q1FY01
– Linux 2.2.15	Q2FY01
– HP−UX 11.0	Q3FY01
– Microsoft Windows 2000	Q3FY01
• Sun StorEdge T3 array 2− and 4−post rackmount rail kits for the service provider environment	Q2FY01
• Fibre Channel switch support (Ancor)	Q2FY01
• 73−GB drives	Q2FY01

Target Users

The primary customers for the Sun StorEdge T3 array are Sun network storage direct accounts, storage−only resellers, solution resellers, OEMs, distributors, and system remarketers. The Sun StorEdge T3 array meets user needs as shown in the table below.

Individual User	Buying Influence Needs
MIS manager	FC−AL technology investment in the future
Procurement	Investment protection in existing and future products
Developer	Standards compliance for implementation of FC−AL products
Systems administrator	Flexible management in both software and hot−swap components
Operations	High availability, allowing efficient system operation
End user	High performance, resulting in quick transaction response

Target Markets

The Sun StorEdge T3 array is well suited for the capacity and performance requirements of application servers, network data services, and performance−oriented systems. Strategic uses for this array within the manufacturing, government, finance, and entertainment industries include the following:

Industry/Customer	Key Features to Highlight
Disaster recovery	Future support for remote mirroring to 10 kilometers (using switches)
Workgroup storage	Scalable design with proper capacity to support workgroup sizes
Datacenter storage	Enterprise−class redundancy and mission−critical availability features
Technical computing	High−performance data storage for engineering design projects
Scientific computing	High bandwidth for data capture, retrieval and storage
Upgrades to existing arrays	Priced and packaged to migrate customers

The Sun StorEdge T3 array is ideal for high−bandwidth environments in these price ranges (in US dollars):

- $25,000 to $100,000 for workgroups and departments (Sun StorEdge T3 array for the workgroup)
- $100,000 and up for enterprises (Sun StorEdge T3 array for the enterprise)

Targeted groups within these market segments are:

- Fortune 1000 customers moving to storage area networks (SANs)
- NFS system customers
- Data modeling and data−intensive customers
- Technical and scientific customers
- High−performance computing (HPC) customers
- Internet service providers (ISPs)
- E−commerce customers (interactive online, e−commerce organizations, digital media, financial services organizations, and Internet−centric organizations)

Target Applications

The Sun StorEdge T3 array is well suited for customers who desire scalable hardware RAID Fibre Channel storage. Target applications include:

- Service providers (e−mail, web servers, e−commerce)
- Workgroup (NFS, e−mail, file and print services)
- Enterprise and datacenter (OLTP, data warehouse, e−commerce)
- Technical and scientific applications (high−performance computing)
- Computer generated animation (CGA)
- Image capture and retrieval applications such as medical imaging and high−performance data acquisition

Selling Highlights

Market Value Proposition

The Sun StorEdge™ T3 array is an open, modular network solution for simple, reliable, and scalable storage.

Organizations of all sizes, in every industry, want a simple, reliable, and manageable approach to storage. Customers seek solutions based on open standards that are capable of solving their needs for access to information across their networks. The Sun StorEdge T3 array is a new, economical, yet powerful and scalable, storage system that delivers advanced data services to the storage network. This system helps maximize performance in NFS, web serving, e–mail, and a variety of other applications. The array's unique design is based on a simple building block concept, combining advanced RAID technology with industry–standard Fibre Channel technology in a modular package. Combining building blocks creates a high–performance, highly available network storage system that can be centrally administered. The scalability of the Sun StorEdge T3 array allows each customer's storage system to grow as their storage needs grow.

Compatibility

The following table lists the supported features and product attributes for both the Sun StorEdge T3 array for the workgroup and the Sun StorEdge T3 array for the enterprise.

Feature	**Description**
Sun StorEdge T3 array for the workgroup	• One–array configuration • Nine 18.2–GB or 36.4–GB, 10000–rpm FC–AL drives • Fully populated with drives • Preconfigured for RAID 5 (8 + 1) • Single RAID controller • RAID 0, 1, or 5 • Supports up to 2 LUNs per array • Rackmount–ready or tabletop options • Sun StorEdge Component Manager 2.1 software, license, media, and documentation
Sun StorEdge T3 array for the enterprise	• Two–, four–, and eight–array configurations • Nine 18.2–GB or 36.4–GB, 10000–rpm FC–AL drives • Fully populated with drives • Preconfigured for RAID 5 (8 + 1) • Dual RAID controllers • RAID 0, 1, or 5 • Two to four LUNs per pair • Rackmounted options (four– and eight–array configurations) • Rackmount–ready or tabletop options (two–array configurations) • Sun StorEdge Component Manager 2.1 software, license, media, and documentation • VERITAS Volume Manager 3.0.4 software for soft partitioning (included with all Sun StorEdge T3 array for the enterprise ; Tier 2 server license)

Feature	**Description**
Supported host platforms	• Ultra™ 60 and 80 workstations • Sun Enterprise™ 250, 220R, 450, 420R workgroup servers • Sun Enterprise 3X00–6X00, and 10000 servers
Supported operating environments	• Solaris™ 2.6 • Solaris 7 • Solaris 8
Software features	• CLI management interface
Supported software	• Sun StorEdge Instant Image 2.0 • Sun StorEdge Network Data Replicator (SNDR) 2.0 • Sun StorEdge Data Management Center 3.0 (Q1FY01) • Solstice Backup™ 5.5.1 • Solstice DiskSuite™ 4.2.1 • Sun Enterprise Server Alternate Pathing (AP) 2.3.1 • Sun Management Center 2.0.1 • Sun StorEdge Component Manager (CM) 2.1 • Sun Remote Services (SRS) 2.0.1 • StorTools™ 3.3 diagnostics • Sun Cluster 2.2 (selected configurations, available Q1FY01) • UFS • VERITAS NetBackup (NBU) 3.4 • VERITAS Volume Manager 3.0.4 (or later) with DMP (VxVM) • VERITAS File System (VxFS) 3.3.3
Supported host system adapters	• SBus dual loop SBus adapter • PCI FC–AL single loop adapter • PCI dual FC–AL adapter (available Q2FY01)
Functions	• Boot device (available Q2FY01)
RAS features	• Quick and easy to repair (less than five minutes to swap any FRU, visual FRU state LEDs) • IDs for all FRUs on labels and ID module • Failure detection/reporting for all FRUs via SNMP and Sun StorEdge Component Manager software • No tools required • StorTools™ diagnostics software support
Performance	• Bandwidth/IOPS performance; HPC, DW/DSS markets (93 MB/sec. reads, 77 MB/sec. writes); see the the Performance section of this document for more information

Enabling Technology

Features Overview

In today's Net economy, fast response and continuous availability are key to any company's survival. The competition is a mere click away, and, in general, if dot-com customers have to wait much longer than five seconds for requested data, they may be gone and may not return. Sun understands this market dynamic. That is why Sun has built technology like mirrored cache and fully redundant, hot-swappable hardware components into the Sun StorEdge™ T3 array, providing customers with the IT muscle to deliver information where and when they need it.

The Sun StorEdge T3 array employs impressive new technologies to build break-away solutions:

- Advanced architecture that uses full Fibre Channel connectivity, switched-loop design, and failover security
- Simple and capable storage unit design that is highly scalable and easily accessed for adding, upgrading, and swapping components
- Supported by Sun StorEdge Component Manager software, which provides server-based, single-point administration for attached arrays and their hardware components
- Sun Remote Services program support for continuous remote systems monitoring

Switched-Loop Architecture

Sun's switched-loop architecture is at the heart of the Sun StorEdge T3 array's ability to scale performance linearly as capacity grows. Traditional SCSI and Fibre Channel arrays typically consist of one or more controllers connected to one or more disk trays by dual Fibre Channel loops. In a bandwidth-intensive application, for example, a traditional array's two internal disk loops could be completely saturated with just two disk trays delivering data concurrently. Additional capacity would not increase performance.

The Sun StorEdge T3 array employs a radically different architecture to connect its disks to the controller functions. Sun has overlaid the concept of a Fibre Channel switched fabric on the loop architecture used to connect the disks to the controllers. This allows for the ability to segment the disk interconnect loops on a tray-by-tray basis into smaller dedicated sub-loops that can all operate independently and concurrently without interference. This function is under control of the Sun StorEdge T3 array controllers and is managed dynamically in order to help optimize performance and deliver complete failover data access.

A small Sun StorEdge T3 array system consisting of two controller units typically segments one set of redundant loops into two dedicated data loops—one per controller—so that each controller's data accesses can proceed without interference from the other controller. The second loop is typically not segmented and is used to transfer mirrored cache writes between the controllers, again without interfering with either controller's disk accesses.

A full rack of Sun StorEdge T3 array controller units organized into four fail-over partner groups delivers 800 MB per second of dedicated data access internal loop bandwidth and 400 MB per second of dedicated cache mirror bandwidth for a total of 1.2 GB per second of internal data transfer bandwidth. Compared to the more traditional array design using just two internal loops delivering only 200 MB per second of total bandwidth, the Sun StorEdge T3 array's ability to scale is virtually unparalleled in the industry.

Three–Dimensional Scalability: Capacity, Performance, and Availability

The ability to adapt to rapid and unexpected change in I/O workloads, capacity requirements, and system–delivered bandwidth while delivering continuous availability is another design requirement that is becoming absolutely necessary in the dot–com world. The Sun StorEdge T3 array addresses this requirement by delivering some of the best overall scalability in the market. The system scales capacity, performance, and availability in a linear and predictable fashion. As capacity increases, performance increases by a predictable amount. Availability scales as additional data paths and redundancy are added with each expansion array.

In reality, capacity, bandwidth and I/O per second (IOPS) can change independently of each other. For example, an increase in streaming audio or visual content may drive bandwidth, while a new SAP application may drive IOPS and capacity. The Sun StorEdge T3 array's revolutionary switched–loop architecture allows customers to scale on any combination of capacity, IOPS, or bandwidth without being forced into "over buy" situations which are common with many of the large traditional storage solutions that have been offered in the past.

To simply add capacity, an expansion Sun StorEdge T3 array unit can be added to a configuration. If I/O increases, a controller can be added to the unit to effectively double the cache and potential IOPS into the storage subsystem. The same flexibility applies to bandwidth–sensitive applications, allowing customers to address ever–changing and dynamic application demands.

Lightning–Fast RAID 5

The Sun StorEdge T3 array is designed for outstanding Fibre Channel RAID 5 performance. The system employs a revolutionary hardware–pipelined, XOR engine (pXOR) that operates, and can calculate parity data, at the full internal data bus speed of the array. This helps reduce the requirement for cache memory accesses, which serve as a bottleneck in most RAID 5 arrays.

The Sun StorEdge T3 array's pXOR unit helps improve performance by reducing mechanical disk seek and latency periods. The pXOR engine does this by accumulating partial XOR sums (up to 128), allowing the array to accumulate stored write–behind data in its cache memory and deliver it to the disk back–store in large chunks that can take advantage of the command sorting feature of the disks. Reducing mechanical wait states is among the best ways to improve application performance.

In addition, the Sun StorEdge T3 array's ability to optimize physical disk I/O access patterns directly delivers improved application response time and improved overall system performance.

System Architecture

Overview

The Sun StorEdge™ T3 controller unit array can be configured as either one or two controller units. The figures below provide architectural views of these two configurations.

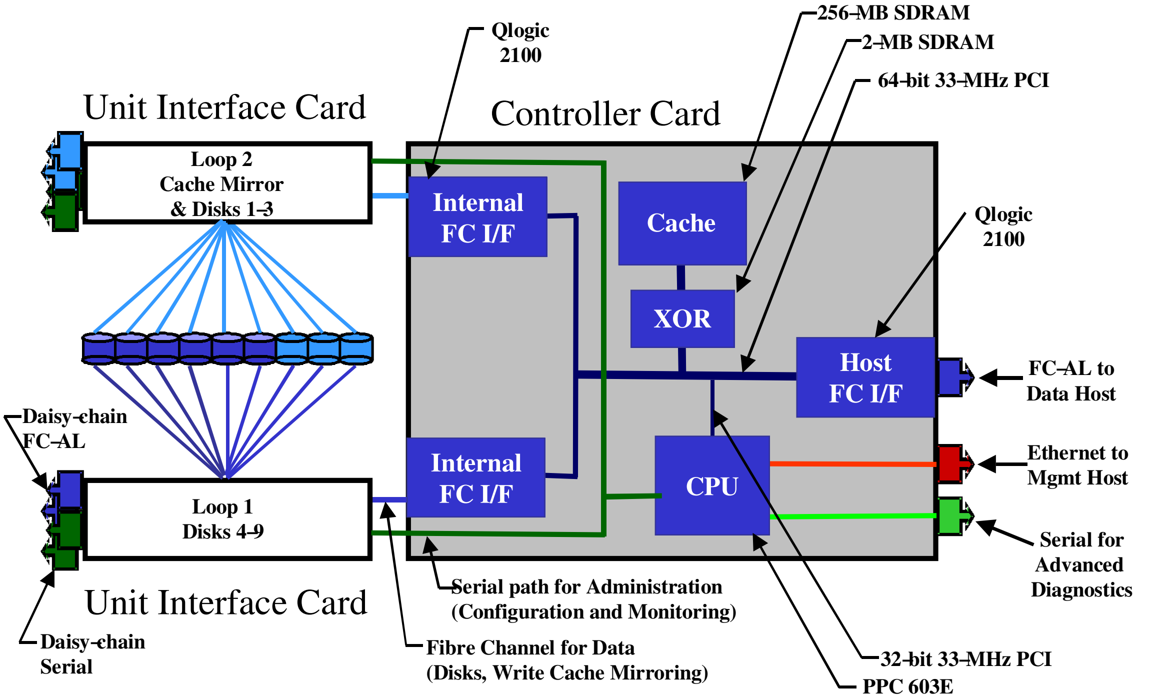


Figure 3. Architecture of the Sun StorEdge T3 array (single controller unit configuration)

The system administrator can attatch two units by using the interconnect cables on each unit interconnect card. These interconnect cables carry the Fibre Channel loops and control buses. The Fibre Channel loops are redundant loops between units and the control buses are redundant buses between units. This allows any RAID controller in the system to access the control bus on any unit in the system.

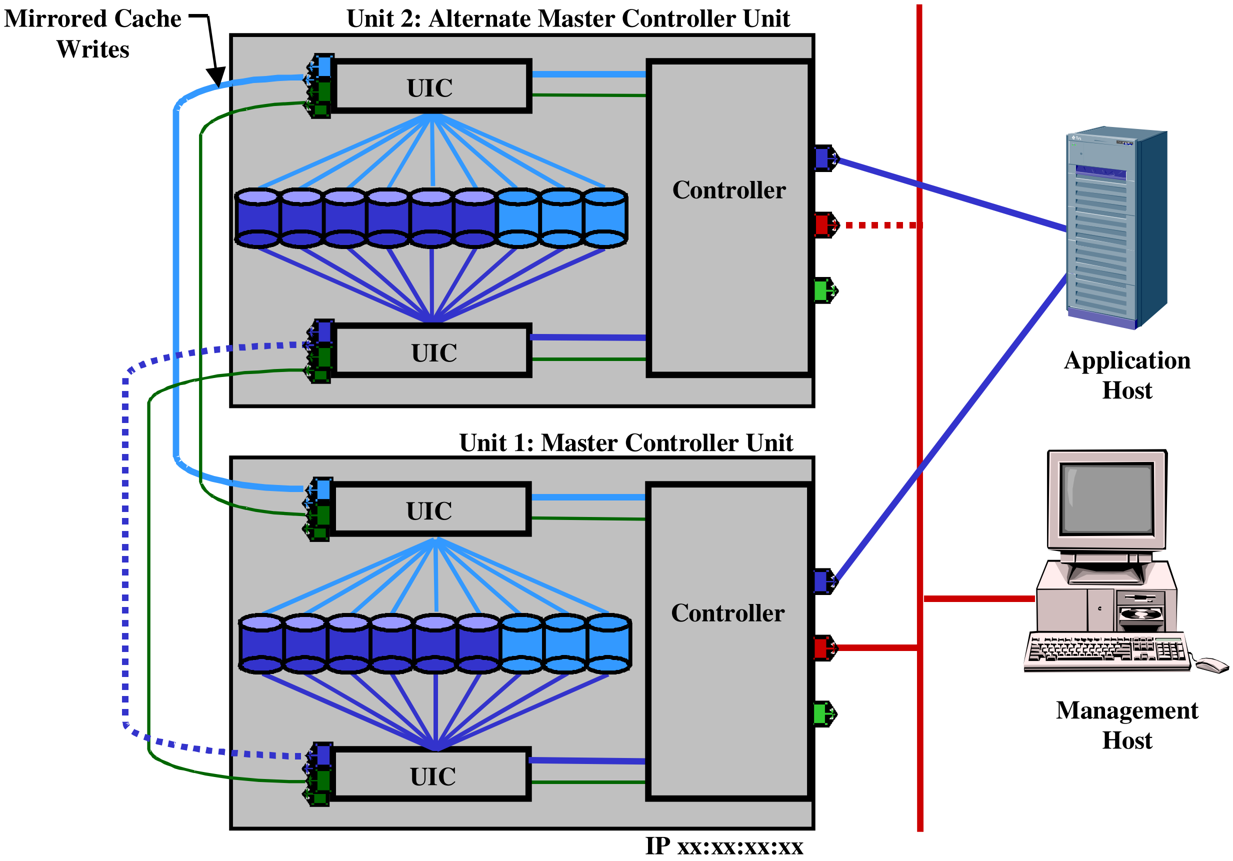


Figure 4. Architecture of the Sun StorEdge T3 array (dual controller unit configuration)

The Sun StorEdge T3 array uses dual–ported Fibre Channel disk drives and the interconnect circuitry for each loop is on its own Fibre Channel unit interconnect card. Each unit interconnect card includes software–controlled switches for breaking a loop into multiple Fibre Channel loops, all of which can be used simultaneously. Each RAID controller has its own loop for accessing its drives. The second loop is for cache mirroring between pairs of RAID controllers. If a drive loop fails, the RAID controller uses the second loop to access drives.

The system administrator can hot plug all storage unit components into the passive midplane. Components include nine FC–AL disk drives, two power/cooling units, two unit interconnect cards, and a RAID controller card. Two control buses and one sense bus within each unit carry the command signals, sense signals, and diagnostic information for logging. These buses also carry sense signals from other components within the system, for example, the on–battery signal from the power/cooling unit.

The RAID controller card includes an RS–232 COM service port and a 10BASE–T Ethernet network connection. The service port is used by maintenance and service technicians for setup and diagnostic procedures. The Ethernet connection provides a system–management interface to a management console. The external cables on each unit include a single host FC–AL cable, two power cables, and a 10BASE–T Ethernet cable.

Drives

Every Sun StorEdge T3 unit is configured with nine dual−ported Fibre Channel (FC−AL) disks of 18−GB or 36−GB capacity (as disks of larger capacity become available, the Sun StorEdge T3 array will support those drives). Each disk is positioned within a custom enclosure that can hold either half−height or low−profile drives. The drive plus enclosure constitutes the disk FRU. The disks are configured as RAID 5, RAID 1, or RAID 0. The ninth disk may optionally be configured as a hot−spare or standby drive.

Each drive has a private region of 200 MB reserved for system use. All remaining capacity is available for use by the application host.

RAID controller

The controller is both the data processing and administrative “brain” of the Sun StorEdge T3 array. It provides all the array’s external interfaces and controls all back−end activities, whether they be related to data management or administration. The controller’s data host interface is a Qlogic 2100 Fibre Channel (FC−AL) ASIC. It connects to a 64−bit, 33−MHz PCI bus, which functions as the backbone of the Sun StorEdge T3 array. Also residing on the PCI bus is 256 MB of SDRAM cache, with a proprietary inline FPGA XOR engine that has 2 MB of SDRAM. Two more Qlogic 2100s provide the interfaces to two back−end FC−AL loops. Finally, there is a bridge chip on the backbone, providing a transition to a 32−bit, 33−MHz PCI administration bus to the controller CPU.

The administration bus also connects to the controller FLASH PROM/FRU ID, external 10BASE−T Ethernet port, and serial line interface to an external RS232 serial port, and two internal serial lines to the unit interconnect cards.

The external ports use standard connectors: DB9 for FC−AL, RJ45 for Ethernet, and RJ11 for the serial port. Pinouts are provided in the product documentation.

The controller PCU is a PowerPC 603E running at 200 MHz. Note that the CPU is not on the system bus; its role with regard to application data is limited to managing the data, not manipulating it. Although the CPU controls DMA transfer of data between host interface FC−AL ASIC and cache, and between cache and back−end FC−AL ASICs, data never travels through the CPU itself. Even XOR parity calculations are performed not by the CPU but rather by the inline XOR engine, as data moves in and out of cache. This efficient data flow is a key factor in achieving superior RAID 5 performance in the Sun StorEdge T3 array.

Note that because the Ethernet and serial lines are also isolated from the controller backbone, it is not possible to transfer data through the external Ethernet or serial ports. They are available exclusively for administration, just as the external FC−AL loop is available exclusively for application I/O.

RAID 5 Parity Engine

The Sun StorEdge T3 array is designed for outstanding Fibre Channel RAID 5 performance. The system employs a revolutionary hardware−pipelined, XOR engine (pXOR) that operates, and can calculate parity data, at the full internal data bus speed of the array. This helps reduce the requirement for cache memory accesses, which serve as a bottleneck in most RAID 5 arrays.

The Sun StorEdge T3 array’s pXOR unit helps improve performance by reducing mechanical disk seek and latency periods. The pXOR engine does this by accumulating partial XOR sums (up to 128), allowing the array to accumulate stored write−behind data in its cache memory and deliver it to the disk back−store in large chunks that can take advantage of the command sorting feature of the disks. Reducing mechanical wait states is among the best ways to improve application performance.

In addition, the Sun StorEdge T3 array's ability to optimize physical disk I/O access patterns directly delivers improved application response time and improved overall system performance.

Cache

Each controller has 256 MB of data cache. Writing to cache improves write performance by staging data in cache, assembling the data into data stripes, and then destaging the data from cache to disk, when appropriate. This method frees the data host for other operations while cache data is being destaged, and it virtually eliminates the read–modify–write delays seen in non–cache systems. Read cache improves performance by determining which data will be requested for the next read operation and prestaging this data into cache. RAID 5 performance is also improved by coalescing writes.

The purpose of the data cache in the Sun StorEdge T3 Array primarily is to provide a low latency buffer for write data, allowing writes to be quickly acknowledged to the application host. The cache is especially crucial to RAID 5 write performance, because it can coalesce several partial–stripe writes into a single read/modify/write operation. A secondary benefit of the cache is to buffer read data, allowing for low latency on repeated reads of the same data.

A key feature of the Sun StorEdge T3 array is that its cache is adaptive. The algorithms used for allocating, coalescing, and flushing data are automatically and dynamically adjusted based on I/O patterns. This limits the amount of cache configuration needed to be performed by the user, thus greatly simplifying administration, improving ease of use, and ensuring that cache behavior is optimal for current I/O patterns.

The Sun StorEdge T3 array's block size is set by the user to be 16, 32, or 64 KB. This defines both the size of the cache buffers and the unit of data written to each disk in a RAID stripe. Note that the Sun StorEdge T3 array's block size is not necessarily equal to the host I/O size; in fact, for OLTP operations is often advantageous to make the Sun StorEdge T3 array's block size eight times that of the host I/O size.

Each Sun StorEdge T3 array block is divided into eight segments. Depending on the back– end I/O operation, the atomic I/O operation is either a block or a segment.

All data in the cache is read cache. Therefore, all data—regardless of whether it has been read or written into cache, or is dirty or clean—is available for subsequent host read requests as a cache hit. Dirty write data is limited to 80 percent of cache, helping to ensure that some cache space will always be available for read–ahead data. If write data volume reaches the 80 percent threshold, then the CPU will cause a small amount of dirty data to be flushed to disk to free up space for incoming writes.

Writes are cached only when write–behind mode is enabled. In general, dirty write data will be flushed to disk when the 80 percent threshold has been reached, or when the system is idle. Which data is flushed is determined by a a least–recently written algorithm, allowing blocks actively receiving writes to remain in cache to maximize the chances for coalescing write.

Cache is also flushed when write–behind mode is disabled and write–through mode goes into effect. In this case, all dirty write data is flushed to disk, and no further writes are acknowledged until they are fully committed to disk. This occurs during certain error conditions—such as power failure or a when a controller fails, removing the safety net of mirrored cache—when the unit is reset, resynced, or powered down.

Configuration Details

In each Sun StorEdge T3 array, the nine disk drives are configured into one or two logical volumes or LUNs, which are the atomic units presented to the application host. In other words, the application host does not see the individual disk drives.

To employ other configuration options, the user must adhere to the following configuration rules:

- LUNs must consist of whole disks.
- A disk may not be partitioned into different LUNs.
- LUNs may not span physical trays.
- There is a maximum of two LUNs per tray.
- The minimum size for RAID 1 LUNs is two disks, and maximum size is nine disks.
- The minimum size for RAID 5 LUNs is three disks and maximum size is nine disks.
- If a hot spare is used, it must be used with all LUNs in a given tray, and it must be declared when the first LUN on a tray is created.

These rules may appear restrictive, but they provide for great simplicity of configuration. The user has to make only these decisions:

- Will there be a standby (hot spare) drive?
- How many LUNs, one or two? If two, how many disks for each LUN?
- What RAID level is required for each LUN?
- What kind of administration is required (LUNs, systems)?
- What caching/mirroring should be used (on, off, or auto)?
- What kind of write through should be used (write behind, auto, or off)?

Unit Interface Cards (UIC)

The unit interface card (UIC) has three inter–related functions: join units in a daisy chain, perform back–end loop switching, and complete diagnostics. There are two UICs per Sun StorEdge T3 unit, one for each back–end loop.

The UIC architecture is deceptively simple. Loop resiliency circuitry (LRC) acts as an internal Fibre Channel switch, connecting all back–end Fibre Channel components in a star configuration. This includes all nine drives, one of the back–end Qlogic 2100s on the controller board, and one pair of unit daisy–chain ports. The LRC also provides Fibre Channel clock regeneration.

The remainder of the UIC consists of an 8051 CPU connected to FLASH PROM FRU ID, control/sense registers, and a dual UART. The CPU is connected to the LRC through the registers, which collect and maintain component status and diagnostic states. The administration serial line from the controller CPU connects through the midplane to the UIC CPU, and then to the dual UART, which extends one serial line to each of the two back–end external ports.

The LRC switching capability gives the Sun StorEdge T3 array unique back–end reliability, availability, and scalability (RAS) capabilities. In normal operation, each UIC selectively enables a subset of its components for purposes of load balancing, cache mirroring, and redundancy. First, consider normal operation.

The Sun StorEdge T3 array's Unit 1, Loop 1 UIC enables the Loop 1 back–end controller ASIC and drives 4 through 9. Any I/O requests to a volume on Unit 1 that include data on drives 4 through 9 travel through this loop. Note that the Loop 1 back– end daisy chain ports are not enabled on the loop. Therefore, Unit 1, Loop 1 and Unit 2, Loop 1 are maintained as two independent loops.

The Sun StorEdge T3 array's Unit 1, Loop 2 UIC enables the Loop 2 back–end controller ASIC, drives 1 through 3, as well as the Loop 2 back–end daisy chain ports. The same applies to Unit 2. This means that for the entire partner group, there is just one Loop 2, which spans both units: from the U1C1 Loop 2 ASIC to its Loop 2 UIC (including drives 1–3), to the U1 Loop 2 back–end daisy chain ports, to the U2 Loop 2 back–end daisy chain ports, to its Loop 2 UIC (including drives 1–3), to the U1C1 Loop 2 ASIC.

This back−end configuration of three loops for the partner group provides static load balancing in normal operation. Two of the loops share the load for six drives. The third loop, which spans both units, also carries the load for six drives (three in each unit), plus any mirrored cache writes.

This LRC switching function also provides unique and powerful diagnostic capabilities. In case of failure on a loop, the UIC systematically can switch components in and out of the loop until the offending component has been identified. Then, the UIC can switch off that component until it is replaced, fencing it off from the loop, and allowing the loop to be restored to active use. Note that if the offending component is a disk drive, and if the cause of the failure is one of the FC−AL ports on the drive, then the drive continues to be available on the other loop via its second FC−AL port.

In addition to this connection supporting the customer data over the fiber data path, there is also a serial connection for the administrative data over the control path. The fiber cable and connector and the serial cable and connector are integrated into a single cable and connector that links the controller unit and expansion unit to the next unit in the stack.

Reliability, Availability, and Serviceability

These are some of the reliability, availability, and serviceability (RAS) features of the Sun StorEdge™ T3 array.

Reliability

Reliability features include the following:

- Error checking and correction on disk drives
- Skip sectors and spare cylinders on disk drives
- Automatic sector reallocation on RAID controller
- Link redundancy chip and 8− to 10−bit encoding on FC−AL loops
- Parity on data cache
- Passive midplane (except ID signature) and temperature sensor

Availability

Availability features include the following:

- Redundant power supplies with integrated UPS and dual power cords
- Electrically isolated N+1 fans
- Redundant unit interconnect cards and interconnect cables
- Redundant drives (RAID), standby drives, and drive loops
- Redundant RAID controllers for automatic failover and cache mirroring (in dual−unit system)
- Redundant host interfaces (in dual−unit system)

Serviceability

The system administrator may selectively replace unit components as needed. Serviceability features include the following:

- Low FRU count (three excluding drives and cables)
- All FRUs can be hot−swapped with no tools required (except for chassis)
- Status/failure LED on every FRU
- All FRUs electronically identifiable
- Fibre Channel world−wide−name support
- Online installation, scaling, and service
- Upgradeable drive firmware (with only the associated volume offline during upgrade)
- Detection and reporting for incorrect drive position
- Automatic drive−ID selection

Specifications

Specifications for the Sun StorEdge™ T3 controller unit array include the following.

Performance	**Specifications**
Bandwidth	77 MB/second writes, 93 MB/second reads
IOPS	4400 per controller unit, 100% reads 8−KB IOs
RAID disk capacity	Nine x 18.2−GB (163 GB total) or Nine x 36.4−GB (327−GB total) raw
Controller read/write cache	256 MB
Physical Planning	
Tabletop unit dimensions	5.5 inches high 3U (13.97 cm), 17.5 inches wide (44.45 cm), and 18.5 inches deep (46.99 cm)
Weight	67 pounds (30.15 kilograms) maximum with half−height drives
Input power	450 watts maximum
Auto−ranging	100/240 VAC at 4763 Hz single−phase
FRU access at front	Disk drives
FRU access at rear	Controller card, unit interconnect cards, and power/cooling units
Environmental (operating)	
Temperature	5 to 35C, maximum gradient 20 C per hour
Relative humidity	20 to 80% noncondensing, maximum gradient 10% per hour
Effective altitude	−1,000 to +10,000 feet (−305 to +3,048 meters)
Shock (from any axis X, Y, Z)	4.0 g for maximum duration of 11 ms (half sinewave)
Vibration (from any axis X, Y, Z)	5 to 500 Hz at 0.25 g
Environmental (nonoperating)	
Temperature	−20 to 60 C, maximum gradient 20 C per hour
Relative humidity	5 to 93% noncondensing, maximum gradient 10% per hour
Effective altitude	−1,000 to +40,000 feet (−305 to 12,192 meters)
Shock (fr	

Performance	**Specifications**
Power plug	NEMA 5−15P
Standards compliance	
Safety and emissions	FCC Class A, UL/CSA, CE
Interfaces and protocols	FC−AL, SCSI, HTTP, HTML, Telnet, and FTP
Policies	Y2K, L10n, I18n (except RAID controller firmware)
Other	RS232C Ethernet 802.3

Performance Summary

The Sun StorEdge™ T3 array performance test results were run using 18−GB disks. The goal of the benchmark activities was to measure the Sun StorEdge T3 performance characteristics, understand the performance, tune performance if any parameters can be tuned. Numerous configurations were tested, including different RAID levels.

The Sun StorEdge T3 disk tray's default parameter settings provide a basis for good performance. Optimal performance for a given workload can be achieved with minor changes to these default settings.

The Sun StorEdge T3 disk tray performs predictably, so minor variations in workload result in small changes in performance. Any parameters can be tuned.

Note: *All benchmark results are subject to change. These results are correct as of June 15, 2000.*

Key Findings

The Sun StorEdge T3 disk tray performs best when I/O requests are greater than or equal to 64 KB, for example, in DSS applications. With I/O−intensive applications such as online transaction processing (OLTP), the Sun StorEdge T3 disk tray performs comparably to existing Sun StorEdge arrays.

Sun StorEdge T3 array parameters are as follows:

- 32−KB stripe unit, full−stroke seek range (130 GB for RAID 5, 70 GB for RAID 1).
- For random I/O operation, cache memory and cache mirroring were enabled when two Sun StorEdge T3 arrays were configured.

Host parameters are as follows:

- 128−thread workload, 2−KB I/O for random read and 32−thread workload, 2−KB I/O for random write.
- For sequential read and sequential write, 512−KB I/O for RAID 5 and 576−KB I/O for RAID 1.

RAID Performance

In the RAID 1 performance figures below, RAID volume is configured as RAID 1, 9 x 18−GB disks.

RAID 1	Sun StorEdge T3 Array for the Workgroup (1 tray)	Sun StorEdge T3 Array for the Enterprise (2 trays)	Block Size (KB)	I/O Size (KB)
Sequential Read	60 MB/sec.	117 MB/sec.	64 KB	512 KB
Sequential Write	64 MB/sec.	83 MB/sec.	64 KB	512 KB
Random Read	1584 IOPS	3118 IOPS	16 KB	2 KB
Random Write	856 IOPS	1458 IOPS	16 KB	2 KB

In the RAID 5 performance figures below, RAID volume is configured as RAID 5, 8+1, 9 x 18–GB disks.

RAID 5	Sun StorEdge T3 Array for the Workgroup (1 tray)	Sun StorEdge T3 Array for the Enterprise (2 trays)	Block Size (KB)	I/O Size (KB)
Sequential Read	93 MB/sec.	123 MB/sec.	64 KB	512 KB
Sequential Write	77 MB/sec.	115 MB/sec.	64 KB	512 KB
Random Read	1680 IOPS	3316 IOPS	16 KB	2 KB
Random Write	620 IOPS	1180 IOPS	16 KB	2 KB

Cache Memory and Mirroring

Enabling cache mirroring reduces performance for small, sequential write operations by about 50 percent, since only about half the cache memory is available per controller, and the controllers have the overhead of copying writes synchronously. Read and large write operations, and small, random write operations perform roughly the same as without cache mirroring enabled.

Seek Range

The seek range has a significant impact on IOPS and response time. In general, as the seek range decreases, performance increases, which is true for all network storage systems. The tables below show the seek ranges used in this benchmark.

Two Sun StorEdge T3 arrays, seek range performance data, 32 threads:

RAID 1	Seek Range		
	4 GB	14 GB	70 GB
Random read	152 %	125 %	100 %
Random write	173 %	118 %	100 %

Two Sun StorEdge T3 arrays seek range performance data, 32 threads 100 percent defined as full–stroke IOPS. At RAID 5, 4–GB seek range, it is 92 percent more IOPS:

RAID 5	Seek Range		
	4 GB	26 GB	130 GB
Random read	162 %	127 %	100 %
Random write	192 %	115 %	100 %

RAID Levels

The Sun StorEdge T3 array performance with RAID 5 is comparable to performance with RAID 1 for most workloads, except in random write operations. The chief exception is in small, random write operations, where the disk trays configured as RAID 1 perform approximately 20 percent better.

Predictable Performance

The Sun StorEdge T3 array performs consistently, so minor variations in workload result in small changes in performance. As a result of this predictability, you can extrapolate what kind of performance to expect from the StorEdge T3 disk tray in different workload environments, based on the data available in this report.

The equipment and configurations used in the Sun StorEdge T3 array performance benchmark are shown below.

Server

- PCI—Sun Enterprise™ 450 server, two CPUs, PCI host bus adapters, 1024 MB of memory
- SBus—Sun Enterprise 4500 server, two CPUs (167 MHz), 4 SBus host bus adapters running Solaris™ 2.6 Operating Environment software, with the latest patches.

Sun StorEdge T3 Disk Trays

- Four disk tray units, with one controller per unit
- Firmware—nb91.bin, perfbin.91, nb093.bin, nb094.bin
- EPROM—2.04, 2.06, 2.08
- LPC—04.06, 04.07, 04.09
- Disk drives—Seagate ST118202FC. 18 GB, 10000 rpm. Revision: EA29
- Cache memory—256 MB

Software

- Solaris 2.6 Operating Environment or later releases, with the latest patches
- Spectral Benchmark Facilities Benchmark software
- VERITAS Volume Manager 3.0.4 software
- Solstice DiskSuite™ 4.2.1 software

Block Size

Block size, which is also known as stripe unit size, is the size of the data unit being "striped" across the disks. Block size affects performance as expected. For applications with a large number of sequential I/O requests, such as decision support systems (DSS) and high performance computing (HPC), a block size of 64 KB is beneficial. For latency−sensitive applications such as OLTP applications, using a 16−KB block size is best. Other applications that are between the two extremes may perform best with the 32−KB block size. The block size setting for the Sun StorEdge T3 array also determines internal settings in the controller (such as number of parallel XOR operations the controller can perform) which affect the self−tuning behavior of the array. This is the single−most important "tuning knob" for the array.

Reconstruction Time

Degraded mode occurs when a disk drives fails without a hot spare being available in the configuration. The reconstruction mode occurs during one of the following scenarios:

- When the Sun StorEdge T3 unit is reconstructing all of the failed drive information to the hot spare drive from parity or mirror drive information.
- When a failed disk drive is replaced with new disk drive.

In degraded mode, a Sun StorEdge T3 array with a logical volume containing a failed disk drive showed a significant decrease in performance. However, the second logical volume in the partner group operated normally without any performance changes. The reconstruction time varied, depending on how the "reconstruction rate" parameter is set and the number of I/O requests from the host. The higher the reconstruction rate parameter is set, the faster the reconstruction rate and the slower the I/O to the host.

Tuning

Unlike most enterprise–class RAID arrays on the market today, the Sun StorEdge T3 array avoids the myriad of tuning parameters that making tuning performance an art. There are three primary factors to tune in the Sun StorEdge T3 array, and each has only one or two settings that make sense for a particular situation. These parameters are RAID level, stripe unit size, and reconstruction rate.

RAID Level

The Sun StorEdge T3 array offers the choice for RAID 0, RAID 1, and RAID 5. For almost all applications, RAID 5 is the appropriate choice. RAID 0 has great performance, but low reliability. It may be appropriate for limited applications such as storing temporary or reproducible data, but is not appropriate for general–purpose use unless combined with some sort of software RAID layer to add reliability. RAID 1 performs better than RAID 5 for small random write situations, but the performance benefit generally does not make up for the higher cost of mirrored storage. Unless the workload in question consists of 40 to 50 percent or more small random writes, the price/performance is likely to be the same or better using RAID 5. For a slightly higher cost than RAID 1, it may be possible to purchase twice as many arrays configured as RAID 5 and spread out data accesses across these additional arrays.

Stripe Unit Size

There are three possible stripe unit size (or block size) settings for the Sun StorEdge T3 array. These are 16, 32, and 64 KB, and should be matched to the I/O size of the application. In general, transaction–processing environments (such as most database, ISP, and EPR applications) use a small I/O size and benefit from using a 16–KB stripe unit size. Applications that tend to use large I/O sizes (such as HPC, data warehousing, and imaging) tend to benefit from using a 64–KB stripe unit size. Applications that use a medium I/O size (such as NFS file servers, especially in a data–intensive environment) should fare best with a stripe unit size in the middle, so a 32–KB setting is recommended. The choice of stripe unit size intuitively follows the I/O size of the application, and should be easy to select once the application environment is understood.

Reconstruction Rate

The reconstruction rate is number between 1 and 16, and by default is set to 8. The setting controls how much reconstruction I/O the controller can do between servicing host I/Os. The default setting of 8 is a good compromise between acceptable performance to the host and time to completely reconstruct the data (which is also the window of vulnerability to a catastrophic double–failure). If the reconstruction time needs to be as short as possible and severely degraded performance is acceptable, the reconstruction rate should be increased closer to 16. If the host performance needs to be as high as possible and reconstruction time is not important, the reconstruction rate should be decreased closer to 1. At the extremes of 1 and 16 the controller is almost entirely dedicated to serving host I/O in degraded mode or reconstructing lost data onto a fresh disk. In general, use the default setting of 8 unless the application has a strong compelling reason to use another setting.

Capacity Planning

Capacity planning involves understanding the overall system demand today and in the future, and configuring sufficient resources to have a high level of confidence in meeting those demands. Using the Sun StorEdge T3 array, capacity planning is very easy. Characteristics such as linear scalability, predictable performance, and simplified tuning help minimize many of the traditional capacity planning challenges.

Version (v2.0) of the Configuration Rules for Mission−Critical Storage incorporates the Sun StorEdge T3 array and provides more information on capacity planning. Using that document even a novice engineer can arrive at a well−designed and sized configuration. The Configuration Rules may be found on−line internal to Sun at:

- `http://reseller.sun.com/products/storage/config`

Requirements and Configuration

System Requirements

Supported hardware and software for the Sun StorEdge™ T3 array includes the following.

Host Bus Adapters (HBAs)

- PCI FC−AL single−loop adapter, 100 MB/second optical interface (X6729A)
- FC−AL 100 MB/second dual−channel SBus host adapter with one GBIC module (X6730A)

Storage Network Interconnect

- Media interface adapter (MIA)
- Maximum 50−nm multimode fiber optic cable length of 500 meters

Host Platforms

- Sun Ultra™ 60 and 80 workstations (desktop)
- Sun Enterprise 250, 220R, 450, 420R servers (workgroup)
- Sun Enterprise 3500, 4500, 5500, and 6500 servers (enterprise)
- Sun Enterprise 10000 server (data center)

Current Platform Support Matrix

Platform	Max. Sun StorEdge T3 Direct−Attach Arrays 18/36−GB Disk	Max. Sun StorEdge T3 Hub−Attached Arrays 18/36−GB Disk	Max. GB	Host Bus Adapter
Ultra 60 workstation	4	0	1.3 TB	X6729A
Ultra 80 workstation	4	0	1.3 TB	X6729A
Sun Enterprise 220R server	3	0	982 GB	X6729A
Sun Enterprise 250 server	4	0	1.3 TB	X6729A
Sun Enterprise 420R server	3	0	982 GB	X6729A
Sun Enterprise 450 server	8	0	2.6 TB	X6729A
Sun Enterprise 3X00 server	16	16	5.2 TB	X6730A
Sun Enterprise 4X00 server	16	16	5.2 TB	X6730A
Sun Enterprise 5X00 server	16	16	5.2 TB	X6730A
Sun Enterprise 6X00 server	16	16	5.2 TB	X6730A
Sun Enterprise 10000 server	64	64	20 TB	X6730A
Note: *For the Sun Enterprise 10000 system, an 88−TB configuration with 36−GB drives will be available in August 2000.*				

Host Operating Environments

Operating Environment	Patches Required	
Solaris™ 2.6 Operating Environment	• ssd	T105356 or later
	• ifp	Q107280 or later
	• sf/socal	T105375–23 or later
	• format	106226 or later
	• kernel update	105181 or later
	• ifp Fcode	109399 or later
	• sf Fcode	109400 or later
Solaris 7 Operating Environment	• ssd	T107458 or later
	• ifp	T107292–06 or later
	• sf/socal	T107469–76 or later
	• ifp Fcode	109399
	• sf Fcode	109400
	• luxadm	107473 or later
	• DKIO	107834 or later
	• kernel update	106541 or later
Solaris 8 Operating Environment	• ssd	T109524–02 or later
	• ifp	T109189–02 or later
	• sf/socal	T109460–02 or later
	• ifp Fcode	109399
	• sf Fcode	109400

Note: *In Q1FY01, the Sun StorEdge T3 arrays will support Microsoft Windows NT 4.0 with Service Pack 5.*

Software Compatibility

Sun has extensively tested the Sun StorEdge T3 workgroup and enterprise arrays for compatibility with Sun server, storage, and storage software product lines. This includes the Sun Ultra 60 workstation, the Sun Enterprise 10000 storage environments, and all currently shipping Sun StorEdge array products (D1000/A1000, A3X00, A3500FC, and A5X00). Numerous software packages have also been rigorously tested across these platforms, including:

- Sun StorEdge Instant Image 2.0
- Sun StorEdge Network Data Replicator (SNDR) 2.0
- Solstice Backup™ 5.5.1
- Solstice DiskSuite™ 4.2 and 4.2.1
- Sun Enterprise Server Alternate Pathing (AP) 2.3.1 (available Q1FY01)
- Sun Management Center 2.0.1
- Sun StorEdge Component Manager (CM) 2.1
- Sun Remote Services (SRS) 2.0.1
- StorTools™ 3.3
- Sun Cluster 2.2 (available in selected configurations Q1FY01)
- VERITAS NetBackup (NBU) 3.4
- VERITAS Volume Manager with DMP (VxVM) 3.0.4

- VERITAS File System (VxFS) 3.3.3

System Configuration

The Sun StorEdge T3 array is offered in two configurations, each providing different levels of availability, software, and services.

- The Sun StorEdge T3 array for the workgroup with a single RAID controller offers a reliable and cost–effective storage system with 163–GB or 327–GB capacity. This is available in tabletop or rack–ready versions. Features include:
  - Hardware RAID controller for RAID 0, 1, and 5
  - 256–MB read/write cache
  - Dedicated hardware RAID 5 XOR parity engine
  - Reliable single RAID controller design
  - Redundant power and cooling modules
  - Hot–spare disk drive
  - Sun Remote Services (SRS) Event Monitoring and Management service ready
  - Sun StorEdge Component Manager 2.1 for centralized array monitoring,configuration, and control
  - Sun standard 2–year product warranty
- The Sun StorEdge T3 array for the enterprise offers redundant RAID controllers for high–availability enterprise and datacenter environments. The enterprise models have fully redundant, hot–swappable hardware components, and capacities ranging from 327 GB up to 2.6 TB per cabinet. This array is available in tabletop, rack–ready, or rack–installed configurations with two, four, or eight arrays. Features include:
  - Dual high–availability hardware RAID controller for RAID 0, 1, and 5
  - 256–MB read/write mirrored cache
  - Dual dedicated hardware RAID 5 XOR parity engines
  - Redundant power and cooling modules
  - Hot spare disk drives
  - Dual host data paths
  - 2–year warranty with a SunSpectrum Gold℠ level service
  - Sun Remote Services (SRS) Event Monitoring and Management service ready
  - Sun StorEdge Component Manager 2.1 for centralized array monitoring, configuration and control
  - Volume Management with multipathing
  - Sun StorEdge ArrayStart installation and configuration service

Front Components

The front of the Sun StorEdge T3 unit provides user access to the unit's nine Fibre Channel RAID disk drives. Each disk drive has an 18.2−GB or 36.4−GB capacity, its own dual Fibre Channel interface and circuitry, and front−panel LEDs for drive activity (green) and status (amber).

To open the front cover (or bezel), the user depresses the latches on each side of the front panel and pulls forward to completely remove the bezel. The unit's nine disk drives are positioned sideways with their activity and status LEDs at top.

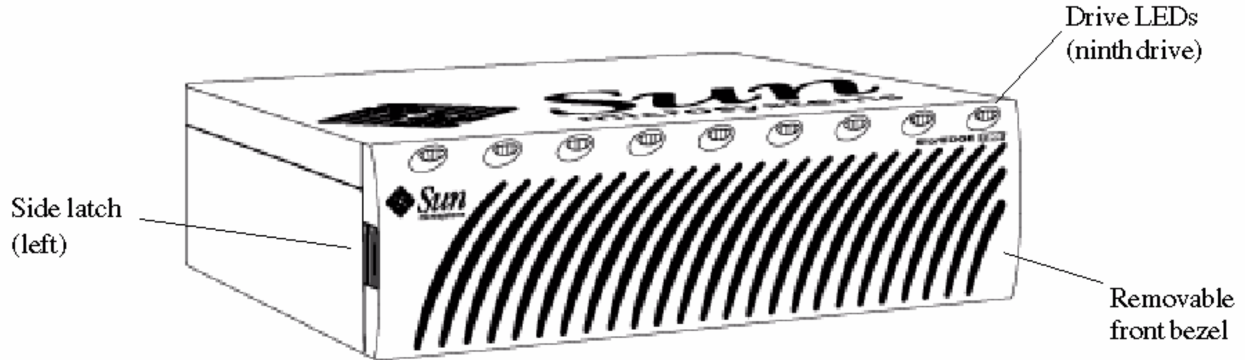


Figure 5. Front view of the Sun StorEdge T3 controller unit

Rear Components

The rear of the Sun StorEdge T3 controller unit provides user access to redundant Fibre Channel unit interconnect cards (lower left), one RAID controller card (lower right), and redundant power/cooling units (upper left and right):

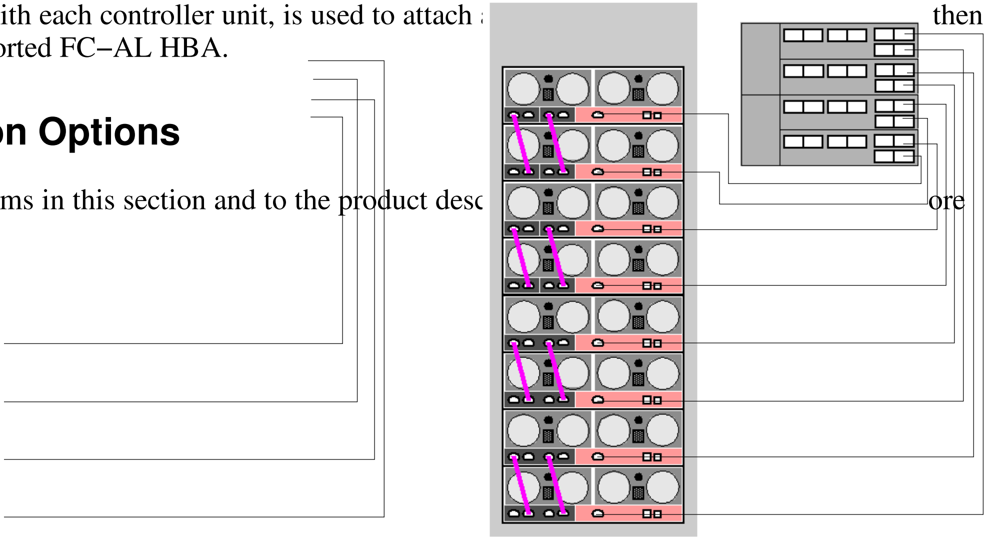
- Each of the two unit interconnect cards includes interface circuitry and two Fibre Channel connectors for interconnecting units.
- The RAID controller card includes RAID controller hardware and firmware, one host Fibre Channel interface, a 10BASE−T Ethernet host interface, and an RS−232 COM service port.
- Each of the two power/cooling unit contains a power supply, two cooling fans, an integrated UPS battery, and status indicators for AC LED (green/amber) and POWER OK LED (green).

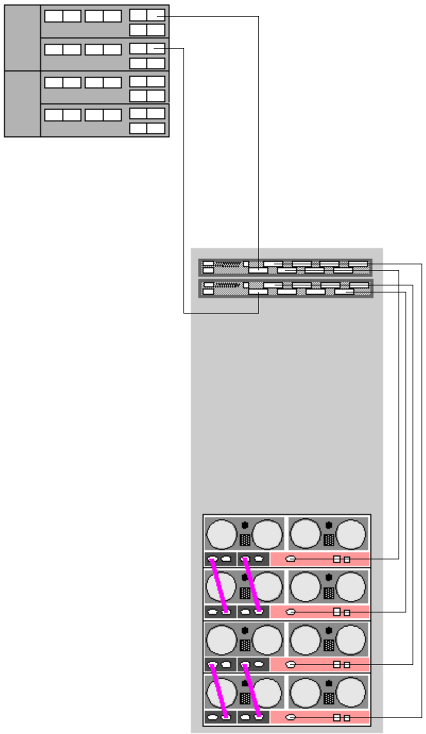
The unit interconnect cables may be replaced without taking the partner group offline. One cable MUST be in place at all times for the partner group to remain functional.

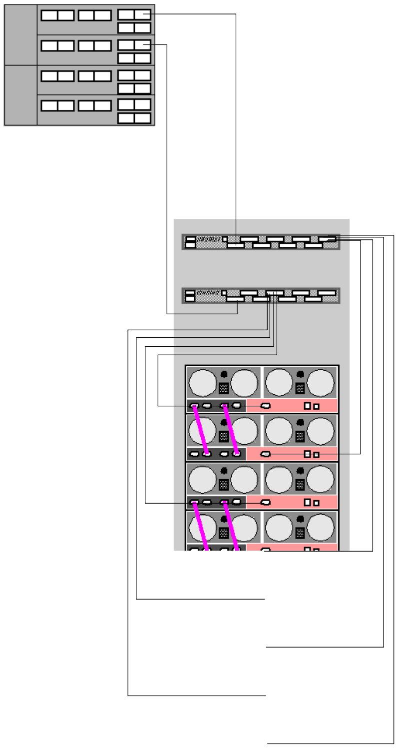
The RAID controller card has a single DB−9 copper FC−AL connector. A media interface adapter (MIA), supplied with each controller unit, is used to attach then attached to a supported FC−AL HBA.

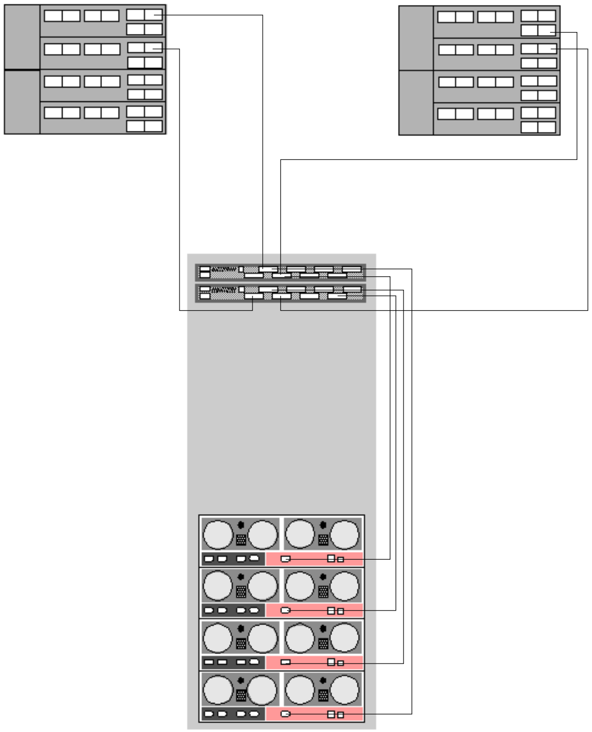
Configuration Options

Refer to the diagrams in this section and to the product desc ore details.

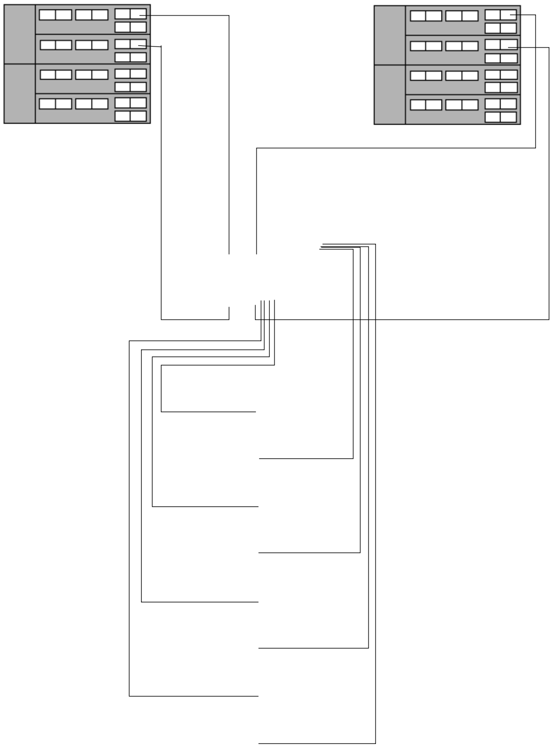








4 controllers, 2 hubs, 2 hosts



8 controllers, 2 hubs, 2 hosts

System Administration

System Maintenance

The modular design of the Sun StorEdge™ T3 array makes it easy to replace failed components. Field replaceable units (FRUs) include the following:

- RAID controller card
- Nine 18.2−GB or 36.4−GB, 10000−rpm, FC−AL disk drives
- Two Fibre Channel unit interconnect cards
- Two power/cooling units (including batteries)
- Empty chassis (with centerplane installed)
- Media interface adapter (MIA)

All major FRUs can be hot−swapped to ease system maintenance and prevent system downtime. The Sun StorEdge T3 array includes the following hot−swap components:

- RAID controllers, in a two−unit configuration (one must remain installed to maintain functionality)
- Preconfigured disk drives
- Fibre Channel unit interconnect cards (at least one per tray must remain installed and connected to corresponding unit interconnect card in paired tray to maintain connectivity)
- Power/cooling units (at least one must remain installed to maintain power)

The unit's nine disk drives can be accessed simply by opening the front cover of the enclosure. The rear of the Sun StorEdge T3 unit provides access to the other FRUs. See the "Requirements and Configuration" section for front and rear diagrams and additional information.

Localization and Internationalization

The Sun StorEdge T3 array is Year 2000 certified. This array is also fully compliant with localization and internationalization policies, with exception of the controller firmware and `syslog` entries.

Software Administration

This section describes the following aspects of software administration:

- Compatible Sun and third–party software products
- Supported host operating environments
- StorTools™ system diagnostic software
- Storage management software
  - Optional VERITAS Volume Manager software
  - Sun StorEdge™ Component Manager software

Compatible Sun and Third–party Software

- **Sun Software**
  - Sun StorEdge Instant Image 2.0
  - Sun StorEdge Network Data Replicator (SNDR) 2.0
  - Sun StorEdge Data Management Center 3.0
  - Solstice Backup™ 5.5.1
  - Solstice DiskSuite™ 4.2 and 4.2.1
  - Sun Enterprise Server Alternate Pathing (AP) 2.3.1 (Q1FY01)
  - Sun Management Center 2.0.1
  - Sun StorEdge Component Manager (CM) 2.1
  - Sun Remote Services (SRS) 2.0.1
  - Sun Cluster 2.2 (Available in selected configurations Q1FY01)
  - StorTools 3.3
- **Third–party Software**
  - VERITAS NetBackup (NBU) 3.4
  - VERITAS Volume Manager with DMP (VxVM) 3.0.4
  - VERITAS File System (VxFS) 3.3.3

Host Operating Environments

The Sun StorEdge T3 array supports the following host operating environments:

- Solaris™ 2.6, Solaris 7, and Solaris 8 Operating Environment

  Solaris Operating Environment PatchPro patches are available on the SunSolve℠ program web site at `http://sunsolve.sun.com.`

StorTools Software

The Sun StorEdge T3 array supports the StorTools 3.3 utility for diagnosing host–loop integrity. The RAID controller in the Sun StorEdge T3 array manages disk–loop integrity.

VERITAS Volume Manager Software

Optional VERITAS Volume Manager software supports and adds functionality to the Sun StorEdge T3 array RAID controller hardware.

Features	Benefits
• Host–based RAID levels 0, 1, 1+0, and 5	• Improves performance and data availability
• Dynamic multipathing	• Balances performance, adds reliability, and provides path fail–over
• Hot relocation	• Increases data availability
• Disk groups	• Facilitates movement of data between hosts
• Volume resizing	• Helps enable volumes to change as needs dictate
• File system expansion	• Helps enable file systems to grow dynamically
• On–line snapshots	• Facilitates on–line backups
• Graphical user interface	• Eases administration
• Performance analysis tool	• Helps enable problem (bottleneck) isolation and tuning

Sun StorEdge Component Manager Software

Sun StorEdge Component Manager software can be ordered with the Sun StorEdge T3 array as a no charge item. Sun StorEdge Component Manager software is a Jiro™ open storage management platform–compliant, server–installed, Java™ technology–based application for managing attached Sun StorEdge arrays and their hardware components. Administrators and service personnel who install, monitor, and maintain supported Sun StorEdge arrays can use Sun StorEdge Component Manager software to perform a variety of subsystem tasks:

- Monitor enclosures by using hardware polling, alarm notification, event logging, and remote reporting for abnormal conditions and activities.
- Display the status of enclosures, enclosure components, and their associated properties.
- Exercise control directives on some enclosure components, for example, powering off a disk.

Sun StorEdge Component Manager software provides out–of–band management through the Ethernet connection on the RAID controller of the Sun StorEdge T3 controller unit array.

Note: *Sun StorEdge Component Manager software does not manage the logical organization of stored data.*

Sun StorEdge Component Manager 2.1 software runs on Sun Enterprise 250, 220R, 450, 420R, 3X00, 4X00, 5X00, and 6X00, and 10000 servers, and also on Ultra 60 and 80 workstations. Sun StorEdge Component Manager 2.1 software runs under the Solaris 2.6, Solaris 7, or Solaris 8 Operating Environment, and also supports the Microsoft Windows NT platform.

Use the Sun StorEdge Component Manager software when a graphical representation of array and enclosure attributes is preferred over selected command–line actions. Sun StorEdge Component Manager software may not be suitable, on server platforms with small memory configurations. On such platforms, Sun StorEdge Component Manager software's memory consumption of 70 MB and up for multiple arrays may outweigh the advantages of its graphical services.

Market Value Proposition

Sun StorEdge Component Manager software is new GUI–based software for managing the physical attributes of one or more attached Sun StorEdge enclosures. Sun StorEdge Component Manager software enhances the reliability, availability, and serviceability of storage assets under its custody through:

- Enclosure discovery
- Intuitive health displays
- Alarm generation
- Log monitoring
- Hardware control

Product Positioning

Sun StorEdge Component Manager software is positioned as a Java technology–based storage management software plug–in that is accessible from the Sun StorEdge Management Console software. Sun StorEdge Component Manager 2.1 software is fundamentally a tool for controlling and monitoring the physical attributes of the Sun StorEdge T3 arrays. Sun StorEdge Component Manager software is ***not*** intended to address the logical organization of the data stored in those arrays.

In the larger picture, Sun StorEdge Component Manager software will take on the role of configuration, control, monitoring, and the diagnostic entry point for physical components. This will be an evolving effort over the next few years, and will encompass new Sun StorEdge arrays, switches, and tape subsystems.

Sun StorEdge Management Console Software

Sun StorEdge Management Console software implements elements of the Jiro open storage management platform through a collection of fundamental Java technology–based storage management functions. Sun StorEdge Component Manager software and other Java technology–based Sun StorEdge management services rely on the Sun StorEdge Management Console software for these functions:

- GUI navigation
- Common event notification
- Common logging
- Alarm generation
- Remote notification (phone home)
- Distributed managed object discovery and communications
- Persistent state

The Sun StorEdge Management Console software launcher window presents a GUI for navigating through Sun StorEdge Component Manager software features. The main window includes a toolbar that the administrator can use to launch a new Sun StorEdge Management Console window, the Alarm Viewer, the Log Viewer, or online help. This window also includes management application tabs for Health, Configuration, and Control, plus alarm status buttons.

Sun StorEdge Component Manager Software GUI

Sun StorEdge Component Manager software's graphical user interface (GUI) and underlying management services run as plug–ins under the Sun StorEdge Management Console. Sun StorEdge Component Manager software's look–and–feel is consistent with other Sun StorEdge management services that are under development.

Sun StorEdge Component Manager software allows administrators and service personnel to monitor, display, and control devices and activities within supported Sun StorEdge T3 arrays. Descriptions for Sun StorEdge Component Manager software's basic functions follow.

Function	Description
Enclosure discovery	Identify the set of storage arrays and associated enclosures managed by a host.
Enclosure monitoring–health	Monitor and log the operational status of one or more storage arrays and associated enclosures managed by a host.
Enclosure monitoring–alarm generation and viewer	Create, display, and manage alarms generated by abnormal events detected by Sun StorEdge Component Manager software. Notification can include a combination of visual alarms to the GUI, e–mail messages, or SNMP traps for remote reporting.
Enclosure management and control	Control storage array and associated enclosure components; enable and disable RAID controllers
Log viewing	View log entries by administrator. Logging provides auditing results of tasks executed by Sun StorEdge Component Manager software, or provides information about a sequence of events.
Log file monitoring	Monitor a log file continuously for particular string patterns. Once a pattern is identified, rules that are preset in the application can trigger alarms or events.

Architecture

Sun StorEdge Component Manager software is a client–agent model application. The client part is a lightweight Java technology–based application GUI. The agent part is also written in the Java programming language, and runs on a Solaris™ Operating Environment server (host) to which the storage enclosure is attached.

Sun StorEdge Component Manager software is comprised of three layers:

- The top layer is the GUI–client layer that accepts user commands and reports results.
- The middle layer is the application layer that contains the logic to initiate data acquisition, process information, and schedule and generate sets of actions.
- The bottom layer is the managed–objects layer that performs hardware commands to satisfy requests through the underlying Java Native Interface (JNI).

The three layers communicate through distributed object management facilities in the Sun StorEdge Management Console software.

Ordering Information

Sun StorEdge™ T3 Array Ordering

The following items are included with all Sun StorEdge™ T3 arrays:

- Sun StorEdge Component Manager 2.1 software (order part number SCMMS−210−9P99; item is no charge)
- Sun Remote Services and Event Monitoring and Management 2.0 software ready

Additional items included with the Sun StorEdge T3 array for the enterprise are:

- Installation and configuration service (Sun StorEdge ArrayStart™ service)
- VERITAS Volume Manager software (order part number VMGS−304−9999; item is no charge)

Part Numbering Scheme

Below is a description of the basic part numbering scheme.

Marketing Name	Configuration	Arrays/Controllers	Total Capacity	Rack/Revenue Rec.
(T3WG) T3 array for the workgroup	(TT) tabletop	(11) 1 array, 1 controller	Gigabytes	(GR4) 68−inch Sun Enterprise 5500, 6500 cabinet
(T3ES) T3 array for the enterprise	(RR) customer rack ready	(22) 2 arrays, 2 controllers		(R5) 72−inch Sun StorEdge cabinet
	(RK) Sun rack	(44) 4 arrays, 4 controllers		
	(RH) Sun rack with 2 hubs	(88) 8 arrays, 8 controllers		

Configuration Matrix

		Sun StorEdge™ T3 Array for the Workgroup	Sun StorEdge T3 Array for the Enterprise		
Configuration	**Drive**	**1 Array**	**2 Arrays**	**4 Arrays**	**8 Arrays**
(TT) Tabletop	18 GB	**XT3WG−TT−11−163**	**XT3ES−TT−22−327**		
	36 GB	**XT3WG−TT−11−327**	**XT3ES−TT−22−655**		
(RR) Customer rack ready; requires rackmounting kit	18 GB	XT3WG−RR−11−163	XT3ES−RR−22−327		
	36 GB	XT3WG−RR−11−327	XT3ES−RR−22−655		
(RR) Rack ready, mountable in Sun system cabinet or 72−inch Sun StorEdge cabinet. Rack must be ordered separately. • GR4 – 68−inch Sun Enterprise™ 5500, 6500 cabinet • R5 − 72−inch Sun StorEdge cabinet	18 GB	T3WG−RR−11−163GR4 T3WG−RR−11−163R5	T3ES−RR−22−327GR4 T3ES−RR−22−327R5		
	36 GB	T3WG−RR−11−327GR4 T3WG−RR−11−327R5	T3ES−RR−22−655GR4 T3ES−RR−22−655R5		
(RK) Sun rackmounted in 72−inch Sun StorEdge cabinet	18 GB			XT3ES−RK−44−655 T3ES−RK−44−655	**XT3ES−RK−88−1310** T3ES−RK−88−1310
	36 GB			XT3ES−RK−44−1310 T3ES−RK−44−1310	**XT3ES−RK−88−2620** T3ES−RK−88−2620
(RH) Sun rackmounted With two hubs in 72−inch Sun StorEdge cabinet	18 GB			XT3ES−RH−44−655 T3ES−RH−44−655	XT3ES−RH−88−1310 T3ES−RH−88−1310
	36 GB			XT3ES−RH−44−1310 T3ES−RH−44−1310	XT3ES−RH−88−2620 T3ES−RH−88−2620
		Included with Sun StorEdge T3 Array for the Workgroup	**Included with Sun StorEdge T3 Array for the Enterprise**		
Order SCMMS−210−9P99 no charge part number		Sun StorEdge Component Manager 2.1	Sun StorEdge Component Manager 2.1 software		
Included during mission−critical sales process. Line charges are additional.		Sun Remote Services Event Monitoring and Management 2.0 Ready	Sun Remote Services Event Monitoring and Management 2.0 Ready		
		Standard 2−year warranty	2−year Gold Level Service support		
			Installation and Configuration Service (Sun StorEdge ArrayStart™)		
			VERITAS Volume Manager 3.0.4 software. Order VVMGS−304−9999 no charge part number.		

Notes:

1. *Bold part numbers are the "Standard Configurations" with shorter lead times, e.g.,* ***XTES−RK−88−2620****.*
2. *All part numbers with NO X are factory assemble to order (ATO), e.g., T3ES−RK−44−1310.*

Sun StorEdge T3 Array for the Workgroup, One–Array Configurations

Order Number	Title and Description
XT3WG–TT–11–163	163–GB Sun StorEdgeT3 tabletop array for the workgroup (143–GB usable RAID 5 storage) 9 x 18.2–GB, 10000–rpm, FC–AL drives, 1 RAID controller 256 MB, preconfigured as one RAID 5 LUN (8+1), 1 copper FC–AL port, 1 copper–to–optic media interface adapter, one 5–meter fiber–optic cable, 2 power supplies w/ internal battery backup, 2 fans, 2 power cords, SRS ready.
XT3WG–TT–11–327	327–GB Sun StorEdge T3 tabletop array for the workgroup (286–GB usable RAID 5 storage) 9 x 36.4–GB, 10000–rpm, FC–AL drives, 1 RAID controller 256 MB, preconfigured as one RAID 5 LUN (8+1), 1 copper FC–AL port, 1 copper–to–optic media interface adapter, one 5–meter fiber–optic cable, 2 power supplies w/ internal battery backup, 2 fans, 2 power cords, SRS ready.
XT3WG–RR–11–163	163–GB Sun StorEdge T3 array for the workgroup (143–GB usable RAID 5 storage) 9 x 18.2–GB, 10000–rpm, FC–AL drives, 1 RAID controller 256 MB, preconfigured as one RAID 5 LUN (8+1), 1 copper FC–AL port, 1 copper–to–optic media interface adapter, one 5–meter fiber–optic cable, 2 power supplies w/ internal battery backup, 2 fans, 2 power cords, SRS ready, requires separately ordered rackmount rail kit (X9673, X9674). See Ordering Notes 1, 2, and 3 below.
XT3WG–RR–11–327	327–GB Sun StorEdge T3 array for the workgroup (286–GB usable RAID 5 storage) 9 x 36.4–GB, 10000–rpm, FC–AL drives, 1 RAID controller 256 MB, preconfigured as one RAID 5 LUN (8+1), 1 copper FC–AL port, 1 copper–to–optic media interface adapter, one 5–meter fiber–optic cable, 2 power supplies w/internal battery backup, 2 fans, 2 power cords, requires separately ordered rackmount rail kit (X9673, X9674), SRS ready. See Ordering Notes 1, 2, and 3 below.
T3WG–RR–11–163GR4	163–GB Sun StorEdge T3 array for the workgroup (9 x 18.2–GB, 10000–rpm FC–AL drives); rackmounted in 68–inch Sun Enterprise 5500/6500 cabinet (available Q2FY01).
T3WG–RR–11–163R5	163–GB Sun StorEdge T3 array for the workgroup (9 x 18.2–GB, 10000–rpm FC–AL drives); rackmounted in R5 72–inch Sun StorEdge cabinet.
T3WG–RR–11–327GR4	327–GB Sun StorEdge T3 array for the workgroup (9 x 36.4–GB, 10000–rpm FC–AL drives); rackmounted in 68–inch Sun Enterprise 5500/6500 cabinet (available Q2FY01).

Order Number	Title and Description
T3WG–RR–11–327R5	327–GB Sun StorEdge T3 array for the workgroup (9 x 36.4–GB, 10000–rpm FC–AL drives); rackmounted in R5 72–inch Sun StorEdge cabinet.

Sun StorEdge T3 Array for the Enterprise, Two–Array Configurations

Order Number	Title and Description
XT3ES–TT–22–327	327–GB Sun StorEdge T3 tabletop array for the enterprise includes, 2 arrays configured in 1 partner group, (286–GB usable RAID 5 storage) preconfigured as two RAID 5 LUNs (8+1) 2 RAID controllers, 256–MB cache, 18 x 18.2–GB, 10000–rpm, FC–AL drives, 2 copper–to–optic media interface adapters, two 5–meter fiber–optic cables, 2 unit interconnect cables, 2 power cords installation and configuration, 2–year SunSpectrum Gold℠, SRS ready.
XT3ES–TT–22–655	655–GB Sun StorEdge T3 tabletop array for the enterprise, includes 2 arrays configured in 1 partner group,(572–GB usable RAID 5 storage) preconfigured as two RAID 5 LUNs (8+1) 2 RAID controllers, 256–MB cache, 18 x 36.4–GB, 10000–rpm, FC–AL drives, 2 copper–to–optic media interface adapters, two 5–meter fiber–optic cables, 2 unit interconnect cables, 2 power cords installation and configuration, 2–year SunSpectrum Gold included, SRS ready.
XT3ES–RR–22–327	327–GB Sun StorEdge T3 array for the enterprise, includes, 2 arrays configured in 1 partner group,(286–GB usable RAID 5 storage) preconfigured as two RAID 5 LUNs (8+1) 2 RAID controllers, 256–MB cache, 18 x 18.2–GB, 10000–rpm, FC–AL drives, 2 copper–to–optic media interface adapters, two 5–meter fiber–optic cables, 2 unit interconnect cables, 2 power cords, installation and configuration, requires separately ordered dual rackmount rail kit (X9673, X9674); 2–year SunSpectrum Gold included, SRS ready. See Ordering Notes 1, 2, and 4 below.
XT3ES–RR–22–655	655–GB Sun StorEdge T3 array for the enterprise, includes 2 arrays configured in 1 partner group,(572–GB usable RAID 5 storage) preconfigured as two RAID 5 LUNs (8+1) 2 RAID controllers, 256–MB cache, 18 x 36.4–GB, 10000–rpm, FC–AL drives, 2 copper–to–optic media interface adapters, two 5–meter fiber–optic cables, 2 unit interconnect cables, 2 power cords installation and configuration, 2–year SunSpectrum Gold included, SRS ready, requires separately ordered rackmount rail kit (X9673, X9674). See Ordering Notes 1, 2, and 4 below.

Order Number	Title and Description
T3ES−RR−22−327GR4	327−GB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 18.2−GB, 10000−rpm FC−AL drives); rackmounted in 68−inch Sun Enterprise 5500/6500 cabinet (available Q2FY01).
T3ES−RR−22−327R5	327−GB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 18.2−GB, 10000−rpm FC−AL drives); rackmounted in R5 72−inch Sun StorEdge cabinet.
T3ES−RR−22−655GR4	655−GB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 36.4−GB, 10000−rpm FC−AL drives); rackmounted in 68−inch Sun Enterprise 5500/6500 cabinet (available Q2FY01).
T3ES−RR−22−655R5	655−GB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 36.4−GB, 10000−rpm FC−AL drives); rackmounted in R5 72−inch Sun StorEdge cabinet.

Sun StorEdge T3 Array for the Enterprise, Four−Array Configurations

Order Number	Title and Description
XT3ES−RK−44−655	655−GB Sun StorEdge T3 array for the enterprise includes 4 arrays configured in 2 partner groups, 572−GB usable RAID 5 storage preconfigured as four RAID 5 LUNs (8+1), 36 x 18.2−GB, 10000−rpm, FC−AL drives, 4 copper−to−optic media interface adapter, four 15−meter fiber−optic cables, 4−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, installation and configuration, 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.
XT3ES−RK−44−1310	1310−GB Sun StorEdge T3 array for the enterprise, includes, 4 arrays configured in 2 partner groups, 1144−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 36 x 36.4−GB, 10000−rpm, FC−AL drives, 4 copper−to−optic media interface adapter, two 15−meter fiber−optic cables, 4−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, installation and configuration, 2−year Spectrum Gold included, SRS ready. See Ordering Note 5 below.

Order Number	Title and Description
XT3ES−RH−44−655	655−GB Sun StorEdge T3 array for the enterprise, includes 4 arrays configured in 2 partner groups, 572−GB usable RAID 5 storage preconfigured as four RAID 5 LUNs (8+1), 36 x 18.2−GB 10000−rpm FC−AL drives, 4 copper−to−optic media interface adapter, two 15−meter fiber−optic cables, 4−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, 2 hubs with 5 GBICs each, installation and configuration, 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.
XT3ES−RH−44−1310	1310−GB Sun StorEdge T3 array for the enterprise, includes 4 arrays configured in 2 partner groups, 1144−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 72 x 36.4−GB, 10000−rpm, FC−AL drives, 4 copper−to−optic media interface adapter, two 15−meter fiber−optic cables, 4−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, 2 hubs with 5 GBICs each, installation and configuration, 2−year Spectrum Gold included, SRS ready. See Ordering Note 5 below.

Sun StorEdge T3 Array for the Enterprise, Eight−Array Configurations

Order Number	Title and Description
XT3ES−RK−88−1310	1310−GB Sun StorEdge T3 array for the enterprise, includes 8 arrays configured in 4 partner groups, 1144−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 72 x 18.2−GB 10000−rpm FC−AL drives, 8 copper−to−optic media interface adapter, eight 15−meter fiber−optic cables, 8−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, installation and configuration 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.
XT3ES−RK−88−2620	2620−GB StorEdge T3 array for the enterprise, includes 8 arrays configured in 4 partner groups, 2312−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 72 x 36.4−GB 10000−rpm FC−AL drives, 8 copper−to−optic media interface adapter, eight 15−meter fiber−optic cables, 8−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, installation and configuration 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.

Order Number	Title and Description
XT3ES−RH−88−1310	1310−GB Sun StorEdge T3 array for the enterprise, includes 8 arrays configured in 4 partner groups, 1144−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 72 x 18.2−GB, 10000−rpm, FC−AL drives, 8 copper−to−optic media interface adapter, two 15−meter fiber−optic cables, 8−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, 2 hubs with 5 GBICs each, installation and configuration, 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.
XT3ES−RH−88−2620	2620−GB Sun StorEdge T3 array for the enterprise, includes 8 arrays configured in 4 partner groups, 2312−GB usable RAID 5 storage preconfigured as eight RAID 5 LUNs (8+1), 72 x 36.4−GB 10000−rpm FC−AL drives, 8 copper−to−optic media interface adapter, two 15−meter fiber−optic cables, 8−unit interconnect cables, installed in one 72−inch Sun StorEdge expansion cabinet, fans and door included, 2 hubs with 5 GBICs each, installation and configuration 2−year SunSpectrum Gold included, SRS ready. See Ordering Note 5 below.

Ordering Notes

1. Delete "X" and append "R5" to the order number (e.g., T3WG−RR−11−163R5) for factory installation in an 72−inch Sun StorEdge expansion cabinet rack or a Sun Enterprise 4502−R cabinet. Rackmounting rails are included with the non X−option part number.
2. Delete "X" and append "GR4" to the order number (e.g., T3WG−RR−11−163GR4) for factory installation in a Sun Enterprise 5500 or 6500 system cabinet. Rackmounting rails are included with the non X−option part number.
3. When ordering the X−option part number (e.g., XT3WG−RR−11−163) include the appropriate 4U single rackmount rail kit, X9673A OR X9674A.
4. When ordering the X−option part number (e.g., XT3ES−RR−22−327) include the appropriate 7U dual rackmount rail kit, X9663A OR X9664A.
5. Delete "X" (e.g., T3ES−RH−88−2620) for factory configuration with the Sun Enterprise 10000 cabinet.
6. Delete "X" for factory configured options (e.g., 9629A).

Options

Part Number	Description	Category
X9663A	7U Dual rackmount rail kit for 72−inch Sun StorEdge Expansion or RETMA rack	Sun StorEdge T3 for the enterprise rack kits
X9664A	7U Dual rackmount rail kit for Sun Enterprise 5500 or 6500 cabinet	

Part Number	Description	Category
X9673A	4U single rackmount rail kit for 72−inch Sun StorEdge expansion cabinet or RETMA rack	Sun StorEdge T3 for the workgroup rack kits
X9674A	4U single rackmount rail kit for Sun Enterprise 5500 or 6500 cabinet	
X9676A	Sun StorEdge T3 mounting tray kit (tabletop to rackmount upgrade); one required for each tray	Rack accessories
X9629A	1 rack unit (RU) air baffle for Sun StorEdge T3 array inside Sun Enterprise 5500 and 6500 system cabinets (one required in each system cabinet); see Ordering Note 6, above	
X9715A	5−meter optic FC−AL cable	Cable
X6716A	Sun StorEdge T3 FC−AL 18−GB, 10000−rpm disk drive in mounting tray (spares use only)	Drive spares
X6714A	Sun StorEdge T3 FC−AL 36−GB, 10000−rpm disk drive in mounting tray (spares use only)	

Services Available

The Sun StorEdge T3 array for the enterprise models include an enhanced services package, which allows customers to rapidly implement complex, reliable, and monitored storage environments. This extended service package helps ensure the use of sound storage installation and configuration practices, thereby allowing Sun to put the support infrastructure in place that is required to maintain the most demanding enterprise and datacenter environments.

These extended services are offered from the smallest Sun StorEdge T3 paired array systems to the largest multi−paired array rack models. These services include:

- 2−year warranty with a Gold level service
- Installation and configuration service via the Sun StorEdge ArrayStart program
- Sun Remote Services SRS Event Monitoring and Management service

These services give Sun customers an effective way to rapidly implement and easily maintain complex data storage environments.

Recommended services available for the Sun StorEdge T3 array for the workgroup and enterprise systems are (at additional cost):

Service	Availability
Sun StorEdge T3 array for the workgroup ArrayStart base	ARRAY−HW−INST−BASE
Sun StorEdge ArrayStart per−gigabyte charge	ARRAY−INST−PER−GB
Sun StorEdge Remote Services (SRS) 2.0.1	Line charges, GEO dependent
Sun Professional Services (SunPS℠) Performance Analysis and Capacity Planning	Available now
Sun StorEdge T3 array for the workgroup to T3 array for the enterprise upgrade service	Available Q1FY01
SunPS Sun StorEdge T3 Architecture and Implementation Service	Available Q1FY01

Warranty

The warranty information is described in the Service and Support section of this document.

Upgrades

Upgrades from single Sun StorEdge T3 workgroup arrays to Sun StorEdge T3 enterprise array configurations will be offered in late Q1FY01.

Sun offers trade−in programs for Sun−to−Sun and competitive−to−Sun system upgrades. These programs compete aggressively with other vendor products by combining new Sun technologies and services with attractive trade−in values. These migration paths gives customers the ability to easily and cost−effectively move to newer technology and maximize their investment in Sun products.

Upgrades will be offered to existing Sun customers to upgrade from previous SPARCstorage™ Array 1XX or 2XX, RSM™ 200 series, RSM 2000/Sun StorEdge A3X00 and/or Sun StorEdge A5X00 system products to the Sun StorEdge T3 array.

Customers with non−Sun storage systems will also be offered upgrade paths to the Sun StorEdge T3 array.

Sun StorEdge T3 Array for the Workgroup Upgrade Configurations

Order Number	Title and Description
UG−T3WG−TT−11−163G	Upgrade to 163−GB Sun StorEdgeT3 tabletop array for the workgroup (9 x 18.2−GB, 10000−rpm FC−AL drives). Customer returns two SPARCstorage Array 112/114 systems with minimum 63 GB each, or one SPARCstorage Array 2XX system with minimum 164 GB. Must also order CU−CONSL−RMA in quantity equal to that of storage products traded in.
UG−T3WG−TT−11−327G	Upgrade to 327−GB Sun StorEdge T3 tabletop array for the workgroup (9 x 36.4−GB, 10000−rpm FC−AL drives). Customer returns two SPARCstorage Array 112/114 systems with minimum 63 GB each, or one SPARCstorage Array 2XX system with minimum 164 GB. Must also order CU−CONSL−RMA in quantity equal to that of storage products traded in.
UGT3WG−RR−11−163G	Upgrade to 163−GB Sun StorEdgeT3 rack−ready array for the workgroup (9 x 18.2−GB, 10000−rpm FC−AL drives). Customer returns two SPARCstorage Array 112/114 systems with minimum 63 GB each, or one SPARCstorage Array 2XX system with minimum 164 GB. Requires separately ordered rackmount rail kit. Must also order CU−CONSL−RMA in quantity equal to that of storage products traded in.

Order Number	Title and Description
UG–T3WG–RR–11–327G	Upgrade to 327–GB Sun StorEdge T3 rack–ready array for the workgroup (9 x 36.4–GB, 10000–rpm FC–AL drives). Customer returns two SPARCstorage Array 112/114 systems with minimum 63 GB each, or one SPARCstorage Array 2XX system with minimum 164 GB. Requires separately ordered rackmount rail kit. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

Sun StorEdge T3 Array for the Enterprise Upgrade Configurations

Order Number	Title and Description
UG–T3ES–TT–22–327G	Upgrade to 327–GB Sun StorEdgeT3 tabletop array for the enterprise (two arrays configured in one partner group, each 9 x 18.2–GB, 10000–rpm FC–AL drives). Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
UG–T3ES–RR–22–327G	Upgrade to 327–GB Sun StorEdge T3 rack–ready array for the enterprise (two arrays configured in one partner group, each 9 x 18.2–GB, 10000–rpm FC–AL drives). Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Requires separately ordered dual rackmount rail kit. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
UGFA–T3ESRR–327GR4	Upgrade to 327–GB Sun StorEdge T3 rack–installed array for the enterprise (two arrays configured in one partner group, each 9 x 18.2–GB, 10000–rpm FC–AL drives); factory installed for Sun Enterprise 5500 and 6500 platforms. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

Order Number	Title and Description
UGFA–RM–327GR4	Upgrade to 327–GB Sun StorEdge T3 rack–installed array for the enterprise (two arrays configured in one partner group, each 9 x 18.2–GB, 10000–rpm FC–AL drives); factory installed for Serengeti or Starfire™ platforms. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
UG–T3ES–TT–22–655G	Upgrade to 655–GB Sun StorEdge T3 tabletop array for the enterprise (two arrays configured in one partner group, each 9 x 36.4–GB, 10000–rpm FC–AL drives); field–installed tabletop version. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
UG–T3ES–RR–22–655G	Upgrade to 655–GB Sun StorEdge T3 rack–ready array for the enterprise (two arrays configured in one partner group, each 9 x 36.4–GB, 10000–rpm FC–AL drives); field–installed version. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
UGFA–T3ESRR–655GR4	Upgrade to 655–GB Sun StorEdge T3 rack–installed array for the enterprise (two arrays configured in one partner group, each 9 x 36.4–GB, 10000–rpm FC–AL drives); factory installed for Sun Enterprise 5500 and 6500 platforms. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

Order Number	Title and Description
UGFA–RM–655GR4	Upgrade to 655–GB Sun StorEdge T3 rack–installed array for the enterprise (two arrays configured in one partner group, each 9 x 36.4–GB, 10000–rpm FC–AL drives); factory installed for Serengeti or Starfire platforms. Customer returns four SPARCstorage Array 112/114 systems with minimum 63 GB each, or two SPARCstorage Array 2XX systems with minimum 164 GB, or one Sun StorEdge A5000 array with 254 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

Competitive Upgrades

The following competitive upgrades offered at this time.

Order Number	Title and Description
CU–CONSL–RR–163GR5	Consolidation upgrade to 163–GB Sun StorEdgeT3 rack–installed array for the workgroup (9 x 18.2–GB, 10000–rpm FC–AL drives). Customer returns two SPARCstorage Array 112/114 systems with minimum 63 GB each, or one SPARCstorage Array 2XX systems with minimum 164 GB. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CONSL–RR–327GR5	Consolidation upgrade to 327–GB Sun StorEdgeT3 rack–installed array for the workgroup (9 x 36.4–GB, 10000–rpm FC–AL drives). Storage Consolidation Trade–In Program. Customer returns a total of one point worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CNSLESRR–327GR5	Consolidation upgrade to 327–GB Sun StorEdgeT3 rack–installed array for the enterprise (two arrays, each 9 x 18.2–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of two points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

Order Number	Title and Description
CU–CNSL–RR–655GR5	Consolidation upgrade to 655–GB Sun StorEdgeT3 rack–installed array for the enterprise (two arrays, each 9 x 36.4–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of two points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CNSL–CAB–655G	Consolidation upgrade to 655–GB Sun StorEdgeT3 array for the enterprise cabinet (four arrays, each 9 x 18.2–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of four points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CNSL–CAB–1310G	Consolidation upgrade to 1310–GB Sun StorEdgeT3 array for the enterprise cabinet (four arrays, each 9 x 36.4–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of four points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CNSL–CAB–H–655G	Consolidation upgrade to 655–GB Sun StorEdgeT3 array for the enterprise cabinet (four arrays, each 9 x 18.2–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of four points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.
CU–CNSLCAB–H–1310G	Consolidation upgrade to 1310–GB Sun StorEdgeT3 array for the enterprise cabinet (four arrays, each 9 x 36.4–GB, 10000–rpm FC–AL drives); factory installed in 72–inch Sun StorEdge cabinet. Storage Consolidation Trade–In Program. Customer returns a total of four points worth of Sun and/or non–Sun storage listed on the Storage Trade–In Point Matrix. Must also order CU–CONSL–RMA in quantity equal to that of storage products traded in.

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
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart℠ 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℠)	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℠ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ Service	Yes	Yes	Yes	Yes

Warranty

The warranty on array hardware is two years, with on−site, second−business day service for the first year. The software warranty is 90 days for media only. The Sun StorEdge T3 array for the enterprise includes a 2−year Gold−level service contract.

- **Sun StorEdge T3 array for the workgroup**

90 Days	• Telephone, software installation support
First Year	• Second business day on−site • Telephone support 8 a.m. To 5 p.m. local time, Monday through Friday
Second Year	• Parts return to Sun • Telephone, support 8 a.m. to 5 p.m. local time, Monday through Friday

- **Sun StorEdge T3 for the enterprise systems**

  SunSpectrum Gold program 2−year support is included with the Sun StorEdge T3 for the enterprise configurations.

  The SunSpectrum Gold program is business−critical support for customers who need high availability for key business systems. It combines proactive services that help avoid downtime with outstanding responsiveness to technical issues.

  See the table earlier in this section for more detailed information.

Education

SunU and SunED classes are available for this product:

- SunU course numbers 41805 and 41806
- SunED course number SM−255

Glossary

Arbitrated loop	A loop topology where two or more ports can be interconnected, but only two ports at a time may communicate.
Bus	A point–to–point network component. Used by Sun™ Management Center software to represent a network link to which many other hosts may be connected.
Channel	An interface directed toward high–speed transfer of large amounts of information.
Chunk	A quantity of information that is handled as a unit by the host and disk device.
Circuit–switched bus	A bus in which a transaction is normally implemented in an automatic fashion. Simple and easy to construct, a circuit–switched bus is often less efficient than a comparable packet–switched bus. An SBus is a circuit–switched bus.
Concatenation	A volume created by sequentially mapping blocks on disks to a logical device. Two or more partitions can be concatenated and accessed as a single device.
Disk array	A subsystem that contains multiple disk drives, designed to provide performance, high availability, serviceability, or other benefits.
Disk group	A grouping of disk drives and the data on them that facilitates organization and the movement of disks between systems.
ECC	Error checking and correcting. ECC code is used to verify the integrity of data and can be used to correct some data errors. The ECC code used in the Sun Enterprise™ 3500–6500 servers is able to detect and correct single–bit errors, and detect double–bit errors.
Event	A change in the state of a managed object.
Fabric	A group of interconnections between ports that includes a fabric element.
FC–AL	Fibre Channel arbitrated loop, a loop topology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled *fibre* in the context of Fibre Channel.
Fiber–optic cable	Jacketed cable made from thin strands of glass, through which pulses of light transmit data. Used for high–speed transmission over medium to long distances.
Frame	An indivisible unit for transfer of information in Fibre Channel.
FRU	Field replaceable unit.
Full duplex	A communications protocol that permits simultaneous transmission in both directions, usually with flow control.
GBIC	Gigabit interface converter.

GUI	Graphical user interface. The GUI provides the user with a method of interacting with the computer and its special applications, usually via a mouse or other selection device. The GUI usually includes such things as windows, an intuitive method of manipulating directories and files, and icons.
Heterogeneous hosts	Various application servers that run the Solaris™ Operating Environment or Microsoft Windows NT Server operating environment and are attached to the same storage.
Hot−plug	A hot−plug component means that it is electrically safe to remove or add that component while the machine is still running. Typically, the system must be rebooted before the hot−plug component is configured into the system.
Hot spare	A drive in an array that is held in reserve to replace any other drive that fails. Hot spares are continuously powered up and spinning. This allows the array processor to have immediate access to a functioning drive for possible reconstruction of lost data.
Hot−swap	A hot−swap component can be installed or removed by simply pulling the component out and putting the new one in. The system will either automatically recognize the component change and configure itself as necessary or will require user interaction to configure the system; however, in neither case is a reboot required. All hot−swappable components are hot pluggable, but not all hot−pluggable components are hot−swappable.
Hub	A device for connecting fiber cables.
Interleaved memory	Helps reduce memory access time by permitting multiple memory components to operate in parallel. Memory is divided into *n* banks arranged so that every *n*th byte is supplied by a different memory bank. In a two−way interleaved system, the first double word is supplied by bank 0 while the second is supplied by bank 1. Normally, the size and extent of interleave is arranged so that a single typical request is satisfied by as many banks as possible. This arrangement permits a single memory request to be fulfilled without waiting for memory recycle time.
I/O rate	A measure of a device's capacity to transfer data to and from another device within a given time period, typically as I/O operations per second.
IOPS	Input/output operations per second. A measure of I/O performance, this is commonly used to quote random I/O performance.
IP	Internet protocol. A set of protocols developed by the United States Department of Defense to communicate between dissimilar computers across networks.
Jiro	An open platform initiative that simplifies storage management by providing interoperability between storage vendor products.
LED	Light emitting diode.
Link	One inbound fiber and one outbound fiber connected to a port.
LRC	Loop redundancy circuit

MIA	Media interface adapter. A small electronic device that converts electrical signal to optical signals. It performs that same function as a gigabit interface converter (GBIC) but is installed on the outside of the storage array. Sun selected the MIA so the installed base of PCI and SBus host bus adapters could be used with this new generation of storage arrays.
Micron	One millionth of a meter. Also called *micrometer*.
Mirror synchronization	The process by which VERITAS Volume Manager software keeps two or more copies of data identical.
Mirroring	In RAID terminology, refers to the redundant storage of data, either by duplicating the exact data or generating parity data bit−for−bit.
Module	A software component that may be loaded dynamically to monitor data resources of systems, applications, and network devices.
Multimode fiber	An optical wave guide which allows more than one mode (rays of light) to be guided.
Network	An arrangement of nodes and connecting branches, or a configuration of data processing devices and software connected for information exchange.
N_Port	A port attached to a node for use with point−to−point or fabric topology.
NL_Port	A port attached to a node for use in all three topologies (point−to−point, arbitrated loop or fabric.
Node	A device that has at least one N_Port or NL_Port.
NVRAM cache	A non−volatile (battery−backed) random access memory area used as an intermediate store for data between a host computer system and disk drives.
Optical fiber	Any filament of fiber, made of dielectric material, that guides light.
Packet−switched bus	A bus in which information is transmitted in fixed−sized units. This type of bus is often associated with the use of split transactions. Gigaplane™ and UPA are packet−switched buses.
Parity	In an array environment, data that is generated from user data and is used to regenerate user data lost due to a drive failure. Used in RAID 5.
Point−to−point	A topology where exactly two ports communicate.
Port	An access point on a device for attaching a link.
Protocol	A convention for data transmission that defines timing, control, format, and data representation.
RAID	Redundant array of independent disks. A set of disk drives that appear 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 0	RAID level 0, or striping. Data is distributed among disks for performance. No redundancy is provided, and the loss of a single disk causes the loss of data on all disks.

RAID 0+1	The combination of striping and mirroring. Data is distributed among disks for performance, and mirroring is used to provide redundancy.
RAID 1	RAID level 1, or mirroring. Multiple copies of the data are kept. This is inherently expensive.
RAID 1+0	The combination of mirroring and striping. Data is mirrored to provide redundancy and distributed among disks for performance.
RAID 5	RAID level 5, or striping with distributed parity. Both data and parity are distributed across disks. No single disk can compromise the integrity of the data. RAID 5 optimizes performance, reliability and cost.
RAS	Reliability, availability, and serviceability. Reliability is a measure of the likelihood that problems will occur. A highly reliable system will have few problems. Once a problem occurs, availability is the measure of how the system will protect the user from being adversely affected by the problem. Serviceability is a measure of how easy it is to repair the problem.
Receiver	The circuitry that receives signals on a fiber, and the ultimate destination of data transmission.
Reconstruction	The process of rebuilding lost data on a replacement drive after a drive failure.
Redundancy	Duplication for the purpose of achieving fault tolerance. Refers to duplication or addition of components, data and functions within the array.
Responder	The logical function in an N_Port responsible for supporting the exchange initiated by the originator in another N_Port.
SCSI	Small computer systems interface. An ANSI standard for controlling peripheral devices by one or more host computers.
SAN	Storage area network. SAN architecture uses high–performance, high–capacity Fibre Channel switches to connect storage islands. This approach provides physical connectivity, but does facilitate information sharing or simplify management across servers.
Serial transmission	Data communication mode where bits are sent in sequence in a single fiber.
Single–mode fiber	A step index fiber wave guide in which only one mode (ray of light) will propagate above the cutoff wavelength.
SNMP	Simple network management protocol. A simple protocol designed to allow networked entities (e.g., hosts, routers) to exchange monitoring information.
Striping	Spreading or interleaving logical contiguous blocks of data across multiple independent disk spindles. Striping allows multiple disk controllers to simultaneously access data, improving performance.
Switch	The name of an implementation of the fabric topology.

Switched–loop architecture	Splits the drive interface into multiple, independent loops so that the RAID controller has its own drive loop, plus access to other drive loops. Improves performance and expansion flexibility for enterprise networks.
Throughput	A measure of sequential I/O performance, quoted as megabytes per second (MB/second). *See* IOPS and I/O rate.
Topology	The components used to connect two or more ports together. Also, a specific way of connecting those components, as in point–to–point, fabric, or arbitrated loop.
Transceiver	A transmitter/receiver module.
Transfer rate	The rate at which bytes or bits are transferred, usually measured in megabytes per second.
URL	Uniform resource locator. An URL is a textual specification describing a resource which is network–accessible.
Volume	A volume is a virtual disk 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. Software handles the mapping of virtual partition addresses to physical addresses.

Materials Abstract

All materials will be available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
PowerPack				
– *Sun StorEdge™ T3 Array, Just the Facts*	Reference Guide	Sales Tool, Training	SunWIN, Reseller Web	112864
– *Sun StorEdge T3 Array Customer Presentation*	Presentation Overview; Slide Notes for Presentation	Sales Tool	SunWIN, Reseller Web	120838
– *Sun StorEdge T3 Array Technical Presentation*	Presentation with Slide Notes	Sales Tool	SunWIN, Reseller Web	120839
Product Literature				
– *Sun StorEdge T3 Array Quick Reference Card*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web	73691
– *Literature: Sun StorEdge T3 for the Workgroup Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	DE1074–0 108576
– *Literature: Sun StorEdge T3 for the Enterprise Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	DE1165–0 117451
– *Sun StorEdge T3 Array Elevator Pitch*	Presentation with Notes	Sales Tool	SunWIN, Reseller Web	120363
– *Sun StorEdge T3 Array FastFacts*	Fast Facts	Sales Tool	SunWIN, Reseller Web	120364
White Papers				
– *Sun StorEdge T3 Array Performance Tuning White Paper*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	119879
– *Sun StorEdge T3 Architecture White Paper*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	120366
– *Fibre Channel Technology from Sun Microsystems*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	65659
– *Fibre Channel versus Alternative Storage Interfaces: An Overview*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	65663

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Quote Sheets				
– *Customer Quote Sheet for Sun StorEdge T3 Array*	Quote Sheet	Sales Tool	SunWIN, Reseller Web	119896, FE1270–0
– *T3 partner Quote Sheet for the Sun StorEdge T3 Array*	Quote Sheet	Sales Tool	SunWIN, Reseller Web	119934
Success Stories				
– *AB Watley Success Story*	Success Story	Sales Tool	SunWIN, Reseller Web	120147
– *Network Commerce Inc. Success Story*	Success Story	Sales Tool	SunWIN, Reseller Web	120005
– *Bluelight Success Story*	Success Story	Sales Tool	SunWIN, Reseller Web	120003
Competitive				
– *Sun StorEdge T3 Array Competitive Presentation*	Competitive Presentation	Sales Tool	SunWIN, Reseller Web	120840
– *Sun StorEdge v. EMC Pocketfacts*	Pocket Facts	Training	SunWIN	117277, BE962–0
– *Competitive Edge Sun StorEdge T3 Solution vs. CLARiiON FC4500*	Competitive White Paper	Training	SunWIN	120367
– *Competitive Edge Sun StorEdge T3 Solution vs. Compaq RA8000*	Competitive White Paper	Training	SunWIN	120238
– *Competitive Edge Sun StorEdge T3 Solution vs. EMC 8430*	Competitive White Paper	Training	SunWIN	120369
External Web Sites				
– *Sun StorEdge Array Main Page*	`http://www.sun.com/storage/disk.html`			
– *Fibre Channel Association*	`http://www.fibrechannel.com`			
– *Fibre Channel Loop Community*	`http://www.fcloop.org`			

FAQs

The following information is for internal audiences only.

Q. What host platforms are supported with the Tier 2 VERITAS Volume Manager license that is included with the Sun StorEdge T3 array for the enterprise models?

A. Both Tier 1 and Tier 2 licensing levels are supported with the included license on Sun StorEdge T3 for the enterprise models.

- Desktop workstation and workgroup servers, Tier 1
  - Ultra™ 60 and 80 workstations
  - Sun Enterprise™ 250, 450, 220R, and 420R servers
- Departmental servers, Tier 2
  - Sun Enterprise 3500, 4500, and 5500 servers

Q. What are the differences between the Sun StorEdge T3 for workgroup and the Sun StorEdge T3 array for the enterprise?

A. The Sun StorEdge T3 arrays are offered in the following models:

Sun StorEdge T3 array for the Workgroup	Sun StorEdge T3 array for the Enterprise
• Single RAID controller	• Dual RAID controllers
• RAID Levels 0, 1, and 5	• RAID Levels 0, 1, and 5
• 1 or 2 LUNs/array	• 2 to 4 LUNs per pair
• Sun StorEdge Component Manager 2.1 software	• Sun StorEdge Component Manager 2.1 software
• Sun Remote Services (SRS) 2.0 ready	• Sun Remote Services (SRS) 2.0 ready
• 2−year standard warranty	• 2−year warranty Gold−level service
• Customer installed	• Sun StorEdge ArrayStart installation
	• Volume management software

Q. Can I use the Sun StorEdge T3 array as a boot device?

A. Yes, booting from the SBus (SOC+) is currently supported on Sun Enterprise 3500−6500 servers. Booting from the Sun StorEdge T3 array from PCI−based systems will be supported with the release of the next generation PCI Fibre Channel host bus adapter and the Solaris 8 Operating Environment only.

Q. What platforms and operating systems can I boot from?

Server Platform	Boot Support
Sun Ultra 60 and 80 workstations	No
Sun Enterprise 220R, 250, 420R, and 450 servers	No
Sun Enterprise 3500−6500 servers	Yes *
Sun Enterprise 10000 server	No

* Smallest LUN size is minimum two drives RAID 1 or 0

OS	**PCI HBA**	**SBus HBA**
Solaris 2.6	No	No
Solaris 7 (11/99)	No	Yes
Solaris 8	No	Yes

Q. I was not able to find loop interconnect cables to connect two Sun StorEdge T3 array for the workgroup in the part descriptions or in the X−option price list, Why is Sun not offering these cables?

A. Loop interconnect cables are intended for paired controller configurations only and are offered only as part of the Sun StorEdge T3 workgroup to enterprise upgrade service. This service will help ensure that customers have the highest available and reliable Sun StorEdge T3 systems.

Q. Can 18−GB and 36−GB drives be mixed in a single array?

A. No, There are currently no plans to support drive mixing.

Q. Can a 18−GB tray and a 36−GB tray be mixed in the same partner group?

A. No, There are currently no plans to support mixing different array capacities in a partner group.

Q. Can Sun StorEdge A5X00/A3500/A1000/D1000 arrays and Sun StorEdge T3 arrays be connected to the same host system?

A. Yes, the Sun StorEdge T3 array has been tested with various combinations of the above listed Sun storage systems.

Q. How many Fibre Channel host connections are on each Sun StorEdge T3 array?

A. There is a single 100 MB/sec. host connection on each array. Every array MUST be connected to a host bus adapter (HBA), an FC−AL hub, or an on−board FC−AL socket of the SBus or graphics I/O boards.

Q. Does the Sun StorEdge T3 array have multi−host support? If so, how many hosts/initiators?

A. There is currently a limitation of TWO initiators per loop for the Sun StorEdge T3 for the workgroup (single tray) and a SINGLE initiator limitation for Sun StorEdge T3 for enterprise (paired arrays) configurations. This limitation applies to both FC−AL hub and switch configurations.

Q. Are Long−Wave GBICs support on the Sun StorEdge T3 array?

A. No, there are currently no plans to support the Long−Wave GBIC on the Sun StorEdge T3 array. Extended distance functionality will be moved to the Fibre Channel Switch when it becomes available.

Q. What is the maximum distance supported between the host and the array?

A. The Sun StorEdge T3 array supports a 500−meter distance between host and array using 50/125−micron multi−mode Fibre Channel cables.

Q. Can both Sun StorEdge A5X00 arrays and Sun StorEdge T3 arrays be connected on the same Fibre Channel loop/hub?

A. No, mixing of Sun StorEdge A5X00 and T3 arrays on the same Fibre Channel loop/hub is not supported.

Q. Can FC−AL hubs be used with the Sun StorEdge T3 arrays? How many arrays can be connected to a single hub?

A. Yes, up to four Sun StorEdge T3 arrays can be attached to the Sun 7−port hub.

Q. Can FC−AL hubs and alternate pathing (AP) 2.3.1 be used with the Sun StorEdge T3 arrays?

A. No, FC−AL hubs and Alternate Pathing (AP) 2.3.1 will be supported with the Sun StorEdge T3 arrays at a later time.

Q. Can the Sun StorEdge T3 array LUN size grow and contract dynamically without service disruption?

A. No, dynamic LUN expansion/contraction is not supported.

Q. Can the Sun StorEdge T3 array LUN block size change dynamically without service disruption?

A. No, dynamic block size changes cannot take place without service disruption.

Q. What is a media interface adapter (MIA)

A. The media interface adapter (MIA) is a small electronic device that converts electrical signal to optical signals. It performs that same function as a gigabit interface converter (GBIC) but is installed on the outside of the storage array. Sun selected the MIA so the installed base of PCI and SBus host bus adapters could be used with this new generation of storage arrays.

Q. When will support for the Sun StorEdge T3 expansion units be available?

A. Sun is currently evaluating configuration using the Sun StorEdge T3 expansion unit. No date has been set for these configurations.

Rack Questions

Q. What rackmount options are available for the Sun StorEdge T3 array?

A. Rackmount rail kits are available in 4U for mounting a single array and 7U for mounting pairs of arrays. Rackmount rail kits are available for the Sun Enterprise 5500 and 6500 cabinets and the Sun StorEdge 72−inch expansion cabinet/19−inch RETMA rack. (Internal rackmount support for the Sun Enterprise 5500 and 6500 servers will be available Q1FY01.)

Q. What is the X9676A Sun StorEdge T3 mounting tray? When do I need to order this?

A. The X9676A Sun StorEdge T3 mounting tray is designed to convert an EXISTING single tabletop Sun StorEdge T3 array into a rack−ready configuration. One mounting tray is required for every array. The specific rackmount rail kit for the rack is required in addition to the mounting tray.

Tabletop array + Sun StorEdge T3 mounting tray + rackmount rail mounting kit

XT3WG−TT−11−163	X9676A	X9673A (4U Kit)
XT3WG−TT−11−327		X9674A (4U Kit)
XT3ES−TT−22−327		X9663A (7U Kit)
XT3ES−TT−22−655		X9664A (4U Kit)

Order the rack−ready (RR) version of the array + the rackmount rail kit ONLY when ordering NEW arrays.

Q. How many Sun StorEdge T3 trays will fit in the Sun StorEdge 72–inch cabinet?

A. Eight Sun StorEdge T3 for the workgroup OR eight Sun StorEdge T3 for the enterprise trays will fit in the Sun StorEdge 72–inch cabinet.

– Eight Sun StorEdge T3 arrays for the workgroup consume 32 RUs (rack units) using eight 4U rackmount rails.
– Eight Sun StorEdge T3 arrays for the enterprise consume 28 RUs (rack units) using four 7U rackmount rails.

Q. Can I mix Sun StorEdge A5000/A3500/A1000/D1000 arrays and Sun StorEdge T3 arrays in a Sun StorEdge 72–inch expansion cabinet?

A. No, only the Sun StorEdge T3 arrays can be configured together in a Sun StorEdge expansion cabinet at this time.

Q. Can I mix Sun StorEdge A5X00/A3500/A3500–Light/A1000/D1000 arrays and Sun StorEdge T3 arrays in a Sun Enterprise 5500 or 6500 system cabinet?

A. Yes, only one Sun StorEdge T3 array (single–unit) can be configured with a mix of Sun StorEdge A5X00/A3500–Light/A1000/D1000 arrays in a Sun Enterprise 5500 or 6500 system cabinet.

The maximum number of storage devices with one Sun StorEdge T3 array is as follows:	
Sun StorEdge A5X00 array	One in Sun Enterprise 5500 or 6500 server
Sun StorEdge A/D1000 array	Five in Sun Enterprise 5500 server Four in Sun Enterprise 6500 server
Sun StorEdge A3500–Light array (SCSI or FC–AL controller)	One in Sun Enterprise 5500 6500 server

Q. Can the Sun StorEdge T3 array be factory or field configured internal to the Sun Enterprise 5500 or 6500 system cabinet?

A. Yes, up to two Sun StorEdge T3 arrays (two trays) are supported in the 68–inch Sun Enterprise 5500 or 6500 servers. The arrays can be installed in the field or factory configured.

Field installation require a Sun StorEdge T3 rack–ready (RR) array and the appropriate rackmounting rail kit and air baffle (X9629A).

For factory–configured Sun StorEdge T3 arrays, the rackmount rails are included in the rack–ready part (RR) numbers. One factory–configured air baffle (9629A) needs to be included in each cabinet.

Q. Why are only two Sun StorEdge T3 arrays supported in the 68–inch Sun Enterprise 5500 or 6500 system cabinet when there is room to install additional arrays?

A. Due to electromagnetic interference (EMI), only two Sun StorEdge T3 arrays can be supported inside the Sun Enterprise 5500 or 6500 cabinets.

Q. How many Sun StorEdge T3 arrays are supported with a rackmountable Sun Enterprise 4500 server inside a 72–inch Sun StorEdge expansion cabinet (also known as E4502–R)?

A. The following matrix indicates the number of Sun StorEdge T3 arrays that can be supported in the E4502–R

Product	With 1 Sun Enterprise 4500 server	With 2 Sun Enterprise 4500 servers	With 3 Sun Enterprise 4500 servers	With 4 Sun Enterprise 4500 servers
Sun StorEdge T3 array	6 single units	4 single units	2 single units	0

The quantities in each row are based on the assumption that no other devices will be installed in the cabinet other than the device(s) in the row AND Sun Enterprise 4500 server(s).

Q. Can the Sun StorEdge T3 array be factory or field configured internal to the rackmountable Sun Enterprise 4500 server in the Sun StorEdge expansion cabinet, also known as the E4502−R?

A. No, support for internal attach of the Sun StorEdge T3 array with W4502−R will be available Q1FY01.

Q. Will the Sun StorEdge T3 array be supported internal to the Sun Enterprise 10000 system?

A. The Sun Enterprise 10000 business team will make announcements on the availability of these options in the near future.

Q. Do we absolutely need to have the screen door for the Sun StorEdge 72−inch expansion cabinets and the 68−inch Sun Enterprise 5500 and 6500 systems cabinets?

A. Yes, The door is required on both cabinet configurations to meet FCC Class A electromagnetic interference rules (EMI).

Q. Is the EMI screen door required for Sun StorEdge T3 arrays in the E4502−R?

A. Yes, the door is required to meet FCC Class A electromagnetic interference (EMI) rules.

Q. Is the EMI screen door required for Sun StorEdge T3 arrays in the 68−inch Sun Enterprise 5500 or 6500 system cabinet?

A. No, when Sun StorEdge T3 arrays are installed in the 68−inch Sun Enterprise 5500 or 6500 system cabinet, the EMI screen door cannot be closed. Therefore, the EMI screen door is **NOT** required for the 68−inch Sun Enterprise 5500 or 6500 system cabinet. To meet FCC Class A electromagnetic interference (EMI)rules, only two Sun StorEdge T3 arrays are supported in the 68−inch Sun Enterprise 5500 or 6500 system cabinet.

Q. Why is RETMA listed as a potential rack mounting type in the X9663A and X9673A part numbers?

A: Because the rack mount kits are designed in compliance with EIA310D Electronics Industries Association (EIA) standard. (RETMA is the former name for EIA)

RETMA is an industry standard for a 19−inch cabinet, with mounting flanges per EIA310D. Although the kits are designed to comply with the standard (they do not violate the standard), it does not mean that the rail kits will fit in ANY manufacture rack or “standard cabinet.”

Sample Configurations

Q. What are some sample Sun StorEdge T3 workgroup and Enterprise array configurations?

A. Sample Configuration 1

Sun StorEdge T3 array for the workgroup, tabletop

Qty	Part #	Description
1	XT3WG–TT–11–163	9 x 18.2–GB single controller unit
1	X6729A	FC–100 PCI FC–AL HBA single channel
1	SCMMS–210–9P99	Sun StorEdge Component Manager v2.1 software media, docs

Sample Configuration 2

Two Sun StorEdge T3 arrays for the workgroup rack–ready trays, field–installed in an existing Sun StorEdge 72–inch cabinet.

Qty	Part #	Description
2	XT3WG–RR–11–163	9 x 18.2–GB single controller unit RR
2	X9673A	4U single rackmount rail kit for 72–inch Sun StorEdge expansion or RETMA rack
2	X6729A	FC–100 PCI FC–AL HBA single channel
1	SCMMS–210–9P99	Sun StorEdge Component Manager v2.1 software media, docs

Sample Configuration 3

Sun StorEdge T3 arrays for the workgroup rack–ready tray, factory configured in a 72–inch Sun StorEdge expansion cabinet

Qty	Part #	Description
8	T3WG–RR–11–327R5	9 x 36.4–GB single controller unit RR
1	SG–ARY030A	Factory–configured 72–inch Sun StorEdge expansion cabinet
2	3858A	U.S./Canada power cord for 72–inch Sun StorEdge expansion cabinet
1	9818A	Front door assembly for 72–inch expansion cabinet
1	9819A	Fan assembly for factory–installation in the 72–inch expansion cabinet
8	X6730A	SOC+ SBus FC–AL HBA dual channel (1 GBIC)
1	SCMMS–210–9P99	Sun StorEdge Component Manager v2.1 software media, docs

Sample Configuration 4

Sun StorEdge T3 arrays for the enterprise

Six arrays, three partner groups factory–configured in a Sun StorEdge 72–inch expansion cabinet

Qty	Part #	Description
1	T3ES–RH–44–1310	4 x (9 x 36.4–GB) four controller units in 72–inch Sun StorEdge rack with two hubs
1	T3ES–RR–22–655R5	2 x (9 x 36.4–GB) dual controller factory rackmounted in 72–inch Sun StorEdge rack
2	3858A	U.S./Canada power cord for 72–inch Sun StorEdge expansion cabinet
2	X6730A	SOC+ SBus FC–AL HBA dual channel (1 GBIC)
1	VVMGS–304–9999	VERITAS Volume Manager 3.0.4 software license, media, and docs
1	SCMMS–210–9P99	Sun StorEdge Component Manager v2.1 software media, docs

Sample Configuration 5

Sun StorEdge T3 for the enterprise

Eight arrays, four partner groups, factory configured in a 72−inch Sun StorEdge expansion cabinet

Qty	**Part #**	**Description**
1	XT3ES−RK−88−2620	8 x (9 x 36.4−GB) eight controller unit in Sun StorEdge a 72−inch Sun StorEdge cabinet
2	3858A	U.S./Canada power cord for 72−inch Sun StorEdge expansion cabinet
4	X6730A	SOC+ SBus FC−AL HBA dual channel (1 GBIC)
4	X6731A	FC−AL OE Module 100 MB/sec.
1	VVMGS−304−9999	VERITAS Volume Manager 3.0.4 software license, media, and docs
1	SCMMS−210−9P99	Sun StorEdge Component Manager v2.1 software media, docs