

**Sun StorEdge™ A5000**  
**Family Array for**  
**Microsoft Windows NT Servers**

**Just the Facts**



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# System Positioning



Figure 1. The Sun StorEdge™ A5000 system

## Introduction

Client/server techniques and applications have become vital to the re-engineering enterprise competing in a dynamic global marketplace. Most major organizations and all major computer software and hardware manufacturers now have products and strategies which embody client/server computing. These developments have resulted in the need for a new business computing tool—the enterprise workgroup server. Typically dedicated to a group, department, or small organization that shares common resources or tasks, workgroup servers provide access to specific functions such as application or file services, databases, the Internet and intranets, or e-mail. They are also playing an important role in helping to redefine the implementation of distributed computing architectures.

Enterprise workgroup and departmental servers need to be able to serve the data storage needs of users. Traditionally, storage systems were designed as an adjunct to the computing environment, with new protocols like the small computer systems interface (SCSI) being created and modified as performance needs dictated. Perhaps the most popular add-on peripheral protocol to date, SCSI is reaching its performance and architectural limits. Combined with their other liabilities, distributed SCSI storage systems are becoming a severe bottleneck as computer systems and networking technology continue to advance and the demand for fast data access grows.

These trends underscore the need not only for recentralizing shared data, but also for ensuring that data can be accessed by a wide variety of users quickly and continually. By combining the latest storage technology breakthroughs with high speed networking, organizations can create a scalable Intelligent Storage Network™—an environment in which information and administration is centralized. Dedicated to storage, an Intelligent Storage Network offers many of the features associated with today's networks within a framework designed to meet changing data storage requirements. Like the best networks, an Intelligent Storage Network is standards-based, scalable, modular, multi-pathed, centrally managed, multi-vendor, and highly available. Like the best peripherals, it is also high performance, highly available, low latency, configurable for a variety of work loads, and able to perform well in clustered environments.

Sun Microsystems believes that Fibre Channel is the core technology that enables the Intelligent Storage Network to become a reality. The flexibility, high performance, and reliability of Fibre Channel technology enables organizations to create big, fast storage networks into which not only disks and RAID subsystems can be plugged, but eventually tape backup, archive, hierarchical storage management (HSM), and library systems as well.



## The Sun StorEdge A5000 Disk Array

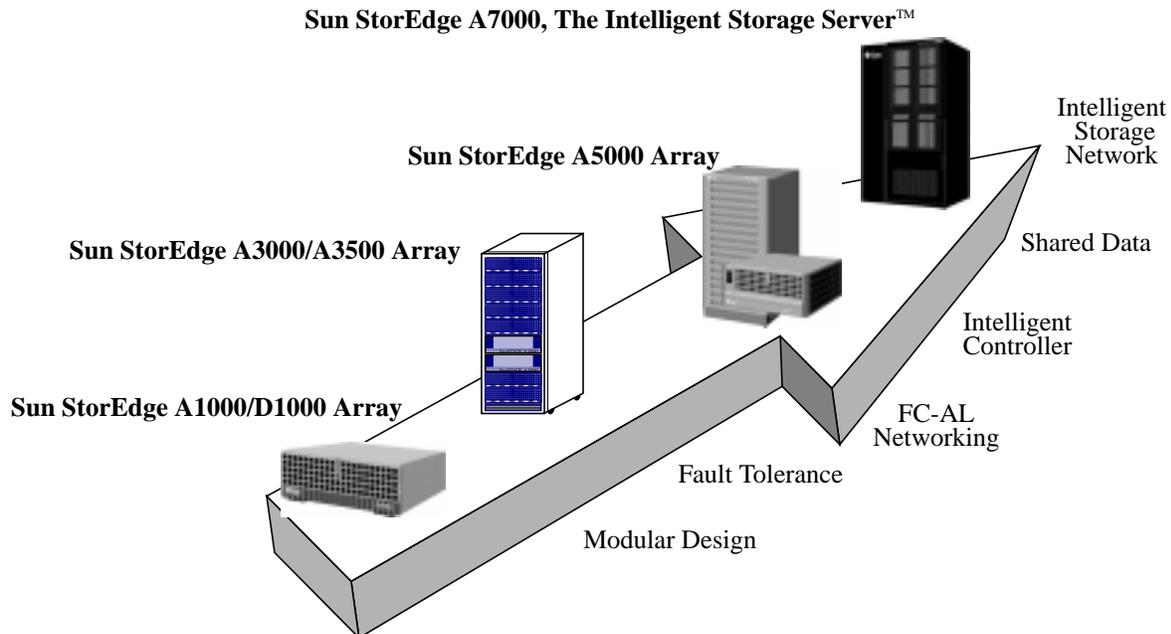
Sun Microsystems continues to set the standard for Fibre Channel-based storage arrays with the Sun StorEdge A5000 array. A second generation FC-AL subsystem, the Sun StorEdge A5000 array is the most popular Fibre Channel storage array available with over 2500 TB of storage installed to date. The building block of Sun's Intelligent Storage Network, the Sun StorEdge A5000 array provides the FC-AL backbone that is central to providing data services in the storage network.

Using second generation Fibre Channel technology and offering high reliability, availability, and serviceability (RAS) features, the Sun StorEdge A5000 array is scalable from the desktop to the workgroup and departmental server—offering higher performance and scalability than any other product in its class. Indeed, the Sun StorEdge A5000 array excels in application and file service, database, Internet, intranet, and e-mail environments.

The Sun StorEdge A5000 array offers two configuration options that utilize the same subsystem enclosure, providing users the flexibility to choose a cost-effective unit with a low price/MB (14 drives), or a high performance unit (22 drives running at 10000 rpm). Models A5000 and A5100 are 14-drive units utilizing 3.5-inch, half-height, 7200-rpm disk drives. The Model A5200 is a 22-drive unit utilizing 3.5-inch, low-profile, 10,000-rpm disk drives.

## Product Family Placement

The Sun StorEdge A5000 array is the first in a series of mass storage systems designed to support the intelligent storage network. Sun storage solutions scale from small deskside systems to mainframe-class storage solutions.



**Figure 2.** The Sun StorEdge product family offers the scalability, performance, and availability users need

Four products comprise the Sun StorEdge product family:

- *Sun StorEdge A1000*, the product of choice for workgroups with storage requirements less than 150 GB. The Sun StorEdge A1000 array gives users Microsoft Windows NT connectivity, performance and scalability at sensitive price points, and the choice of controller-based or host-based RAID.
- *Sun StorEdge A3000*, the product of choice for environments that have stable capacity requirements, have centrally managed remote sites with limited on-site system administration support, and need a controller-based RAID solution with Microsoft Windows NT connectivity.
- *Sun StorEdge A5000*, the product of choice for high bandwidth workgroup and departmental server environments. The Sun StorEdge A5000 array provides the best scalability, availability, and highest performance using gigabit Fibre Channel technology in a host-based RAID solution.
- *Sun StorEdge A7000 Intelligent Storage Server™*, the product of choice for mainframe-class environments. The Sun StorEdge A7000 Intelligent Storage Server provides the largest capacity, with a single enclosure accommodating over 2.9 TB of storage. Supporting up to 32 host connections from mainframe, UNIX®, and Windows NT users alike, the Sun StorEdge A7000 Intelligent Storage Server provides true data sharing and mission-critical/mainframe-class reliability, availability, and serviceability to the most demanding highly available computing environments.

## Key Messages

The Sun StorEdge A5000 subsystem offers high performance, high RAS, and leading-edge technology:

### 1. High Performance

The Sun StorEdge A5000 array employs a variety of technologies to achieve high performance, including 100 -MB-per-second Fibre Channel, FC-AL disk drives running at either 7200 or 10000 rpm, and RAID levels 0, 1, and 5.

### 2. High RAS (Reliability, Availability, and Serviceability)

The RAS features of this array meet the demands of business-critical environments.

Feature	Sun StorEdge Array A5000
Redundant power	Yes
Redundant interfaces (array)	Yes
Redundant interfaces (drive)	Yes
Hot-swappable drives	Yes
Hot-swappable power	Yes
Hot-swappable cooling	Yes
Hot-swappable interfaces	Yes
Diagnostics (FRU revision levels)	Yes
Diagnostics (host adapter)	Yes
Diagnostics (array interface)	Yes
Diagnostics (tray)	Yes
Automatic loop failover	Yes
Load balancing across loops	Yes
Full CRC datapath support	Yes



### 3. Network Storage Strategic Direction

Sun Microsystems continues to set the standard for Fibre Channel-based storage arrays with the Sun StorEdge A5000 array. A second generation FC-AL subsystem, the Sun StorEdge A5000 array is the most popular Fibre Channel storage array available with over 2500 TB of storage installed to date. The building block of Sun's Intelligent Storage Network, the Sun StorEdge A5000 array provides the FC-AL backbone that is central to providing data services in the storage network.

Sun Microsystems is the acknowledged industry leader in Fibre Channel-based storage, with more than 4 petabytes shipped since 1993. The Sun StorEdge A5000 system builds upon that leadership by extending next generation Fibre Channel arbitrated loop (FC-AL) technology to disk drives.

#### Availability

The Sun StorEdge A5000 system began shipping in November, 1997. With the January 1999 announcement of the Sun StorEdge A5200 array, Sun introduced a new member to the product family that uses the latest high density, high performance disk drives in a new rack enclosure. In February 1999, the A5100 model was added to be the highest capacity, lowest cost per megabyte array in Sun's Fibre Channel storage product line.

#### Target Users

The Sun StorEdge A5000 subsystem is the central building block of the Intelligent Storage Network, giving users a vision which begins with the second generation Fibre Channel technology today.

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

#### Target Markets

Sun StorEdge A5000 subsystem is well-suited for the capacity and performance requirements required by modern databases, operations application servers, network data services and performance-oriented systems.

Industry/Customer	Key Features to Highlight
Disaster recovery	FC-AL future upgrade to a 10-km distance between arrays
Departmental storage	Tabletop design with proper capacity to support department sizes
Technical computing	High-performance data storage for engineering design projects
Scientific computing	High bandwidth for data capture, retrieval and storage
High-performance computing	FC-AL 100-MB per second interface for the most demanding performance needs



# Selling Highlights

## Market Value Proposition

Due to its scalability, the Sun StorEdge A5000 array is easily configured to meet the most demanding workgroup and departmental applications. The 100-MB-per-second full-duplex Fibre Channels enable the array to excel at bandwidth-intensive applications such as data marts, web serving, seismic analysis, video production, MCAD, and other technical applications.

## Applications

The Sun StorEdge A5000 subsystem suits workgroup and departmental applications where superior throughput and reliability are required:

- Groupware applications, messaging and collaborative applications
- E-mail, web services, Internet, and legacy systems gateways
- Network and communications management
- Database management or digital media management
- Applications service
- Decision support and data mart
- On-line transaction processing and electronic commerce
- Distributed file and print service

Able to deliver high performance and high availability, the Sun StorEdge A5000 array is a scalable architecture that is ideal for cost-sensitive or volume applications where fast data access is required. Indeed, the Sun StorEdge A5000 array is a flexible mass storage subsystem that supports Microsoft Windows NT Server workgroup and departmental environments with ease.

## Compatibility

The following host systems support the Sun StorEdge A5000 array.

System Supported	Maximum Number of Arrays	Maximum Supported External Storage Capacity
Windows NT Server 4.0	4	1 TB

All maximum capacities noted are configured with single 254-GB enclosures.

## Host Requirements

The following are required to run the Sun StorEdge A5000 array on Microsoft Windows NT Server 4.0 systems:

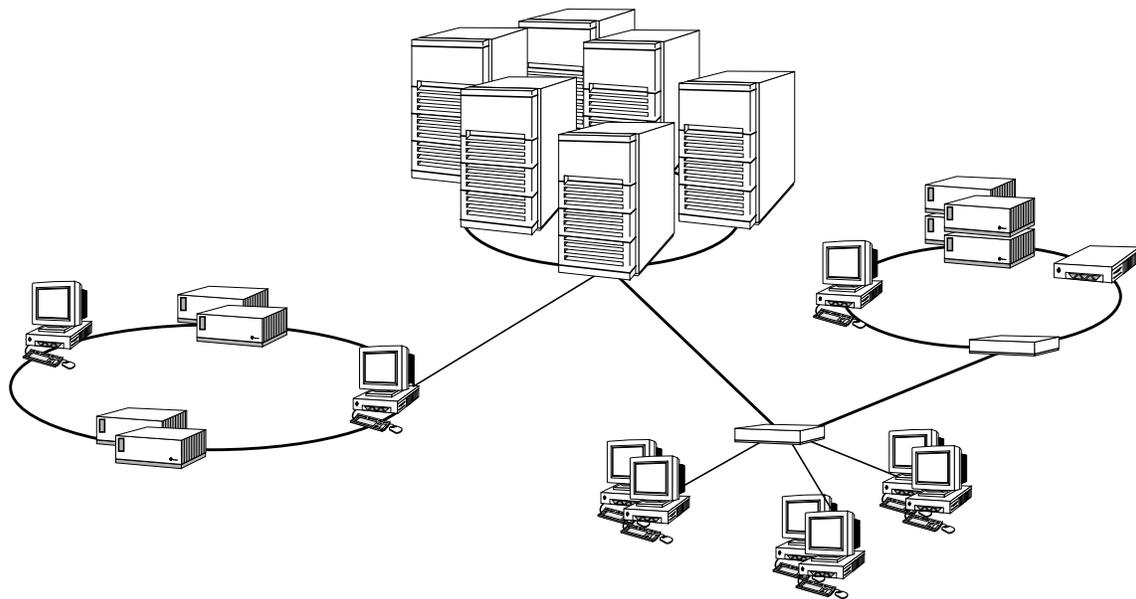
- 90-MHz or higher Pentium processor
- 64 MB of memory
- 500 MB of available hard disk space
- VGA, Super VGA or video graphics accelerator, compatible with Windows NT Server 4.0
- CD-ROM drive
- Mouse

# Enabling Technology

## Technology Overview

Fibre Channel technology is the answer to the growing problems of SCSI-based peripherals. Fibre Channel is a high-performance serial interconnect standard designed for bidirectional, point-to-point communications between servers, storage systems, workstations, switches, and hubs. It offers a variety of benefits over other link-level protocols, including efficiency, high performance, scalability, simplicity, ease of use and installation, and support for popular high-level protocols.

An important enhancement to Fibre Channel has been the development of Fibre Channel arbitrated loop (FC-AL), developed specifically to meet the needs of storage interconnects. Employing a simple loop topology, FC-AL can support both simple configurations and sophisticated arrangements of hubs, switches, servers, and storage systems (see Figure 3, below). Furthermore, by using SCSI protocols over the much faster, more robust Fibre Channel link, FC-AL provides higher levels of performance without requiring expensive and complex changes to existing device drivers and firmware.



**Figure 3.** FC-AL's loop topology can support both simple and complex configurations

## Impressive Specifications

FC-AL-based storage systems will enable the creation of new applications that take full advantage of some impressive specifications:

- **Gigabit bandwidth**

FC-AL is capable of data transfer rates of up to 200 MB per second (full duplex), with 400 MB per second envisioned for the future—far faster than SCSI, Serial Storage Architecture, or P1394 (Firewire<sup>®</sup>).

- **Suitability for networks**

In addition to performance, Fibre Channel is ideal for building storage networks. Employing hubs and switches just like those used in networks, Fibre Channel will allow complex arrangements of storage and systems to be connected together in highly scalable, highly available networks, or fabrics.

- **Use of existing SCSI protocols**

FC-AL allows SCSI command packets to be sent over a high-speed physical medium, reducing software and firmware costs and minimizing impact on existing software.

- **Node-addressability far better than SCSI**

With the ability to support more FC-AL devices on a single host adaptor, cost and implementation complexity is greatly reduced. Using optical fiber media, a single FC-AL loop can support nodes with a separation of up to ten kilometers.

- **Greatly simplified wiring and cabling requirements**

Because Fibre Channel is a simple, largely optical, serial protocol, electrical interference and expensive cabling are much less of an issue than with the complex parallel data paths used by SCSI.

In addition to these features, FC-AL supports redundant data paths, hot-pluggable components, multiple host connections, and dual ported drives—features that 15-year-old SCSI technology was never intended to support (see “FC-AL Benefit Summary”). The technical advantages of FC-AL alone would be enough to convince most that it clearly represents the future of high-speed peripheral interconnects, but FC-AL can also provide peace of mind to those who worry about the bottom line:

- **Industry-standard**

The FC-AL development effort is part of the ANSI/ISO accredited SCSI-3 standard, helping to avoid the creation of nonconforming, incompatible implementations.

- **Broadly Supported**

All major system vendors (Sun, HP, DEC, Compaq, and others) are implementing FC-AL, as are all major disk drive and storage subsystem vendors. The Fibre Channel Association, an industry group dedicated to the promotion of Fibre Channel, is a Who's Who of systems, subsystems, drive, and component vendors. Such wide support ensures competition, lower costs, and user choice.

- **Vastly More Flexible**

Fibre Channel can also be used to do more than disk I/O—the Fibre Channel specification supports high-speed system and network interconnects using a wide variety of popular protocols, including HIPPI, TCP/IP, IPPI, FDDI, and ATM, in addition to SCSI. Many of the interconnect requirements of large enterprises may one day be met by Fibre Channel, promising lower costs, easier administration, and the easy deployment and redeployment of computing resources.



## FC-AL Benefit Summary

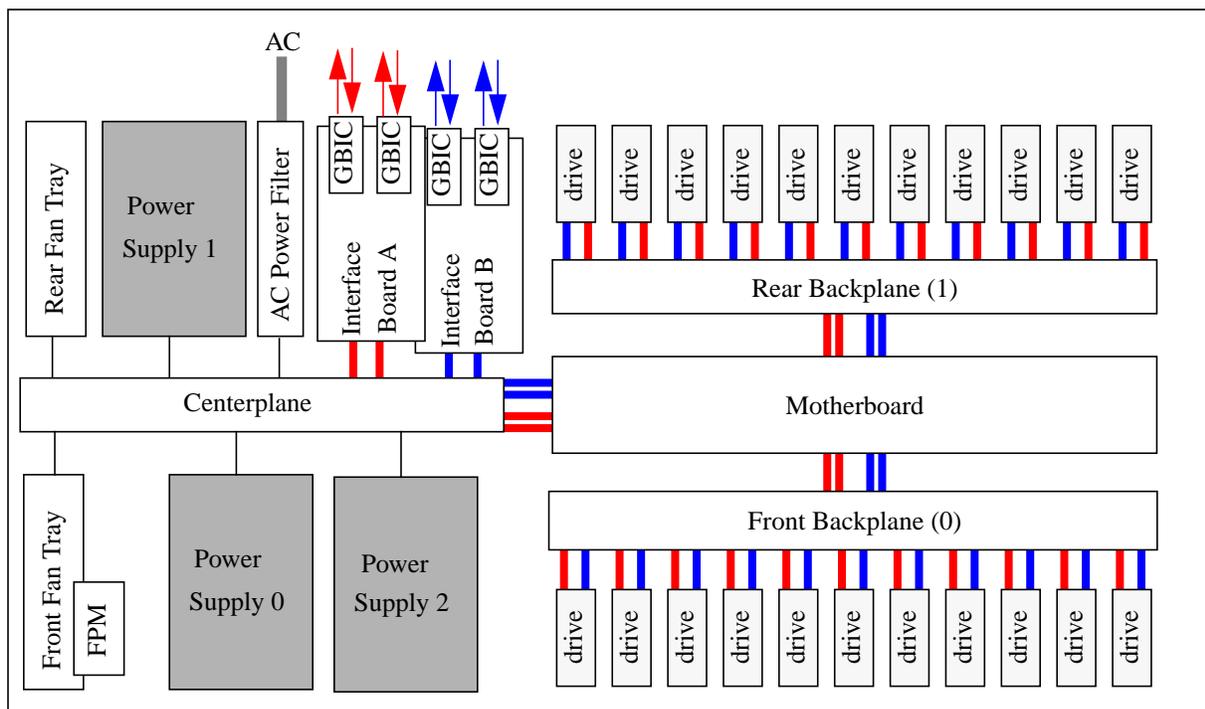
Fibre Channel arbitrated loop (FC-AL) provides a number of important technical advantages.

FC-AL Feature	Comparable SCSI Feature	FC-AL Benefits
100 MB-per-second data rates	40 MB/second data rates	Throughput to match modern computing, peripheral and networking performance
127 devices per loop	16 devices per bus	Simpler, less expensive equipment requirements
Networking capability	None	Easier, simpler configuration of high-performance computing, file, and storage servers and clusters
Up to 10 km between nodes using optical fiber; up to 30 meter using cable	Up to 25-meter differential	More flexible and secure hardware configurations
Hot pluggability, dual porting	Hot plug, single porting	Support for high availability and disaster-tolerant configurations, disk arrays
Use of cyclic redundancy checks to ensure data integrity	Same	Better security and reliability
Simple serial protocol over a copper or fibre medium	Parallel over copper	Less expensive, less complex cable requirements
Use of standard protocols like IP and SCSI	Same SCSI protocols	Reduced impact on system software and firmware; leverages existing code

# System Architecture

## Overview of System Architecture

The Sun StorEdge™ A5000 array is a high-availability mass storage subsystem that uses a disk enclosure capable of supporting up to 200 GB of storage with greater capacities to come as disk capacities grow. Active components in the disk enclosure are redundant and may be replaced while the subsystem is operating. The subsystem includes a SCSI Fibre Channel Protocol host adapter with a Fibre Channel 100-MB FC-AL port and supporting software. The Sun StorEdge A5000 disk enclosure is capable of supporting up to fourteen 1.6-inch disk drives or twenty-two 1.0-inch disk drives. The enclosure is designed to be mounted in a standard Sun rack or on a table top. Up to four disk enclosures may be attached to a host. One or two interface boards may be installed in the enclosure. These boards provide FC-AL connections to the enclosure and additionally provide special services to report and control the state of the enclosure and its components. The enclosure has a front panel display and control panel that allow the configuration of the enclosure to be displayed and modified. No cables are used inside the Sun StorEdge A5000 disk enclosure.



**Figure 4.** System architecture for the 22-drive configuration of the Sun StorEdge A5000—the 14-drive enclosure places seven drives on each backplane

## Interface Board

There are slots for two identical interface boards in the lower rear of the Sun StorEdge A5000 enclosure. The interface boards provides all intelligent controls in the enclosure, sensing and setting the environmental service signals as required by conditions inside the enclosure. The interface boards interprets enclosure service commands from the host software or front panel module and performs the indicated enclosure

management and sensing functions. The interface board provides bypass services for two independent Fibre Channel FC-AL ports and manages the configuration of the internal loops. Interface board unit A serves port A on each FC-AL disk drive. Interface board unit B serves port B on each FC-AL disk drive.

The Sun StorEdge A5000 enclosure can be configured as a single loop, or as a split loop. When operating as a single loop, port 0 or port 1 of the interface board is connected to the Fibre Channel link. The other port is available for attachment of a second host. When operating as a split loop, the front disk drives are connected to port 0 of the interface board and the rear disk drives are connected to port 1 of the interface board. When operating as a split loop, the enclosure is divided in half, creating two separate FC-AL loops. Each loop can be connected to a separate host. The two hosts can be the Solaris™ Operating Environment or Microsoft Windows NT Server systems.

## Loop Configurations

The Sun StorEdge A5000 array uses a number of bypass circuits and multiplexors to allow reconfiguration of the nodes within the enclosure. The nodes can be configured as a full loop, or the loop may be split into two loops. Failing devices and circuits may also be bypassed. The loop configuration is controlled through the enclosure service commands set either from the host, by operator instructions through the front panel module.

## Fibre Channel Disk Drives

All drives in the Sun StorEdge A5000 array contain an FC-AL interface that supports the SCSI command set. Each drive uses a small form-factor, 40 pin single connector attachment for FC-AL interconnect. Two form factors are available: half-height (1.6 inch) or low-profile (1.0 inch) disk drives.

The FC-AL drives are dual-ported for multi-path access. The A and B disk ports can be accessed through separate and independent interface boards. Each FC-AL disk drive is connected directly to the Fibre Channel loop and appears as a node on the loop. Each drive is identified by a World-Wide Name that is unique. The FC-AL drives accept all standard SCSI-3 commands. Since SCSI commands are delivered directly to the drives via the Fibre Channel loop, a legacy copper SCSI interface is not required, ensuring higher throughput and lower latency.

FC-AL drives are hot-pluggable. Software preparations, however, must be made for removal, replacement, and additions to be properly recognized and configured.

## Gigabit Interface Converter (GBIC) Module

The gigabit interface converter (GBIC) module is a small hot-pluggable optical/electrical conversion unit that converts any of the standard Fibre Channel connector and signaling technologies to a standard internal serial connection. The full speed of the module is 1,062.5 Mbit per second.

The standard GBIC provided with the Sun StorEdge A5000 array operates generically with either copper or optical connections. On one end is an electrical connection which interfaces with internal buses, while on the other end is an optical connection with the standard SC fiber cable connector. The GBIC uses a 780 nanometer shortwave laser that operates at an inherently safe power level so that no Open Fiber Control safety circuits are required.

Using 50-micron fiber, the maximum length of a fiber should not exceed 500 meters. Controls to the GBIC allow for turning the transmitter on and off. Sense information from the GBIC indicates transmitter faults and loss of signal.

The next-generation GBICs supported in the Sun StorEdge A5000 array support long-wave mode. Long-wave mode uses single-mode optical cables and long-wave lasers. Running in this mode and using 9-micron fiber, single-mode optical cables, the cable length can run a maximum distance of 10 kilometers.

## Host Adapters

The Sun StorEdge A5000 array is connected to a Microsoft Windows NT Server 4.0 host via a host adapter and cable. The FC-100 host adapter is a single loop, 64-bit, 33-MHz PCI card. The optical GBIC is not removable on this adapter. All standard cables are supported.

## Enclosure Service

Two mechanisms are provided for an operator to interact with the Sun StorEdge A5000 array enclosure. The front panel module allows an operator to directly access most of the enclosure services.

All enclosure services are performed by the processor on the SOC+ chip on the appropriate interface board. If only one interface board is installed and operational, that interface board performs the enclosure services. If two interface boards are installed and operational, the enclosure services are performed cooperatively by the interface boards.

Enclosure services provide and/or accept configuration and maintenance information through the front panel module display. An interface board unit may override instructions from the host or from the front panel module operator if the instructions conflict with the requirement for maintaining proper and safe operating conditions in the enclosure.

The following units generate or receive enclosure status or control information:

- Power supplies
- Fan trays
- Interface boards
- GBICs
- Disk drives
- Disk drive backplanes



## Front Panel Module

The Sun StorEdge A5000 array enclosure has a front panel module, which accepts touch switch inputs and provides graphic and alphanumeric information on an electro-luminescent display screen. In addition, it has three LED indicators that provide summary status information. The front panel module has three main functions:

- Displays enclosure, drive, and loop status, and highlights errors
- Displays vital enclosure data—WWN, box name, box ID, and so on
- Configures the enclosure—box name, loop configuration

The front panel module supplements the enclosure services provided through the SCSI-3 Environmental Services command set. The front panel module provides access to the same enclosure services and to some additional services even if the FC-AL is not connected or if the host processor's monitor and keyboard are distant from the array enclosure.

## Touch Screen

The touch screen has a 3 x 6 array of touch areas which are under-labeled by images from the graphic display indicating when they are active and what action will be performed by each. The touch screen provides numeric inputs to the enclosure and provides buttons for stepping through the diagnostic and display menus.

### Touch Screen Main Features

- Bright, clear display
- 18-button touch screen for configuration and status
- Three-level menu system:
  - Level 1—Menu and system view
  - Level 2—FRU groups and setup
  - Level 3—Individual FRU information and control
- Three system status summary LEDs



Figure 5. Front panel model touch screens

## Fiber Cable

The Sun StorEdge A5000 array supports 50/125 multi-mode, duplexed, UL910- and UL1651-approved fibre cable with OFNP marking. The connector is an SC connector with UL94V-2 rating (minimum). If the connectors do not have an overall jacket that keeps them together, it is advisable to color-code the connectors. Color-coding is particularly important in long cables (where the host and array are in locations remote from each other).

The Sun StorEdge A5000 array also supports 9-micron, single-mode, EIA/TIA 492BAAA-approved long-wave cabling, such as the Corning SMF-28 or Lucent equivalent. The connector is an SC connector with IEC-874-19 rating.

## RAID Support

The Microsoft Windows NT Server Disk Administrator supports RAID technology to optimize performance, availability, and user cost. This technology improves performance, reduces recovery time in the event of file system errors, and increases data availability even in the event of a disk failure. Disk Administrator supports three RAID levels that provide varying degrees of availability with corresponding trade offs in performance and cost:

- RAID 0 (striping and concatenation) enables data to span more than a single disk. While performance is improved, the lack of redundancy in this level leaves data unprotected.
- RAID 1 (mirroring) enables users to keep multiple copies of their data. In the event of a disk failure, data can be obtained from the remaining good copy, increasing data availability. RAID 1 is implemented as RAID 0+1 (striping plus mirroring), providing the data protection of RAID 1 with the performance benefit of RAID 0.
- RAID 5 (striping with distributed parity) offers the ability to reconstruct data in the event of a single disk failure. Significantly less expensive than mirroring, RAID 5 is a common choice when low-cost availability is desired.

# Requirements and Configuration

## System Requirements

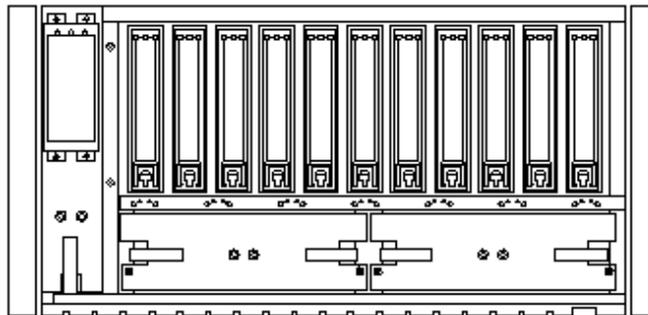
The Sun StorEdge™ A5000 disk array is a mass storage subsystem using network technology and gigabit FC-AL to create high-performance, high-availability storage networks. The enclosure is designed to be mounted in a standard Sun expansion cabinet, stand alone, on a tabletop, or on a rack shelf.

## System Configuration

The configuration choices for the Sun StorEdge A5000 array should be application-driven. Balance availability, performance and price in determining the configuration:

- When configuring for availability, data and hardware redundancy are key. The choice of RAID method determines the level of data redundancy.
  - Mirroring (RAID 1) is best for availability in mission-critical applications and the only certain solution for disaster tolerance.
  - Parity (RAID 5) also offers good availability.
- When configuring for performance, the best benchmark is the application. Striping (RAID 0) is the largest performance booster.
- When price is the priority, minimum hardware and RAID 0 might be the best choice.

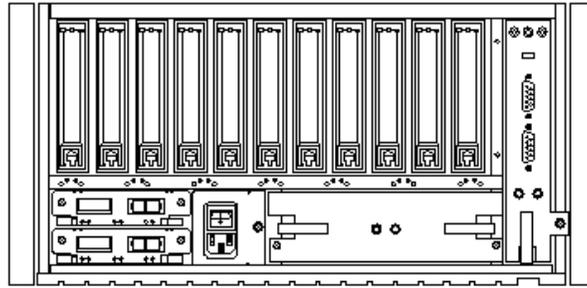
## Front Components



**Figure 6.** Sun StorEdge A5000 front components

The Sun StorEdge A5000 array enclosure is accessible from both the front and the rear. At the front of the array is the first row of seven FC-AL hot-plug disk drives. Also accessible from the front of the system are two hot-plug power supplies and the first of two hot-plug fan trays. The front panel module is the electro-luminescent display which provides information on local test and status.

## Rear Components



**Figure 7.** Sun StorEdge A5000 Rear Components

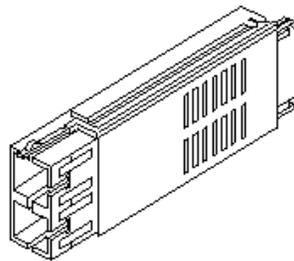
At the rear of the Sun StorEdge A5000 array is the second row of FC-AL disk drives. Also, the third power supply and the other fan tray are accessed from this side, as well as two interface boards, each of which holds one GBIC module.

### PCI FC-100 Host Adapter

The FC-AL host adapter for the Sun StorEdge A5000 system is a single-channel, 100 MB-per-second PCI card, which includes one GBIC optical module and support for one additional module. On Microsoft Windows NT Server systems, a single Sun StorEdge A5000 array can be connected to a single host adapter. Up to four host adapters and Sun StorEdge A5000 arrays can be connected to a single Microsoft Windows NT server.

### GBIC

The gigabit interface converter (GBIC) for the Sun StorEdge A5000 array converts FC-AL electrical signals to optical signals for connecting fiber optic cables. It is a hot-plug device supported on the array interface boards, host adapter and hub.



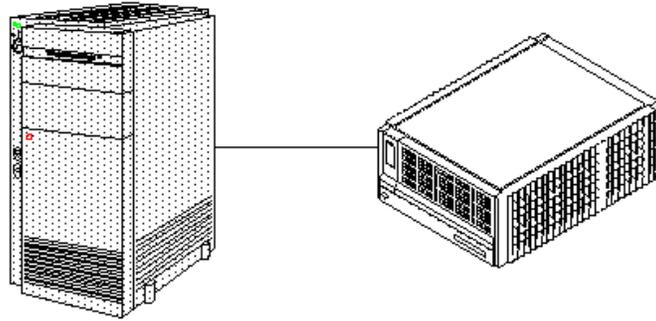
**Figure 8.** Gigabit Interface Converter

## Supported Configurations

The Sun StorEdge A5000 array uses 50-micrometer fibre optic cables to connect arrays and host adapters. Fiber optic cables are keyed and connect to the GBICs on each end. Each interface board and host adapter is supplied with one GBIC, standard.

### Minimum Configuration

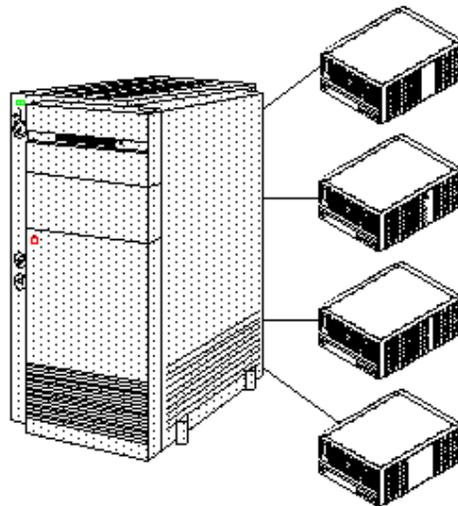
The minimum configuration for a Sun StorEdge A5000 array operating under Microsoft Windows NT Server is a single enclosure connected to the host via a host adapter, providing up to 254 GB of storage capacity.



**Figure 9.** Minimum configuration is a single array connect to the server via host adapter

### Maximum Configuration

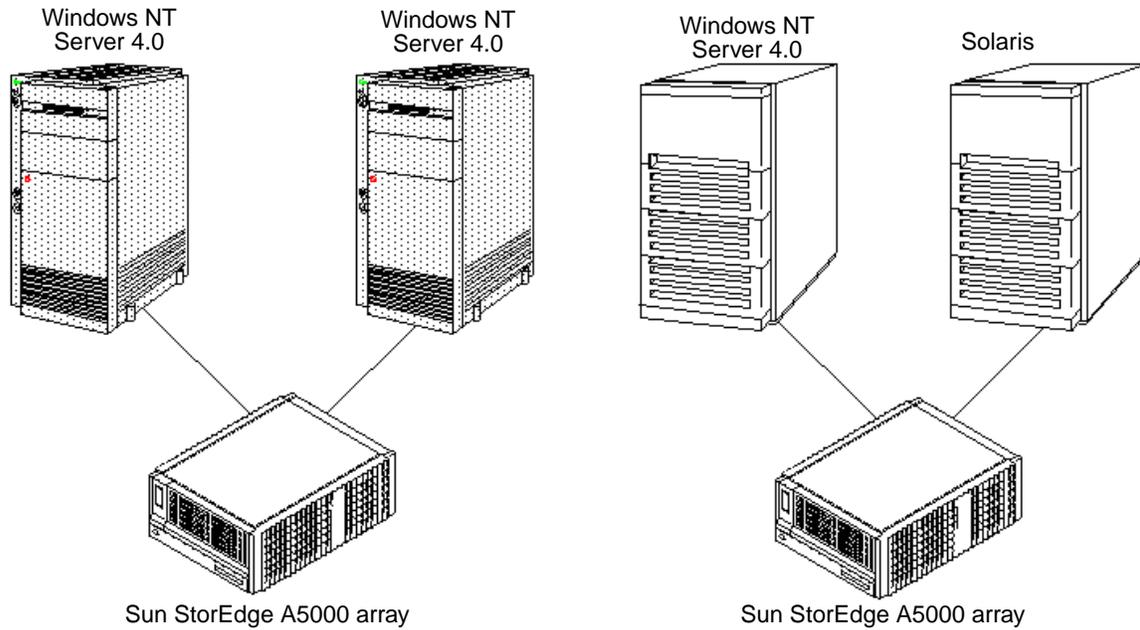
Up to four Sun StorEdge A5000 enclosures can be connected to a single Microsoft Windows NT server, providing up to 1 TB of storage capacity. Each Sun StorEdge A5000 must be connected to its own host adapter; four host adapters are required to supported four Sun StorEdge A5000 enclosures.



**Figure 10.** Maximum configuration connects four Sun StorEdge A5000 arrays to a server, each with their own host adapter

## Shared Array Configuration

The Sun StorEdge A5000 array may be shared between two Microsoft Windows NT Server systems. Each server must have a host adapter and cable connecting it to the enclosure. The drives in the enclosure are divided into a split loop, with one loop connected to each server. The servers may not share drives, and dual loops are not supported.



**Figure 11.** Example of a shared configuration

# System Management

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## System Administration

All active FRUs can be installed or replaced without powering down the subsystem. Disk drives can be exchanged by simply opening either the front or back door of the enclosure and then making the exchange. For all other components it is necessary to first remove the door and then remove the trim panel/hinge that supports the door and covers the other components. The hot-pluggable FRUs are:

- 3.5-inch disk drives (must match backplane type)—either seven 1.6-inch drives or eleven 1.0-inch drives per side
- Power supplies (at least two should remain installed to maintain power)
- Fan trays (must be exchanged promptly as overheating will shut down enclosure)
- Front panel module (removal does not affect unit operations)
- Interface boards (at least one must remain installed or unit powers down)
- Gigabit interface converters (one per loop maintains continuity)

## Software

The Microsoft Windows NT Server Disk Administrator provides customers with the following benefits:

### Features

- RAID levels 0, 1, 5
- Graphical user interface

### Benefits

- Improves performance and data availability
- Eases administration

## Operating System

### Microsoft Windows NT Server

Sun is looking to drive further growth of the Fibre Channel business. To increase our leadership in FC-AL storage and provide new customer flexibility with new and existing Sun StorEdge™ A5000 arrays, we now offer support on the Microsoft Windows NT Server operating system. Microsoft Windows NT Server 4.0 with Service Pack 3 is required for this functionality.

# Ordering Information

## Sun StorEdge A5000 Arrays

Order Number	Title and Description
<b>SG-XARY520A-63G</b>	63-GB Sun StorEdge A5000 array <ul style="list-style-type: none"><li>Subsystem includes seven 9.1-GB, 10000-rpm FC-AL drives, three power supplies, two interface boards and two 2-meter fibre optic cables.</li></ul>
<b>SG-XARY530A-91G</b>	91-GB Sun StorEdge A5100 array <ul style="list-style-type: none"><li>Subsystem includes five 18.2-GB, 7200-rpm FC-AL drives, three power supplies, two interface board and two 2-meter fibre optic cables.</li></ul>
<b>SG-XARY520A-200G</b>	200-GB Sun StorEdge A5000 array <ul style="list-style-type: none"><li>Subsystem includes twenty-two 9.1-GB, 10000-rpm FC-AL drives, three power supplies, two interface boards and two 2-meter fibre optic cables.</li></ul>
<b>SG-XARY530A-254G</b>	254.8-GB Sun StorEdge A5100 array <ul style="list-style-type: none"><li>Subsystem includes fourteen 9.1-GB, 7200-rpm FC-AL drives, three power supplies, two interface boards and two 2-meter fibre optic cables.</li></ul>

## Sun StorEdge A5000 Array Options

Order number	Option Description	Maximum Number Supported	Comments
X6729A	100-MB per second FC-AL PCI single channel host adapter		1 GBIC maximum
X6709A	9.1-GB, 7200-rpm FC-AL disk drive	14 per array	
X6710A	9.1-GB, 10000-rpm FC-AL disk drive	22 per array	
X6734A	Interface board with one GBIC	2 per array	2 GBICs maximum
X9687A	Power supply	3 per array	
X973A	2-meter fiber optic cable	1 per host connection	2 included with array
X978A	15-meter fiber optic cable	1 per host connection	

# Upgrades

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## Upgrade Paths

Protect your investments by upgrading to the Sun StorEdge™ A5000 array. Competitive upgrades to the Sun StorEdge A5000 array provide excellent trade-in values, making it more cost-effective to migrate to the latest technology. See the ordering information below for available upgrade configurations.

## Competitive Upgrade Ordering

Order Number	Title and Description
<b>CU-A5000-63GB</b>	Competitive Upgrade to 63-GB Sun StorEdge A5000 system <ul style="list-style-type: none"><li>• Customer returns a minimum of two 30-GB competitive arrays</li></ul>
<b>CU-A5000-91GB-18D</b>	Competitive Upgrade to 91-GB Sun StorEdge A5000 system <ul style="list-style-type: none"><li>• Customer returns a minimum of one 20-GB competitive array</li></ul>
<b>CU-A5000-200GB</b>	Competitive Upgrade to 200-GB Sun StorEdge A5000 system <ul style="list-style-type: none"><li>• Customer returns a minimum of two 40-GB competitive arrays</li></ul>
<b>CU-A5000-254GB-18D</b>	Competitive Upgrade to 254-GB Sun StorEdge A5000 system <ul style="list-style-type: none"><li>• Customer returns a minimum of one 37-GB competitive array</li></ul>

# Service and Support

The SunSpectrum<sup>SM</sup> program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs æ 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<sup>TM</sup> software, and telephone support for Sun software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value it represents. Customers should check with their local Sun Enterprise<sup>TM</sup> Services representative for program/feature variance and availability in their area.

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

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

## Warranty

The warranty on the array hardware is one year. All FC-AL disk drives carry a five-year warranty. Software is warranted for 90 days.

## Education

- IQ Kit Sales Guide
- IQ Kit Tech Guide
- SunU: Sun StorEdge A5000 disk array, 2 day, FT957W
- Web-based course: FS16W.Z



# Glossary

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Arbitrated loop	A loop topology where two or more ports can be interconnected, but only two ports at a time may communicate.
Channel	An interface directed toward high-speed transfer of large amounts of information.
Fabric	A group of interconnections between ports that includes a fabric element.
Fiber	A wire or optical strand. Spelled “fibre” in the Fibre Channel name.
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.
Full duplex	A communications protocol that permits simultaneous transmission in both directions, usually with flow control.
GBIC	Gigabit interface converter.
Hub	A device for connecting fiber cables.
IP	Internet protocol. A set of protocols developed by the United States Department of Defense to communicate between dissimilar computers across networks.
Laser	Light amplification by stimulated emission of radiation. A device for generating coherent radiation in the visible, ultraviolet, and infrared portions of the electromagnetic spectrum.
LED	Light emitting diode.
Link	One inbound fiber and one outbound fiber connected to a port.
Micron	One millionth of a meter. Also called “micrometer.”
Multi-mode fiber	An optical waveguide 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.

Optical fiber	Any filament of fiber, made of dielectric material, that guides light.
Point-to-point	A topology where exactly two ports communicate.
Port	An access point in a device where a link attaches.
Protocol	A convention for data transmission that defines timing, control, format and data representation.
Receiver	The circuitry that receives signals on a fiber, and the ultimate destination of data transmission.
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.
Serial transmission	Data communication mode where bits are sent in sequence in a single fiber.
Single-mode fiber	A step index fiber waveguide in which only one mode (ray of light) will propagate above the cutoff wavelength.
Switch	The name of an implementation of the fabric topology.
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 MB per second

# Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or Comac order #
<b>Powerpack</b>				
– <i>Sun StorEdge™ A5000 Family Array for Microsoft Windows NT Servers—Just the Facts</i>	Reference Guide	Sales Tool, Training	SunWIN, Reseller Web	95731
– <i>Sun StorEdge A5000 Family Array NT Customer Presentation</i>	Presentation overview; slide notes for presentation	Sales Tool	SunWIN, Reseller Web	98408
<b>References</b>				
– <i>Sun Product Intro—Sun StorEdge A5200 Array</i>	Introduction e-mail	Sales Tool	SunWIN, Reseller Web, E-mail	98411
<b>Product Literature</b>				
– <i>Literature—Sun StorEdge A5000 Array NT Datasheet, 1/99</i>	Datasheet	Sales Tool	SunWIN, Reseller Web	98803
<b>External Web Sites</b>				
– <i>Fibre Channel Association</i>	<a href="http://www.fibrechannel.com">http://www.fibrechannel.com</a>			
– <i>Fibre Channel Loop Community</i>	<a href="http://www.fcloop.org">http://www.fcloop.org</a>			
<b>Internal Web Sites</b>				
– <i>Storage Products Internal</i>	<a href="http://storageweb.eng">http://storageweb.eng</a>			
– <i>Technical Marketing Open Storage Info Web Site</i>	<a href="http://storageweb.eng/techmark_site/arrays/open/index.html">http://storageweb.eng/techmark_site/arrays/open/index.html</a>			