Sun StorEdge™ 6900 Series

Just the Facts

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Introduction

Figure 1. Sun StorEdge™ 6960 system

The Sun StorEdge™ 6910 and 6960 systems are easy to order, deploy, and manage and offer Sun customers integrated storage solutions for storage area network (SAN) environments. These systems are pre−tested and include integrated switches, Sun StorEdge T3[1] arrays, a Storage Service Processor, Storage Virtualization Engines, and phone−home capability (optional). This represents a new approach to providing storage solutions to customers. Instead of requiring the customer to "piece" together individual storage components, the Sun StorEdge 6910 and 6960 systems appear to the customer as a "storage solution in a box."

When used in conjunction with Sun StorEdge Traffic Manager software, the Sun StorEdge 6900 series provides load−balanced performance fas well as storage pooling for maximum storage utilization between Solaris™ Operating Environment and Windows platforms. Allocating storage between multiple hosts is easy with point−and−click granular and flexible control. Unlike competitive systems, the Sun StorEdge 6900 series scales I/O performance in a positive, consistent, and linear manner.

[1]All references to the Sun StorEdge T3 arrays imply the Sun StorEdge T3 array with 1−GB cache controller.

At a high level, the differences between the Sun StorEdge 6910 and 6960 systems are as follows.

Feature	Sun StorEdge 6910	Sun StorEdge 6960
Minimum Number of Sun StorEdge T3 arrays[2]	2	2
Maximum Number of Sun StorEdge T3 arrays[3]	6	16
Maximum Number of Cabinets	1	2
Minimum Capacity[4]	655 GB	655 GB
Maximum Capacity[5]	3.9 TB[6]	10.6 TB[7]
Maximum Number of Ethernet Hubs[8]	1	2
Maximum Number of Power Distribution Units	2	4

Availability

Both the Sun StorEdge 6910 and 6960 systems are scheduled for general availability on a worldwide basis in Q3FY02.

Key Features

- Available in configurations using 36.4−GB or 73.4−GB, bidirectional, dual−ported 10000−rpm FC−AL disk drives[9]
- Embedded Storage Service Processor provides 24x7 monitoring of components in the storage system[10]; configuration of Sun StorEdge T3 arrays, Fibre Channel switches, and Storage Virtualization Engines; upgrades to firmware/software in the Storage Service Processor itself; and diagnostic tools
- Minimum of one partner pair of Sun StorEdge T3 arrays
- A maximum of three Sun StorEdge T3 partner pairs in a Sun StorEdge 6910 system
- A maximum of eight Sun StorEdge T3 partner pairs in a Sun StorEdge 6960[11] system
- Two pairs of Sun StorEdge Network Fibre Channel (FC) switches[12],[13]

[2]Always provided in partner pairs.

[3]Always provided in partner pairs.

[4]Theoretical raw minimum capacity using 36.4−GB drives.

[5]Theoretical raw maximum capacity using 73.4−GB drives.

[6](73.4 GB/drive) x (9 drives/T3B) x (6 T3) ~ 3.9 TB. Does not account for RAID 5 with hot sparing.

[7](73.4 GB/drive) x (9 drives/T3B) x (16 T3) ~ 10.6 TB. Does not account for RAID 5 with hot sparing.

[8]One per cabinet.

[9]Drive sizes may be mixed within the Sun StorEdge 6910 and 6960 systems, but not within Sun StorEdge T3 partner pairs.

[10]The Storage Service Processor provides 24x7 monitoring, but it does not forward the information to Sun unless Sun StorEdge Remote Response is enabled.

[11]Three in the base configuration and five in the Sun StorEdge 6960 expansion cabinet.

[12]8−port switches and 16−port switches for the Sun StorEdge 6910 and 6960 systems, respectively.

[13]One pair is considered "front−end" and another pair is considered "back−end." The two "front−end" switches are connected to hosts or a SAN environment through Fibre Channel I/O ports. The two "back−end" switches are used for data interconnections between the Sun StorEdge T3 arrays and connections to the SVEs.

- Preconfigured with RAID 5 (7+1) plus standby hot spare[14]
- Sun StorEdge Remote Response capability (i.e., phone−home, remote support capability)
- Installation, configuration, and support services (optional at additional cost)

Features and Benefits

Features	Benefits
• Complete storage systems	• Reduced costs associated with storage because customers no longer have to qualify, integrate, and test components
• Factory−integrated and pretested storage systems	• New storage capacity can be deployed more quickly than if individual components were purchased • Lower failure rates compared to storage systems assembled on−site
• Storage virtualization	• Better utilization of storage assets • Ability for storage system to be used in a SAN environment • Supports storage consolidation between operating systems to same storage subsystem
• Based on familiar Sun StorEdge T3 array technology	• Storage costs are controlled because IT staff does not require new training on Sun StorEdge T3 arrays
• Ability to add Sun StorEdge T3 arrays to a base configuration at a later date	• Allows Sun StorEdge 6910 and 6960 systems to scale from 655 GB to 3.9 TB and 10.6 TB, respectively
• Internal Sun StorEdge T3 arrays preconfigured as RAID 5 (7+1) with standby hot spare	• Preconfigured storage arrays mean less time to install
• LUN carving allows customers to carve the underlying Sun StorEdge T3 array LUNs into small virtual LUNs	• Increased device support and ability to customize storage usage
• LUN masking allows customers to restrict access to a given LUN by a particular host	• Provides data security and segregation capability
• Host−managed multipathing[15] —two physical I/O paths to devices on each host[16]	• Redundant paths equate to increased availability

[14]Each Sun StorEdge T3 array has nine drives. Eight are used for RAID 5 and one is used for the standby hot spare.

[15]Only for Solaris 8 Operating Environment. Multipathing is not yet supported when using Microsoft Windows NT 4.0 or Microsoft Windows 2000 Advanced Server.

[16]Host software is required to manage I/O utilization of the presented I/O paths. Such software includes, but is not limited to, VERITAS VxVM with DMP or Sun StorEdge Traffic Manager software. All hosts connected to the same virtual devices must use one, and only one, form of multipathing management.

[17]For the Sun StorEdge 6960 system; up to seven for the Sun StorEdge 6910 system.

Features	Benefits
• Multiple host support —one to fourteen[17] host connections	• Support for clustered environment
• Field−replaceable units (FRUs) are easy to identify, access, and hot−swap	• Easy serviceability, decreased downtime, and reduction in potential errors
• Sun StorEdge 6960 expansion cabinet	• Provides Sun customers with familiar look and feel
• Installation through Sun StorEdge 6900 Installation (at additional cost)	• Experienced Sun−trained systems engineers help ensure proper installation
• Sun StorEdge Remote Response (optional)	• Early service notification of component or system anomalies results in reduced negative impact on data availability

Product Family Placement

The Sun StorEdge 6910 and 6960 systems are positioned as shown in the figure below.

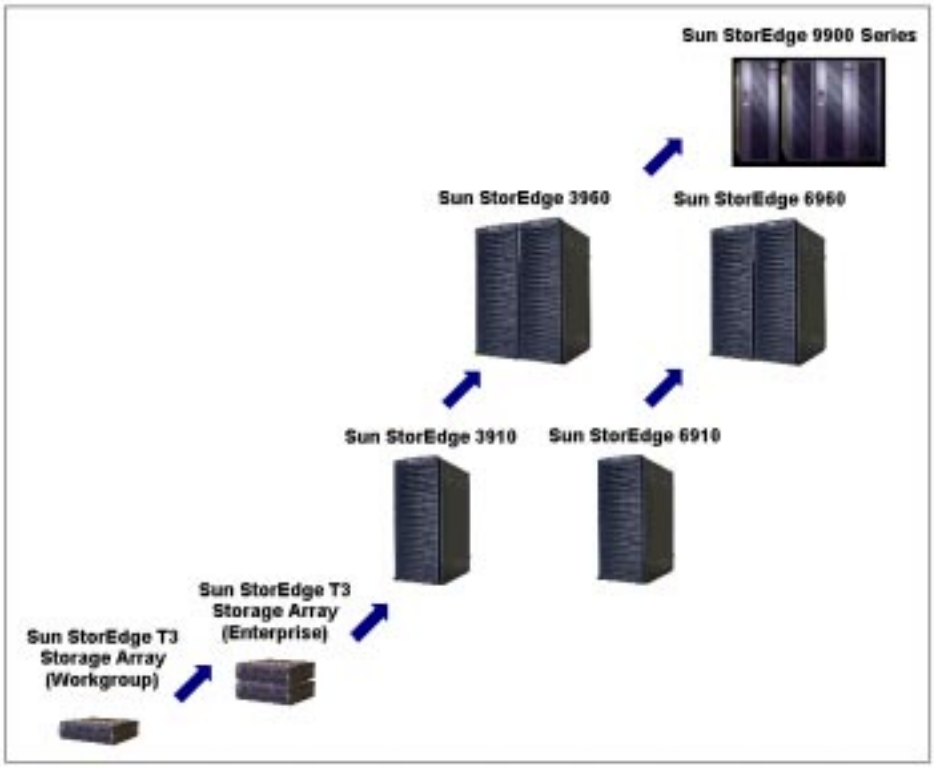

Figure 2. Sun StorEdge product family positioning

The Sun StorEdge 6900 series is targeted for midrange and enterprise applications in distributed environments. They are the natural next step above individual and partner pairs of Sun StorEdge T3 arrays and for customers wishing to implement a SAN solution in their storage environment. The Sun StorEdge 9900 series, on the other hand, is optimized for storage consolidation and enterprise SAN applications in high−end data centers. Together, this product line comprises a comprehensive Sun

StorEdge product family and fulfills customers' requirements from the smallest to the largest applications.

Target Markets

The Sun StorEdge 6900 series is targeted to customers who want scalable hardware RAID Fibre Channel storage. The target markets include:

- Web content delivery/distribution
- Online transaction processing (OLTP)
- Storage pooling
- Messaging
- Collaboration

Key Messages

- The Sun StorEdge 6910 and 6960 systems help reduce customers' total cost of ownership (TCO) because these storage systems are fully integrated and pretested.
- Sun Microsystems provides one of the best end−to−end solutions for the Solaris Operating Environment.
- Sun protects a customer's investment by providing a clear and easy migration path from the Sun StorEdge T3 array to the Sun StorEdge 6910 and 6960 systems.
- The Sun StorEdge 6910 and 6960 systems are simple because they are pre−integrated, pre−cabled for maximum expansion, pretested, and preconfigured with RAID 5.
- Sun lets the customer effectively manage their growth since the Sun StorEdge 6910 and 6960 systems scale from 655 GB to 3.9 TB and 10.6 TB, respectively.
- Fixed price services are available for the Sun StorEdge 6910 and 6960 systems, ranging from hardware installation to consulting services.
- Customers' storage costs are now predictable —a single price for a single storage system plus fixed price services.

Supported Features and Product Attributes

Feature	Description
Sun StorEdge™ 6910	• Minimum of two and maximum of six Sun StorEdge T3 arrays • Minimum of 2−GB and maximum of 6−GB mirrored battery−backed cache (1 to 3 GB usable) • 36.4−GB or 73.4−GB, 10000−rpm, FC−AL drives • Minimum capacity of 655 GB (using 36.4−GB drives) • Maximum capacity of 3.9 TB (using 73.4−GB drives) • Preconfigured for RAID 5 (7 + 1) with standby hot−spare • Two Storage Virtualization Engines • Four 8−port Fibre Channel switches with shortwave GBICs • 24−port Ethernet hub • Dedicated Storage Service Processor with 24x7 monitoring software • All components prepackaged in familiar Sun StorEdge cabinet • Minimum and maximum footprint of 6.14 ft^2 • Installation via Sun StorEdge 6900 Installation (optional, but highly recommended) • Remote support and monitoring via Sun StorEdge Remote Response (optional) • Consulting assistance via Implementation Assistance Service for Sun StorEdge 6900 system (optional)
Sun StorEdge 6960	• Minimum of two and maximum of sixteen Sun StorEdge T3 arrays • Minimum of 2−GB and maximum of 16−GB mirrored battery−backed cache (1 to 8 GB usable) • 36.4−GB or 73.4−GB, 10000−rpm, FC−AL drives • Minimum capacity of 655 GB (using 36.4−GB drives) • Maximum capacity of 10.6 TB (using 73.4−GB drives) • Preconfigured for RAID 5 (7 + 1) with standby hot−spare • Four Storage Virtualization Engines • Four 16−port Fibre Channel switches with shortwave GBICs • One 24−port Ethernet hub (one cabinet) • Two 24−port Ethernet hubs (two cabinets) • Dedicated Storage Service Processor with 24x7 monitoring software • All components prepackaged in familiar Sun StorEdge 6960 expansion cabinet • Minimum footprint of 6.14 ft^2 (one cabinet) • Maximum footprint of 12.29 ft^2 (two cabinets) • Installation/configuration via Sun StorEdge 6900 Installation service (optional, but highly recommended) • Remote support and monitoring via Sun StorEdge Remote Response (optional) • Consulting assistance via Implementation Assistance Service for Sun StorEdge 6900 system (optional)

Features Overview

The Sun StorEdge™ 6910 and 6960 systems employ the following technologies:

- Sun StorEdge T3 array
- Storage Service Processor (SSP)
- Storage Virtualization Engines (SVE)
- Sun StorEdge Fibre Channel switches (8− and 16−port)
- Ethernet hub
- Sun StorEdge 6960 expansion cabinet
- Software components
- Sun StorEdge Remote Response (optional)

Sun StorEdge T3 Array

The Sun StorEdge 6910 and 6960 systems use partner pairs of Sun StorEdge T3 arrays (each with 1−GB cache) to provide high availability, controller failover, and mirrored cache. Both 36.4−GB and 73.4−GB disk versions are offered. Technologies in the Sun StorEdge T3 array are full Fibre Channel connectivity, loop−switching design, and failover security. Further details about the Sun StorEdge T3 array can be found in SunWIN #311985, Sun StorEdge T3 array with 1−GB Cache Controller Just the Facts.

Storage Service Processor (SSP)

The Storage Service Processor (SSP) performs configuration, monitoring, and diagnostic services. More specifically, the SSP is responsible for:

- Monitoring the components in the Sun StorEdge 6910 and 6960 systems
- Fault isolation, verification, and notification of a FRU in the storage system that is failing
- Some limited non−mission−critical configuration functions including configuration of Sun StorEdge T3 arrays, Storage Virtualization Engines, and Fibre Channel switches

The SSP offers both local and remote control/telemetry streams. A telemetry stream consists of events and alerts and provides remote support and monitoring. The SSP provides a centralized common interface capable of executing a configuration and diagnostic command set (via both CLI commands and a GUI), both remotely and locally, for Sun StorEdge T3 arrays, 8− and 16−port switches, Storage Virtualization Engines, SSP itself, and applicable FRUs.

The Storage Service Processor can consolidate multiple telemetry streams into a single external connection (that is, single point of interface to multiple SSPs within a storage system). Any single Storage Service Processor can become the collection point for other geographically local SSPs. This SSP is called the "Master Storage Service Processor" while the other Storage Service Processors are called "Slave Storage Service Processors."[18] Aggregation eliminates the need to manage each Storage Service

[18]Each Storage Service Processor, regardless if it is a master or slave, has its own IP address.

Processor domain separately and supports the ability to manage multiple SSP domains as a single "system" domain.

The SSP can provide a nondisruptive download, both locally and remotely, of new SSP software.

The following software is also installed on every SSP at time of manufacture (see "Software Components" later in this section for further details on these software packages):

- Solaris™ 8 Operating Environment
- Storage Automated Diagnostic Environment
- SANSurfer
- Sun™ Explorer Data Collector
- Software to enable Sun StorEdge Remote Response
- Configuration utilities/tools for Sun StorEdge T3 arrays, Fibre Channel switches, and SVE

Each SSP is configured with the same hardware/software components to help ensure ease of replacement.

Storage Virtualization Engine (SVE)

Virtual storage appears as one device to the host operating system. The purpose of virtualization is to simplify storage by hiding the complexities and details of storage systems; hence, fewer administrators are required for storage management.

The Storage Virtualization Engine (SVE) units utilized within the Sun StorEdge 6900 series are designed to provide continuous, bottleneck−free operation —they are fully redundant. They also provide server−independent, hardware−secured zones.

The SVE is host−independent, which means it is not necessary to install and maintain separate software or host bus adapters (HBAs) on the servers or storage. No new server/host, operating system, or HBAs are required in the virtualization layer. The SVE is simply installed between the hosts and the storage arrays.

The SVE contains a processor, DRAM, and firmware that allow it to act like a traffic manager.

The SVE provides virtual LUN carving, which is the ability to take a large LUN and "slice" (or "carve") it up into smaller virtual LUNs. The same thing is done via VERITAS Volume Manager (VxVM), but at the volume level; virtualization does it at the LUN level and the host sees the LUNs, not the volumes. This approach is easier to manage than host−based volume management for several reasons:

- A host must be used to manage volumes (as opposed to a console)
- Volumes must be mapped to each LUN
- More overhead is associated with volume management
- Each Sun StorEdge T3 array has to be managed separately with volume management —there is no storage pool

The SVE also provides LUN masking functionality.[19]

The Sun StorEdge 6910 system ships with two Storage Virtualization Engines. The Sun StorEdge 6960 system ships with four SVEs.

[19]See Glossary for the definition of LUN masking.

Sun StorEdge Fibre Channel Switches (8−port and 16−port)

The Sun StorEdge 6910 and 6960 systems use hot−swappable, 8−port and 16−port switches, respectively. The switches are used for both data interconnections (internal to the Sun StorEdge 6910 or 6960 cabinets) and external connections. The switches provide cable consolidation, increased connectivity, and increased performance over traditional Fibre Channel hubs. The switches are paired to provide redundancy and thus high availability.

The following are the enabling technologies of both the 8−port and 16−port switches:

- Port delivery of 1.065 Gbit/sec. full duplex with less than a 600 millisecond switch latency
- Support of shortwave (SW) and longwave (LW) GBICs for distance configurations[20]
- Multiple I/Os can run at 100 MB/sec.
- Support for error conditions exception handling

Ethernet Hub

The Sun StorEdge 6910 and 6960 systems use a 24−port Ethernet hub as the backbone for the internal service network. The Ethernet hub acts as an aggregator for all the internal out−of−band connections, providing a single access port for the Storage Service Processor.

Sun StorEdge 6960 Expansion Cabinet

The Sun StorEdge 6910 and 6960 systems are factory−installed in the Sun StorEdge 6960 expansion cabinet, which is the same enclosure used for several other Sun products. This provides customers a consistent look and feel. The customer−accessible areas of each storage system are clearly labeled.

Software Components[21]

Storage Automated Diagnostic Environment

Storage Automated Diagnostic Environment takes the place of Network Storage Agent and the StorTools™ utility used in other Sun StorEdge products. Its two main components are a monitoring and notification agent as well as fault isolation tools. It also provides different levels of access control.

- **Storage Automated Diagnostic Environment Access Control**

  Users with varied user roles can be created under the "User Roles" menu with different levels of access. Currently the access levels are:

  - User —cannot make changes to anything (i.e., read−only)
  - Admin —can change setups, add/remove devices, etc.
  - Test —required to run diagnostics
  - Script —required to run the configuration utilities

[20] The Sun StorEdge 6910 and 6960 systems ship with shortwave GBICs.

[21] Please note that the software packaged with the Sun StorEdge 6910 and 6960 systems is preloaded onto the Storage Service Processor (which is located inside the Sun StorEdge 6900 series).

- **Monitoring and Notification Agent**

  This agent is a server−based online health and diagnostic monitoring tool that remotely monitors the Sun StorEdge T3 arrays, switches, and Storage Virtualization Engines in the Sun StorEdge 6910 and 6960 systems. It can be configured to monitor on a 24−hour basis, collecting information to enhance the reliability, availability, and serviceability (RAS) of these storage systems.

  The primary features of this agent are:

  - Health monitoring and fault detection —Reports on conditions that can impact the availability and operation of the Sun StorEdge 6900 series.
  - Alert notification —Automatically sends event notifications to system administrators and other designated parties using the following mechanisms: e−mail, SNMP traps, XML, or HTTP.
  - Telemetry stream —Sends out events and information to Sun that facilitate improved service and improved products (if configured).
  - Lightweight —The agent requires minimal resources in terms of disk space, compute cycles, and virtual memory footprint.

- **Fault Isolation Tools**

  Because the Storage Service Processor has no access to the data path in the Sun StorEdge 6910 and 6960 systems, only out−of−band diagnostics are available via these tools for the switches, HBAs, GBICs, Sun StorEdge T3 arrays, and Storage Virtualization Engines.[22]

  The Storage Virtualization Engines are monitored using "ping" as well as through the SLIC daemon interface provided by the SVE toolset. The fault isolation tools can depict the SVEs in the topology map and test the SVE−to−Sun StorEdge T3 array paths. If an in−band agent is installed (if a customer allows an agent on the in−band host), VLUN diagnostics are also provided.

  The fault isolation tools offer a wealth of out−of−band tests for the Sun StorEdge T3 storage arrays including OFDG support, log parsing, http tokens to collect FRU status, volume status information, and volume verify. If an in−band agent is installed (if a customer allows an agent on the in−band host), in−band LUN tests are also available.

  From the Storage Service Processor, there are switch external loopback tests to do fault isolation.

- **Configuration GUI**

  This graphical user interface (GUI) can be launched from the Scripts menu and provides a graphical interface to the command line configuration utilities. From the web browser, the user can configure the Storage Virtualization Engines, Sun StorEdge T3 arrays, and Fibre Channel switches, and modify device characteristics such as VLUNs. This is the same functionality that is available via the configuration utilities (see below), just simply via a GUI rather than a menu−driven character user interface or individual commands. Using this GUI, the following tasks can be performed:

  - Maintain host information
  - Add or update the master configuration
  - Discover a device
  - Maintain devices
  - Set up local email and pager notification
  - Set up a Provider

[22] If the customer allows an agent on the in−band host, there are some in−band diagnostic tests available also.

- Control agent activity
- View instrumentation reports
- Create a topology snapshot and history as well as display topology drawings of the Fibre Channel connections
- Verify the health of a SAN
- Monitor devices, SANs, and logs
- Adjust the system functions
- Run diagnostic tests using the GUI menus or the command line

SANSurfer

SANSurfer[23] is switch management software via a graphical user interface (GUI).

Sun Explorer Data Collector

The Sun Explorer Data Collector utility compiles information about the operating system that is installed on the Storage Service Processor along with information about the switches and the Sun StorEdge T3 arrays. The information is used for troubleshooting purposes. Sun Explorer Data Collector is basically a collection of shell scripts that gather Sun StorEdge 6900 system information, bundles it into a compressed tar file, and can be sent to Sun Enterprise Services for evaluation.

Configuration Utilities

Configuration utilities reside on the SSP and are a set of commands to perform maintenance on the Sun StorEdge T3 arrays, SVE, and switches within the Sun StorEdge 6910 and 6960 systems. These utilities are accessed via a menu−driven character user interface, individual commands that are called directly, or a GUI that is launched from Storage Automated Diagnostic Environment. These utilities allow the following actions:

- Configure, check, and display information about the Sun StorEdge T3 arrays, SVEs, and switches
- Determine storage system type and model number
- View detailed configuration utility messages in the logfile

Software to Enable Sun StorEdge Remote Response (SSRR)

Sun StorEdge Remote Response, available through Sun Enterprise Services, allows Sun trained personnel to remotely monitor, troubleshoot, diagnose and service the Sun StorEdge 6910 and 6960 systems 24 hours−a−day, 7 days−a−week, 365 days−a−year.

This service offers the customer fast turnaround when Storage Automated Diagnostic Environment detects a serviceable action by dialing a Sun Enterprise Services solutions center and transmitting the service alert along with any pertinent data for analysis. The solution center then dials back into the Sun StorEdge 6910 or 6960 system to gather further details or resolve the problem, oftentimes without involving the customer or affecting data availability.

Software to enable this service is installed on the SSP’s disk, but is not enabled for use until additional hardware is installed and a contract is in place between the customer and Sun Enterprise Services for

[23]While SANSurfer is provided on the SSP, it is used as a staging area for the switch firmware. There is no intent for anyone to use the GUI package image on the Storage Service Processor.

remote service support. Sun Enterprise Services or Sun−trained personnel must install the hardware and configure the system to "phone home" when the Sun StorEdge 6910/6960 systems are installed (or at a later date upon customer request).

Basic Architecture —Sun StorEdge™ 6910 System without SSRR Enabled

Refer to Figure 3 for an architectural depiction of the Sun StorEdge™ 6910 system. The following information about the basic architecture of the Sun StorEdge 6910 system assumes that Sun StorEdge Remote Response (SSRR) is not enabled.

Power Sequencers

The power sequencers provide redundant power sources for the Sun StorEdge T3 arrays, Fibre Channel switches, and Storage Virtualization Engines (SVEs). One array of each Sun StorEdge T3 partner pair is connected into the opposite power sequencer to ensure availability. This is the same with the switches and SVEs. In this manner, if one sequencer loses power, half of the subsystem remains functional.

Since they reside in the management path (not the data path), only one power connection is provided to both the Ethernet hub and the Storage Service Processor (SSP).

Sun StorEdge T3 Arrays

The Sun StorEdge 6910 system uses partner pairs of Sun StorEdge T3 arrays (each with 1−GB cache). A maximum of six Sun StorEdge T3 arrays (or three partner pairs) can reside in a single Sun StorEdge 6910 system.

Both the master and slave storage arrays of a partner pair are connected to one of two Fibre Channel switches for high availability purposes. They are also connected via an Ethernet connection to the Ethernet hub for administrative purposes.

Ethernet Hub

The Sun StorEdge 6910 system uses a hub as the backbone for the internal service network. The hub has 24 dedicated shielded 10/100BASE−T ports on its front panel and is rackmounted in the Sun StorEdge 6910 system.

The allocation of the Ethernet ports is as follows:

- One for the Storage Service Processor
- Four for the Fibre Channel switches
- Two for each Sun StorEdge T3 partner pair (max. of six ports for fully populated Sun StorEdge 6910 system)
- Two for the two SVEs

Storage Service Processor (SSP)

The Storage Service Processor is a server with a single 500−MHz, 64−bit UltraSPARC™ processor, a minimum 512 MB of on−board memory (expandable to 1 GB), and a 40−GB IDE internal drive. The SSP is preloaded with the Solaris™ 8 Operating Environment and applicable configuration tools and software (see the Enabling Technology section of this document for further details).

The SSP has two 10/100BASE−T Ethernet RJ45 ports and two RS−232 serial ports (refer to Figure 5).

One Ethernet port is dedicated to connecting to all internal rack FRUs, via the Ethernet hub. The other Ethernet port can be dedicated to either a "head connection" (for example, a laptop) or interconnection of a larger network of SSPs or system hosts. In other words, multiple SSPs can be aggregated into a LAN, where a single SSP is designated the "master."

The two serial ports can be used as a field hook−up to proprietary device debug ports (for example, Sun StorEdge T3 serial port) or as a modem port.

The SSP has a single power source input. If the power distribution unit (PDU) supplying power to the SSP fails, there is no notification of the power failure nor any subsequent storage system component notifications that would inevitably follow. This condition exposes the storage system to potential data unavailability if any of the failed−over components should fail before the monitoring agent heartbeat period elapses.[24] In addition, the SSP has only one boot disk. Thus, mirroring of boot drives in the SSP (so that a drive failure can minimize downtime latency by simply booting off the secondary drive) is not a feature of the Sun StorEdge 6910 system.

Fibre Channel Switches

The Sun StorEdge 6910 system uses four 8−port switches, which provide redundancy for high availability purposes.

Each of the four switches is connected via Ethernet to the service network for management and service from the Storage Service Processor.

The two front−end switches are connected to hosts or a SAN environment through Fibre Channel I/O ports. Since one of the eight ports is used for connection to a Storage Virtualization Engine, there are seven ports left for I/O connections.

The two back−end switches are used for data interconnections between the Sun StorEdge T3 arrays and connections to the SVEs. One of the eight ports is used for connection to an SVE. Two of the eight ports are used for connection to its partner switch. The remaining ports are used for connections to the Sun StorEdge T3 arrays.

Storage Virtualization Engines (SVEs)

The Storage Virtualization Engines (SVEs) in the Sun StorEdge 6910 system provides physical access to all of the underlying Sun StorEdge T3 arrays. There are two SVEs in the Sun StorEdge 6910 system.

Each SVE provides physical access to *half* of the underlying Sun StorEdge T3 arrays in the Sun StorEdge 6910 system.

The SVE provides multiple I/O paths to the individual underlying Sun StorEdge T3 arrays.

Although each SVE has four fibre ports, only two are used —one for host in and one for device out. Fail−over operation does not allow the SVEs to be daisy−chained together, as each SVE pair must be kept discrete from the other to allow proper operation of the Sun StorEdge T3 array path failover function. Using a switch to daisy−chain between SVEs provides higher performance as opposed to using a hub or directly connecting them.

Each SVE is single−sourced with power, but its pair is on the opposite power cord. If power is lost, the other unit is still operational until repairs are made.

[24]The monitoring agent’s heartbeat period is ~ 2 to 3 hours if no other activity has occurred. This parameter can be changed by the customer.

Service Panel

Access to the SSP is through a service panel (see Figure 5). The service panel is bolted to the back of the Sun StorEdge 6910 cabinet inside the back cover. Through the use of either a console connected to the Serial Console Port on the service panel or a laptop connected to the Service Port on the service panel, the functions of the SSP can be carried out. The following interfaces are brought from the SSP to the service panel:

- Storage Service Processor "external" LAN port
- Serial console port
- Two USB ports
- Service access serial port

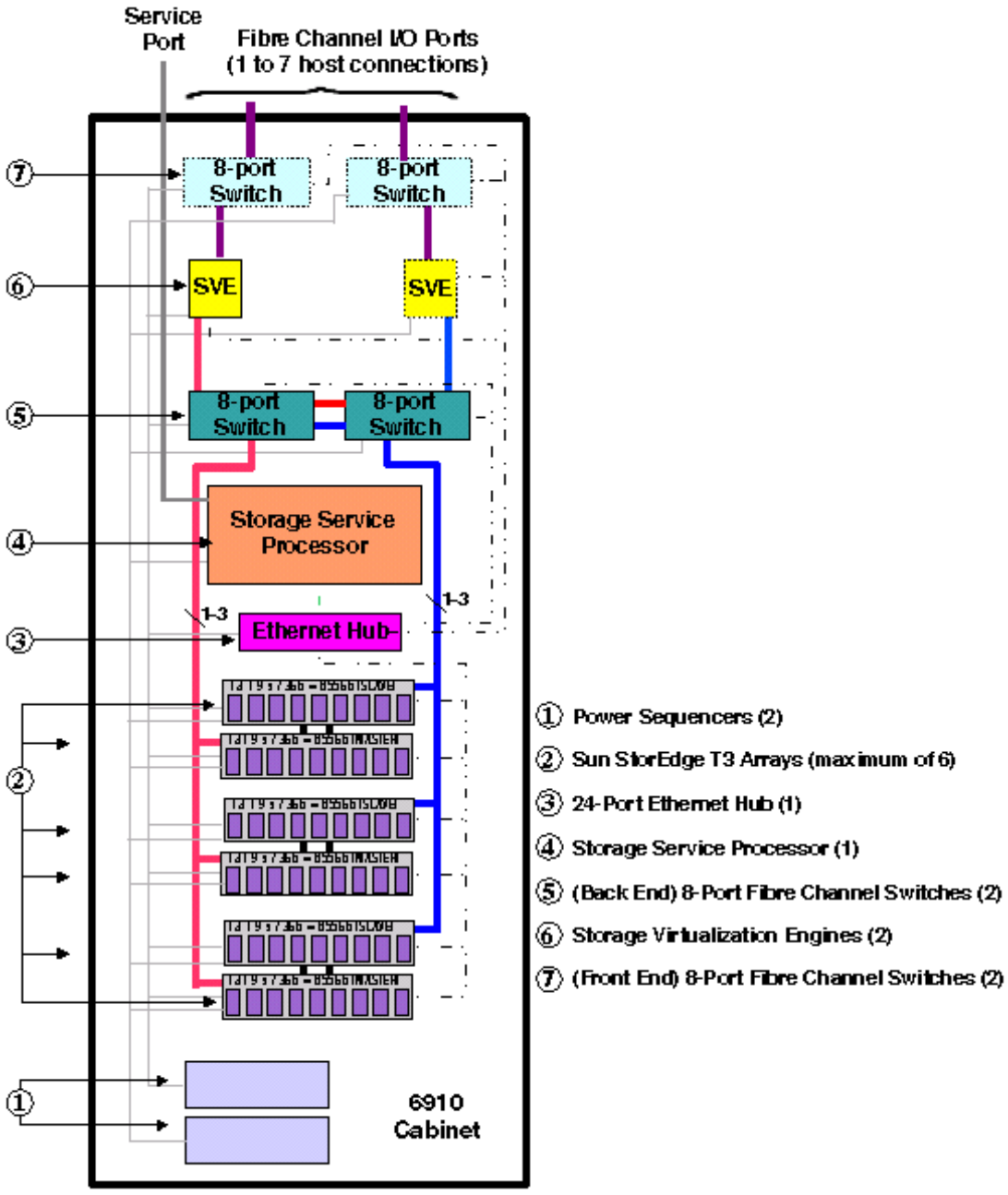

Figure 3. Sun StorEdge 6910 system cabinet configuration

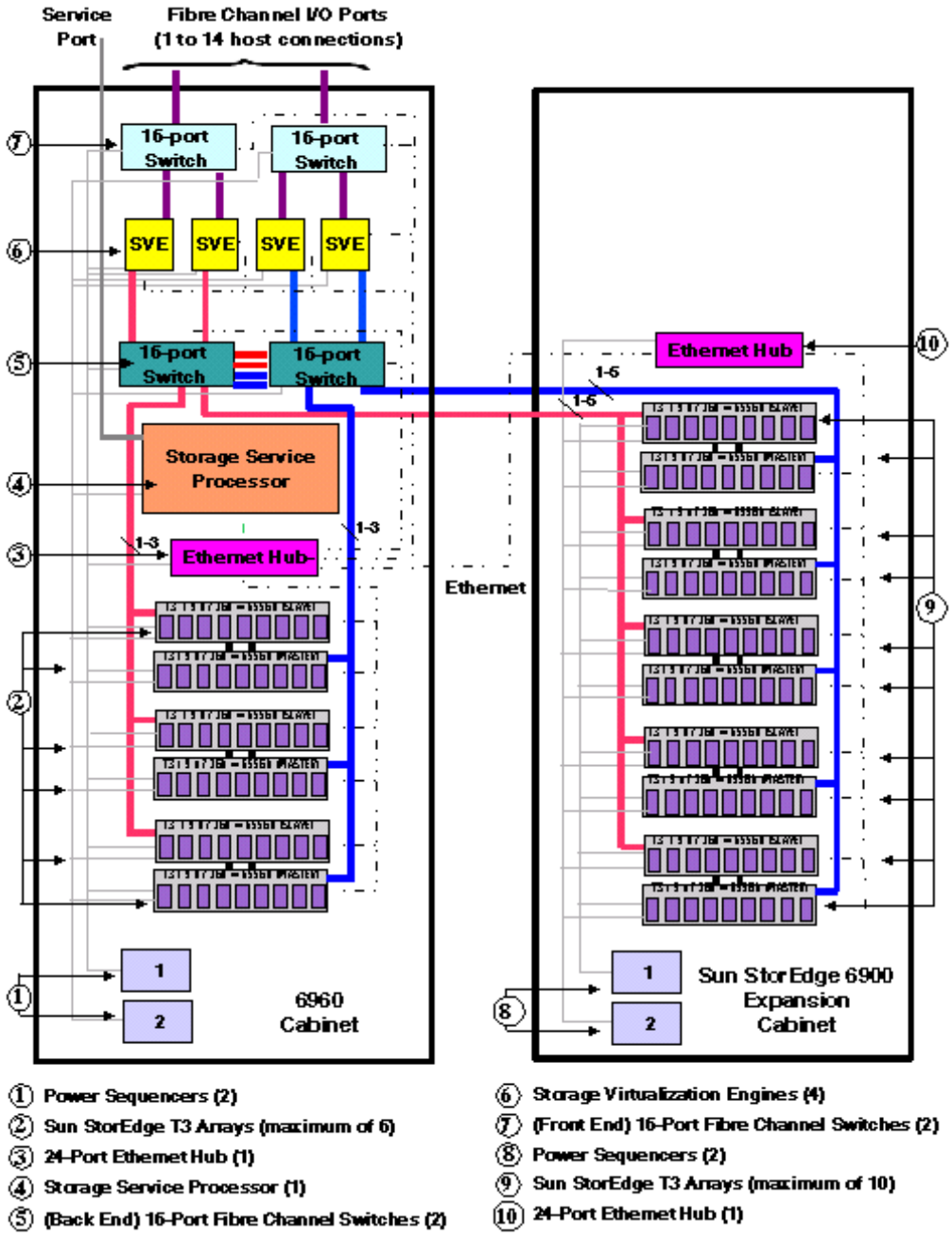

Figure 4. Sun StorEdge 6960 system cabinet configuration

Basic Architecture —Sun StorEdge 6960 system without SSRR Enabled

Refer to Figure 4 for an architectural depiction of the Sun StorEdge 6960 system. The following information about the basic architecture of the Sun StorEdge 6960 system assumes that Sun StorEdge Remote Response (SSRR) is not enabled.

Power Sequencers

The power sequencers provide redundant power sources for the Sun StorEdge T3 arrays, Fibre Channel switches, and Storage Virtualization Engines (SVEs). One array of each Sun StorEdge T3 partner pair is connected into the opposite power sequencer to ensure availability. This is the same with the switches and SVEs. In this manner, if one sequencer loses power, half of the subsystem remains functional.

Since they reside in the management path (not the data path), only one power connection is provided to both the Ethernet hub and the Storage Service Processor (SSP).

Sun StorEdge T3 Arrays

The Sun StorEdge 6960 system uses partner pairs of Sun StorEdge T3 arrays (each with 1−GB cache). A maximum of sixteen Sun StorEdge T3 arrays (or eight partner pairs) can reside in a single Sun StorEdge 6960 system (with Sun StorEdge 6960 expansion cabinet).

Both the master and slave storage arrays of a partner pair are connected to one of two Fibre Channel switches (within a cabinet) for high availability purposes. They are also connected via an Ethernet connection to the Ethernet hub for administrative purposes.

Ethernet Hub

The Sun StorEdge 6960 system uses a hub as the backbone for the internal service network. The hub has 24 dedicated shielded 10/100BASE−T ports on its front panel and is rackmounted in the Sun StorEdge 6960 system. An Ethernet hub is also rackmounted in the Sun StorEdge 6960 expansion cabinet.

The allocation of the Ethernet ports in the base configuration Sun StorEdge 6960 system (i.e., main cabinet) is as follows:

- One for the Storage Service Processor
- Four for the Fibre Channel switches
- Two for each Sun StorEdge T3 partner pair (max. of six ports for fully populated Sun StorEdge 6960 system)
- Four for the SVEs
- One for connection to the Ethernet hub located in the Sun StorEdge 6960 expansion cabinet

The allocation of the Ethernet ports in the Sun StorEdge 6960 expansion cabinet is as follows:

- Two for each Sun StorEdge T3 partner pair (max. of 10 ports for fully populated Sun StorEdge 6960 expansion cabinet)
- One for connection to the Ethernet hub located in the Sun StorEdge 6960 base configuration

Storage Service Processor

The Storage Service Processor is a server with a single 500−MHz, 64−bit UltraSPARC processor, a minimum 512 MB of on−board memory, and a 40−GB IDE internal drive. The SSP is preloaded with the

Solaris 8 Operating Environment and applicable configuration tools and software (see the Enabling Technologies section of this document for further details).

The SSP offers two 10/100BASE−T Ethernet RJ45 ports and two RS−232 serial ports (refer to Figure 5).

One Ethernet port is dedicated to connecting to all internal rack FRUs, via the Ethernet hub. The other Ethernet port can be dedicated to either a "head connection" (for example, a laptop) or interconnection of a larger network of SSPs or system hosts. In other words, multiple SSPs can be aggregated into a LAN, where a single SSP is designated the "master."

The two serial ports can be used as a field hook−up to proprietary device debug ports (for example, Sun StorEdge T3 serial port) or as a modem port.

The SSP has a single power source input. If the power distribution unit (PDU) supplying power to the SSP fails, there is no notification of the power failure nor any subsequent storage system component notifications that would inevitably follow. This condition exposes the Sun StorEdge 6960 system to potential data unavailability if any of the failed over components should fail before the monitoring agent heartbeat period elapses.[25] In addition, the SSP has only one boot disk. Thus, mirroring of boot drives in the SSP (so that a drive failure can minimize downtime latency by simply booting off the secondary drive) is not a feature of the Sun StorEdge 6910 system.

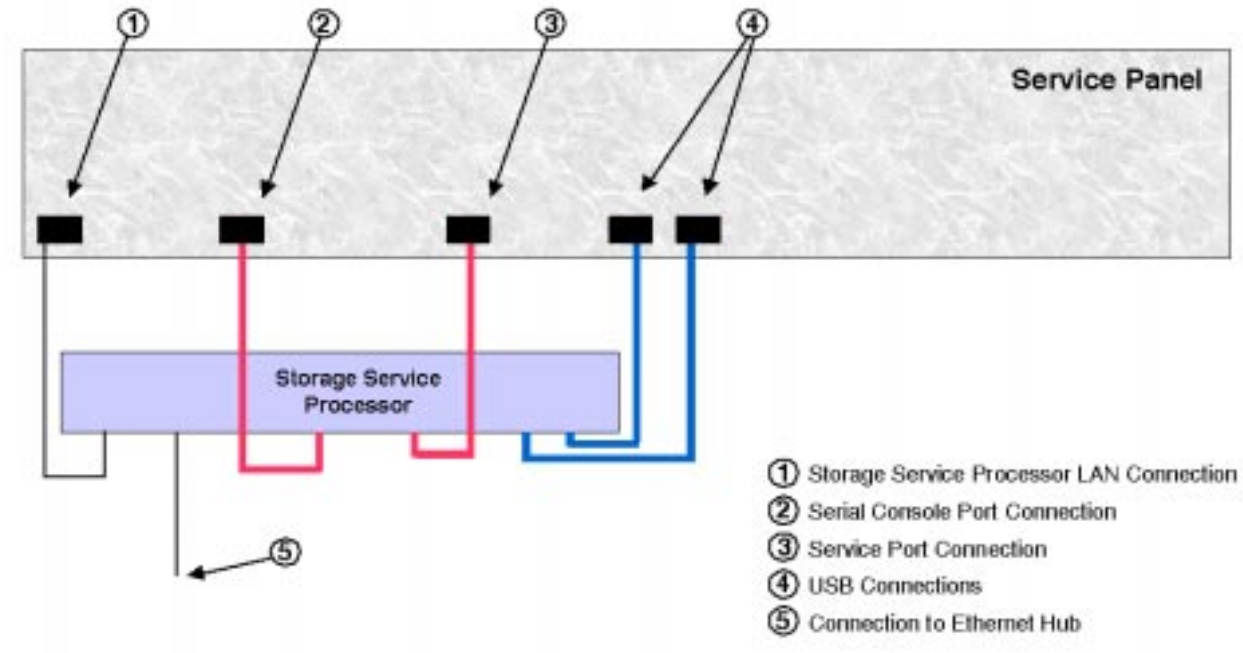

Figure 5. Storage Service Processor without Sun StorEdge Remote Response

[25]The monitoring agent's heartbeat period is ~ 2 to 3 hours if no other activity has occurred. This parameter can be changed by the customer.

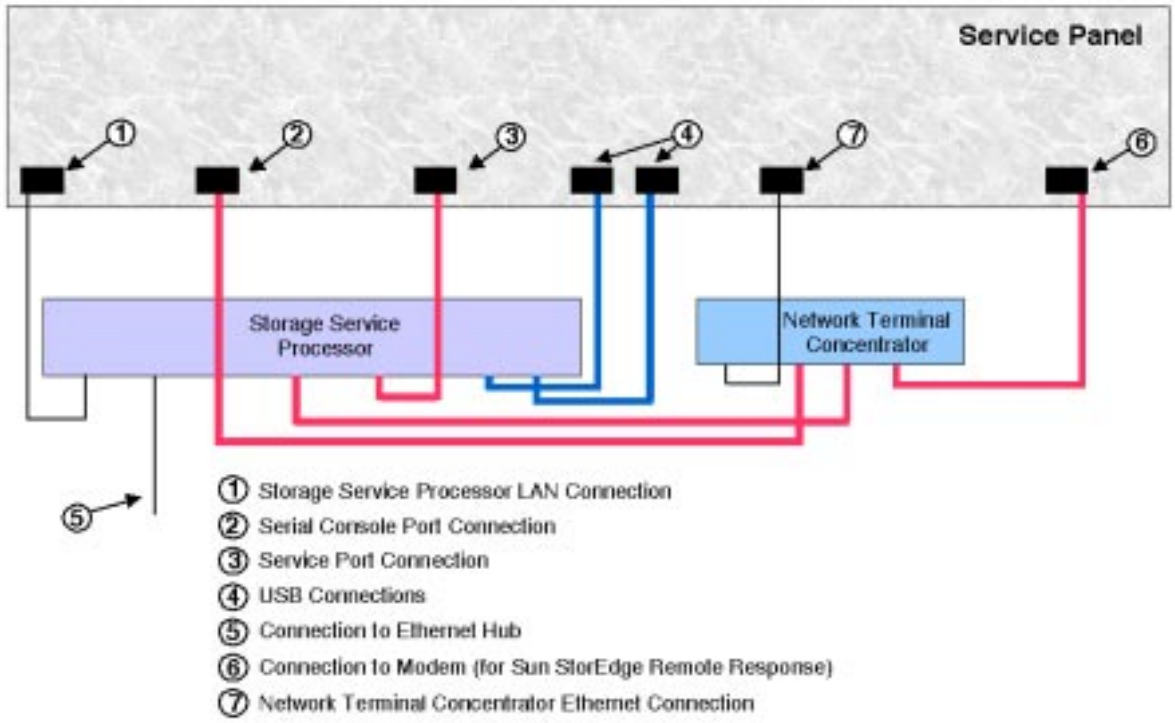

Figure 6. Storage Service Processor with Sun StorEdge Remote Response

Fibre Channel Switches

The Sun StorEdge 6960 system uses four 16−port switches, which provide redundancy for high availability purposes.

Each of the four switches is connected via Ethernet to the service network for management and service from the Storage Service Processor.

The two front−end switches are connected to hosts or a SAN environment through Fibre Channel I/O ports. Since two of the 16 ports are used for connections to the Storage Virtualization Engines, there are 14 ports left for I/O connections.

The two back−end switches are used for data interconnections between the Sun StorEdge T3 arrays and connections to the SVEs. Two of the 16 ports are used for connections to the SVEs. Two of the 16 ports are used for connection to its partner switch. The remaining ports are used for connections to the Sun StorEdge T3 arrays.

When using the Sun StorEdge 6960 expansion cabinet, each Sun StorEdge T3 array must be cabled into one of the 16−port Fibre Channel switches.

Storage Virtualization Engines (SVEs)

The Storage Virtualization Engines (SVEs) in the Sun StorEdge 6960 system provide physical access to all of the underlying Sun StorEdge T3 arrays. There are four SVEs in the Sun StorEdge 6960 system.

Each *pair* of SVEs provides physical access to *half* of the underlying Sun StorEdge T3 arrays in the Sun StorEdge 6960 system.

The SVE provides multiple I/O paths to the individual underlying Sun StorEdge T3 arrays.

Although each SVE has four fibre ports, only two are used —one for host in and one for device out. Fail−over operation does not allow the SVEs to be daisy−chained together, as each SVE pair must be kept discrete from the other to allow proper operation of the Sun StorEdge T3 array path fail−over function. Using a switch to daisy−chain between SVEs provides higher performance as opposed to using a hub or directly connecting them.

Each SVE is single−sourced with power, but its pair is on the opposite power cord. If power is lost, the other unit is still operational until repairs are made.

Service Panel

Access to the Storage Service Processor (SSP) is through a service panel (see Figure 5). The service panel is bolted to the back of the Sun StorEdge 6960 cabinet inside the back cover. Through the use of either a console connected to the Serial Console Port on the service panel or a laptop connected to the Service Port on the service panel, the functions of the SSP can be carried out. The following interfaces are brought from the SSP to the service panel:

- Storage Service Processor "external" LAN port
- Serial console port
- Two USB ports
- Service access serial port

Architecture —Sun StorEdge 6910 and 6960 Systems with SSRR Enabled

The only differences between this architecture and the two aforementioned basic architectures are as follows:

- Additional hardware associated with SSRR
- Additional cabling between the Storage Service Processor and the network terminal concentrator

Refer to Figure 6, which shows the service panel and its connections to the Storage Service Processor when Sun StorEdge Remote Response is enabled.

Network Terminal Concentrator

The network terminal concentrator (NTC) provides a modem connection point for Sun StorEdge Remote Response. The NTC facilitates a PPP connection from a remote solution center and is not dependent upon the Storage Service Processor to dial in.

Modem

Sun StorEdge Remote Response communicates with Sun Service Resolution Centers over a dial−up telephone connection. The modem provides the conversion of the RS−232 serial data stream from the SSP to the customer’s local phone service. The modem is instructed to dial−up the local solution center whenever the Storage Automated Diagnostic Environment’s Monitoring and Notification Agent detects the need for a service action or there is a periodical check−in with a heartbeat message. Sun service personnel dial−back into the SSP to obtain additional data about the alert or, in some cases, fix it remotely.

Reliability, Availability, and Serviceability (RAS)

Reliability

The Sun StorEdge™ 6910 and 6960 systems have the following reliability features:

- 24−hour monitoring by Storage Automated Diagnostic Environment to aid early detection/notification of faults
- Fault detection and isolation capabilities of the FC switches including loss of sync, CRC error checking, parity error handling, reconfiguration of frame bus upon anomaly detection, and reconfiguration of fabric if interconnecting links fail
- Error checking and correction on disk drives
- Skip sectors and spare cylinders on disk drives
- Automatic sector reallocation on RAID controllers
- Link redundancy chip and 8− to 10−bit encoding on FC−AL loops
- ECC on data cache
- Passive midplane (except ID signature) and temperature sensor

Availability

The Sun StorEdge 6910 and 6960 systems have the following availability features:

- Storage Automated Diagnostic Environment monitoring on a 24−hour basis
- Redundant power distribution units (PDUs) capable of serving sufficient switched 110/120V outlets
- No negative impact on data availability due to SSP or internal component LAN failure
- Redundant components such as the Storage Virtualization Engines (SVEs), FC switches, Sun StorEdge T3 arrays, and dual PDUs
- No negative impact on data availability when non hot−swap FRUs are replaced because of redundant architecture[26]
- Hot−swap redundant load−sharing/load−balancing auto−sensing 110VAC/220VAC power supplies with dual power cords in Sun StorEdge T3 arrays
- Built−in hot−swap redundant UPS batteries in Sun StorEdge T3 arrays' power controller units and associated disks so that content in cache can be destaged to the disks upon sense of power loss (graceful shut down), helping to prevent data from being lost no matter how long the power is out
- Four hot−swap, redundant cooling fans per each Sun StorEdge T3 array
- Hot−swap redundant unit interconnect cards in Sun StorEdge T3 arrays
- Hot−swap, redundant, dual−ported FC−AL drives, nonfloating hot−sparing capability, and dual backend drive loops per controller in the Sun StorEdge T3 arrays

[26]Regarding the Storage Virtualization Engine, the data path can be failed−over to replace an SVE. The new SVE can be swapped and configured and then failed−back to resume its data path. It is highly recommended that the user wait until all I/O activity is completed before running the fail−back command or I/O errors and/or system errors could occur.

- Hot−swap redundant RAID controllers in each Sun StorEdge T3 partner pair for automatic failover and cache mirroring
- Redundant host interfaces

Serviceability

The Sun StorEdge 6910 and 6960 systems have the following serviceability features:

- Low FRU count (eight[27] excluding cables and FRUs associated with Sun StorEdge Remote Response)
- Status/failure LED on each FRU of each Sun StorEdge T3 array within a Sun StorEdge 6910 and 6960 system
- Most FRUs have visual method to indicate faults
- A majority of the FRUs are electronically identifiable, including disk drives, power/cooling unit (PCU), unit interconnect card (UIC), and controllers
- Upgradeable drive firmware (with only the associated volume off−line during upgrade)
- Service access panel provides connection to the Storage Service Processor (SSP) in order to perform routine maintenance or reconfigure the storage system
- Every SSP is configured with the same hardware and software components to facilitate ease of replacement
- All Sun StorEdge T3 array FRUs are hot−swappable to help prevent servicing downtime and help minimize mean time to repair (MTTR)
- All Sun StorEdge T3 array FRUs can be hot−swapped without tools
- Loops, loop switching, diagnostics, and administration channels on the back end of the Sun StorEdge T3 arrays are redundant
- Controllers, host channels, and external administration channels are redundant within Sun StorEdge T3 arrays
- Online installation, scaling, and service of the Sun StorEdge T3 array
- Detection and reporting for incorrect drive position in a Sun StorEdge T3 array
- Automatic drive−ID selection in a Sun StorEdge T3 array

[27]FRUs include the Storage Service Processor, Storage Virtualization Engine, Ethernet hub, FC switch, disk drives, power/cooling unit (PCU), unit interconnect card (UIC), and controller. The latter four are FRUs of the Sun StorEdge T3 array. This FRU count does not include FRUs associated with Sun StorEdge Remote Response.

Specifications[28]

Sun StorEdge™ 6910 and 6960 Systems —Maximum Capacity —One Cabinet

Physical Planning	
Dimensions	75.0 inches high (109.5 cm) 23.9 inches wide (60.7 cm) 37.0 inches deep (94 cm)
Footprint	6.14 ft^2 (0.5706 m^2)
Weight (full complement of Sun StorEdge™ T3 storage arrays)	Sun StorEdge 6910 = 1,210 pounds (550 kilograms) Sun StorEdge 6960 = 1,540 pounds (700 kilograms)
FRU Access at Front	Disk drives, Storage Service Processor, Storage Virtualization Engine (SVE)
FRU Access at Rear	Controller card, unit interconnect cards, power/cooling units, Fibre Channel switch, Storage Virtualization Engine[29], Ethernet hub[30]
Required Clearances (for service)	Front = 48 inches (122 cm) Rear = 36 inches (92 cm) Left = 36 inches (92 cm) Right = 36 inches (92 cm)
Power Cord Length	15 feet (4.6 m)
Environmental (operating)	
Temperature	5º to 35º C (41º to 95º F)
Relative Humidity	20% to 80% noncondensing, maximum gradient 10% per hour
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 @ 0.25 g sinusoidal
Heat Output	~ 14,000 BTU
Environmental (nonoperating)	
Temperature	−20º to 60º C (−41º to 140º F)
Relative Humidity	5% to 93% noncondensing, maximum gradient 10% per hour
Altitude	−1,000 to +40,000 feet (−305 to 12,192 meters)
Shock (from any axis X, Y, Z)	10.0 g for maximum duration of 11 ms (half sinewave)
Vibration (from any axis X, Y, Z)	5 to 500 Hz @ 1.00 g sinusoidal

[28]For specifications regarding the Sun StorEdge T3 array, please see the respective Just the Facts (SunWIN #311985).

[29]Replacement of this FRU requires unlatching it in the rear of the enclosure and removing a screw in the front of the enclosure.

[30]Also requires removal of trim panel covering and two screws on the front of the unit in order to replace this FRU.

Connectors	
Service Panel	RJ45 and industry−standard USB connectors
FC Switch	Shortwave GBICs
Power Requirements	
Power Rating	4,200W (maximum) Four dedicated 200 to 220 VAC, 30A circuit breakers
Plug Types (US)	NEMA L6−30P for 200 to 240 VAC
Plug Types (international)	32A, single phase IEC 309, connected for 220 to 240 VAC
AC Power	200 to 240 VAC @ 47 to 53 Hz single phase
Standards Compliance	
Safety and Emissions	IEC 60950, EN 60950, UL 60950, UL 1950, FCC Part 15 (47CRF15B), CISPR 22 (EN55022 —RF Radiated and Conducted Emissions), IEC 61000−3−2, IEC 61000−3−3
Immunity	CISPR 24 (EN55024), IEC 61000−4−2, IEC 61000−4−3, IEC 61000−4−4, IEC 61000−4−5, IEC 61000−4−6, IEC 61000−4−8, IEC 61000−4−11
Interfaces and Protocols	FC−AL, SCSI, HTTP, HTML, Telnet, and FTP
Policies	Y2K (except RAID controller firmware)
Other	RS232C Ethernet 802.3

Sun StorEdge 6960 System —Maximum Capacity —Two Cabinets

Physical Planning	
Dimensions	75.0 inches high (109.5 cm) 47.8 inches wide (121.4 cm) 37.0 inches deep (94.0 cm)
Footprint	12.29 ft^2 (1.411 m^2)
Weight (full complement of Sun StorEdge T3 arrays)	2,895 pounds (1,316 kilograms)
Heat Output	~ 26,000 BTU

Bootable Device

Neither the Sun StorEdge™ 6910 nor 6960 system has been qualified as a boot device.

Host Connectivity[31]

Hosts connecting to either the Sun StorEdge 6910 or 6960 system must provide two paths for redundancy and high availability purposes. The Sun StorEdge 6910 or 6960 systems must connect into a SAN via Python XT (SAN 3.1) configuration rules in fabric mode with the following additions:

- Up to 7 and 14 dual−pathed active hosts supported, respectively (14 and 28 physical connections, respectively)
- Up to two linear ISL connections are supported[32]
- ISLs may be shortwave or longwave GBICs[33]
- Hosts may be in the same or different nameserver zones as customer requirements (such as security) may dictate
- SL mode (FC−AL) is not supported

Each host/server must provide at least one path to each Sun StorEdge T3 array residing within a Sun StorEdge 6910/6960 system. In addition, each host/server must provide the required driver support so that availability is not lost due to a system internal failure of one of the targets/paths.

Multipathing is not a requirement. If the customer opts for multipathing, host software is required to manage the I/O utilization of the presented paths. Such software includes, but is not limited to, Sun StorEdge Traffic Manager software or VERITAS Volume Manager with DMP. All hosts connected to the same virtual device must use one, and only one, form of multipathing management.

The Sun StorEdge 6910 system can be configured for 1 to 7 host connections. The Sun StorEdge 6960 system can be configured for 1 to 14 host connections.

Solaris™ Operating Environment

The Solaris™ 8 (07/01 or update 5) Operating Environment is installed on the Storage Service Processor (SSP) and is the minimum host operating environment support on the Sun StorEdge 6910/6960 systems. The operating system kernel is configured to support all attached peripherals.

[31]Applies only to hosts running Solaris 8 (07/01 or update 5) Operating Environment.

[32]Requires Storage Automated Diagnostic Environment 2.0 or better to be installed on all hosts. If this environment is not installed, then only one linear ISL is supported.

[33]Only one ISL may be longwave in a two−hop configuration.

Other Operating Environments

- Microsoft Windows 2000 Advanced Server (SP2)[34]
- Microsoft Windows NT 4.0 (SP6)[35]

Platform Support

The Sun StorEdge 6910 and 6960 systems support the following Sun hardware platforms:

- Sun Enterprise™ 220R, 250, 420R, 450, 3X00–6X00, and 10000 servers
- Sun Fire™ 280R, V880, 3800, 4800, 4810, 6800, and 15000 servers

Sun StorEdge T3 Arrays

The default configuration for each Sun StorEdge T3 array is as follows:

- Blocksize = 16 KB
- Caching and mirroring set on automatic
- Multipathing support via Sun StorEdge Traffic Manager[36] software
- Read ahead (rd_ahead) set to "off"
- Medium reconstruction rate (recon_rate)
- RAID 5 (7+1) with one hot standby
- Two (2) LUNs per partner pair

Blocksize can be reconfigured to 32 or 64 KB. RAID type can be changed to 1+0. In addition, physical LUNs can be reconfigured to 4 per partner pair.

Sun StorEdge T3 arrays are not mirrored within partner pairs.

Sun StorEdge T3 arrays are pre−configured in the factory to send their syslog information back to the SSP. Syslog information is sent back to the SSP if the arrays are ever returned to their default config.

LUN Configurations

For basic configurations of the Sun StorEdge 6910 and 6960 systems shipped from the factory, the Sun StorEdge T3 arrays are configured with one physical LUN per brick. Preconfigured physical LUNs comprised of 36.4−GB disk drives are 236 GB each, while preconfigured physical LUNs comprised of 73.4−GB disk drives are 477 GB each.[37] Each physical LUN is a full capacity RAID 5 (7+1) volume with a segment size of 16 KB and configured with a standby hot spare. Configuration utilities residing on the SSP allow the reconfiguration of the physical LUNs to meet desired performance requirements.

Maximum virtual LUN count for the Sun StorEdge 6910 system is 512. Maximum virtual LUN count for the Sun StorEdge 6960 system is 1,024.[38]

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[34]Qlogic 2200F/66 and Emulex LP8000−F1/N1 are two HBAs that have been qualified for this operating environment. They are supported by third−party vendors (Qlogic and Emulex, respectively).

[35]Qlogic 2200F/66 and Emulex LP8000−F1/N1 are two HBAs that have been qualified for this operating environment. They are supported by third−party vendors (Qlogic and Emulex, respectively).

[36]Also referred to as MPXIO.

[37]These are maximum LUN sizes, respectively. In other words, physical LUNs are limited to a pair of Sun StorEdge T3 arrays, where the largest physical LUN is simply the available storage on one partner pair.

Fibre Channel Switches

Longwave and shortwave GBICs can be mixed in switches as long as they are in different zones.

The switches are managed by Storage Automated Diagnostic Environment (out−of−band) and can be configured via the configuration utilities residing on the SSP, Storage Automated Diagnostic Environment's GUI, or SANSurfer's GUI. Only default switch settings are saved; configurations performed via the configuration utilities, Storage Automated Diagnostic Environment, or SANSurfer (if different from the default switch settings) are not saved. It is highly recommended that the user document configuration settings when switches are changed from their default settings, in case of a failure that would require a rebuild of the switch configuration.

- Port type settings
  - F_port for host connectivity
  - F_port for Storage Virtualization Engine (SVE) connectivity
  - TL_port for Sun StorEdge T3 array connectivity (back−end switches)
  - F_port for switch interconnection (for SVE interconnection)[39]
- Default switch settings
  - Single hard zone in each of the four switches in a Sun StorEdge 6910 system (each FC switch is a single zone unto itself)
  - Single hard zone in each of the front−end switches and two hard zones in each of the back−end switches in a Sun StorEdge 6960 system

The Sun StorEdge 6910 and 6960 systems provide two physical Fibre Channel ports for each target, both capable of maximum sustained full duplex throughput as stated by Fibre Channel specifications.

Storage Virtualization Engine (SVE)

The SVE uses "F" ports to connect to the switches, both front− and back−end.

VERITAS Volume Manager (VxVM)

The VERITAS Volume Manager (VxVM) license is a host−based license, not an array−based license. With the Sun StorEdge T3 arrays[40], there is a promotion where a *department* server host license for VxVM is included at no charge when purchasing a partner pair of Sun StorEdge T3 arrays. The intent is for this license to be used with the Sun StorEdge T3 arrays. If the customer has a higher tier server, the license must be upgraded at a cost. No such promotion is provided with the Sun StorEdge 6910 and 6960 systems. However, if an existing VxVM license is being used with a partner pair of Sun StorEdge T3 arrays and these arrays are replaced with a Sun StorEdge 6910 or 6960 system on the same host, the existing VxVM license can continue being used. If the host/server is being upgraded or more hosts are being added, the VxVM license needs to be upgraded accordingly.

Host Bus Adapters

[38]The buffer architecture of the Storage Virtualization Engines, however, only allows a maximum of 234 simultaneous I/O transfers. Creating VLUNs beyond this number does not make sense as they would not be continuously utilized.

[39]The initial setting is an F_port and then it autoconfigures to a T_port.

[40]All references to the Sun StorEdge T3 arrays imply the Sun StorEdge T3ES array with 1−GB cache controller.

Server Platform	Sun Host Bus Adapter				Max. No. of 6910/6960 Direct Connected to a Server
	X6799A	X6727A	X6757A	X6748A	
Sun Enterprise 220R	X	X			4
Sun Enterprise 250	X	X			4
Sun Fire V880	X	X			8
Sun Fire 280R	X	X			4
Sun Enterprise 420R	X	X			3
Sun Enterprise 450	X	X			7
Sun Enterprise 3500	X				6
Sun Enterprise 3500		X	X		3
Sun Enterprise 4500	X				8
Sun Enterprise 4500		X			6
Sun Enterprise 4500			X		8
Sun Enterprise 5500	X				8
Sun Enterprise 5500		X	X		6
Sun Enterprise 6500	X				12
Sun Enterprise 6500		X			6
Sun Enterprise 6500			X		8
Sun Fire 3800				X	8
Sun Fire 4800	X	X			8
Sun Fire 4800				X	7
Sun Fire 4810	X	X			8
Sun Fire 4810				X	7
Sun Fire 6800	X	X			8
Sun Fire 6800				X	7
Sun Enterprise 10000	X	X			30
Sun Enterprise 10000			X		60
Sun Fire 15000	X	X			70

If using Microsoft Windows NT 4.0 (SP6) or Microsoft 2000 Advanced Server (SP2), use one of the following two host bus adapters:

- Qlogic 2200F/66
- Emulex LP8000−F1/N1

Sun StorEdge Remote Response (SSRR)

Configuration and installation of Sun StorEdge Remote Response (SSRR) hardware and software require a contract between Sun and the customer.

The customer must provide a suitable telephone connection (analog line) to enable this service. The customer is responsible for maintaining this analog line and for all costs associated with such line, including installation fees, monthly charges, and maintenance costs. The following are requirements of the analog line[41]:

- Required analog jack must be no more than 25 feet from the supported system.
- Analog line must not be shared by or chained with any other computer systems or electronic devices (such as fax machines).
- Analog line must be capable of both sending and receiving calls.
- Analog line must have a phone number assigned to it that makes it possible to connect to an attached modem without being routed through a switchboard or dialing a separate extension number.
- Analog line must be capable of directly dialing Sun.

Customers who opt for SSRR should only use this service via a private LAN. Otherwise, it is highly recommended, to ensure the integrity of customers' systems, that the customer install a firewall between hosts connecting to these storage systems and the storage systems themselves.

The customer must purchase one of two hardware kits to enable the service (either SG−XRRH−C1M1−A or SG−XRRH−C1M0−A). A modem is included in SG−XRRH−C1M1−A. Customers wishing to deploy a Sun StorEdge 6910/6960 system in a country outside of countries which support this modem must purchase SG−XRRH−C1M0−A and provide a suitable modem device.[42] The following are some of the requirements of the modem:

- Dial security
  - Ability to define accounts which have passwords associated with them
  - Ability to specify an administrator account where only the administrator can see/change account information when dial security is enabled
  - If dial security is enabled (when answering), the modem prompts for a password and only allows a connection if the the password given is found in the list of accounts
  - Ability to configure modem for the number of attempts allowed for correctly specifying a valid password
  - Ability to enable/disable modem accounts
- Dialback security
  - Accounts are configurable where dialback can be turned off or on
  - Dialback number can be preprogrammed or prompted for
- Operating system compatibility:
  - Compatible with UNIX operating environment
- Remote operation

[41]Analog line shall conform to specified requirements/restrictions delineated by Sun Enterprise Services. Contact a local Sun Enterprise Services representative for further details.

[42]Modem shall conform to specified requirements/restrictions delineated by Sun Enterprise Services. Contact a local Sun Enterprise Services representative for further details.

  - Remote management capability to configure, set up, and troubleshoot the modem from another site
  - Capability to remotely upgrade modem firmware with new features or ITU protocol changes
  - Ability to password−protect remote configuration
- Interface
  - RS−232 serial interface
- Configuration
  - Configurable so that it is dial−out only, dial−in only, and dial−in−out modes
  - Ability to remotely configure modem
  - Ability to password−protect remote configuration
- Miscellaneous
  - Supports Hayes AT Command set
  - Connects with all ITU fax and data protocols

It is highly recommended that the customer purchase the installation service for these storage systems to enable this service. Further details about this installation service can be found in the section entitled "Support Services."

SSRR supports aggregation of Storage Service Processors (SSPs).

Note: *Within the Sun StorEdge 6910/6960 cabinet, there is an internal network referred to as the "Local Component LAN." It is totally contained in the enclosure and connects the SAN components and the SSP via an Ethernet hub. This network is used for administration of the SAN components and for error alarms and data telemetry going to the SSP. For security and supportability reasons, when SSRR has been activated, customers do not have access to this network ever. Obviously, since the Sun StorEdge 6910/6960 system is physically located at the customer's site, it is impossible to prevent somebody from physically accessing this network. If this is done by the customer or a representative of the customer, the customer is in technical violation of the SSRR agreement/contract. Without SSRR, the customer can have any level of access to this network that they desire. However, it is highly recommended that this "Local Component LAN" not be directly connected to some general LAN.*

If a customer who has SSRR performs repair/reconfiguration activities (whether locally or remotely) that are faulty, they may get charged T&M by Sun Enterprise Services for remote diagnostic/repair activities that are performed as a result of the faulty repair/reconfiguration activity.

Configuration Utilities

The configuration utilities only support predefined and preconfigured hard zones. If something other than that is required, SANSurfer or Storage Automated Diagnostic Environment must be used to reconfigure the switches. Switch configurations performed using SANSurfer, Storage Automated Diagnostic Environment, or the configuration utilities (if different from the default switch settings) are not saved. It is highly recommended that the user document switch configuration settings, in case of a failure that would require a rebuild of the switch configuration. *It is highly recommended that the user NOT use SANSurfer on the Sun StorEdge™ 6900 series.*

Note: *It is also highly recommended that Sun StorEdge Component Manager software not be used with the Sun StorEdge 6910 and 6960 systems. Most of the features and functionality of this software have been captured in the configuration utilities. Using Sun StorEdge Component Manager software in conjunction with the configuration utilities could compromise the Sun StorEdge 6910 or 6960 systems.*

These utilities allow the following activities:

- Manage VLUNs
- Manage virtualization engine zones
- Manage configuration files
- Manage virtualization hosts
- Display awitch configurations
- Verify awitch configurations
- Set Switch configurations
- Display Sun StorEdge T3 array information
- Save Sun StorEdge T3 array configuration information
- Configure Sun StorEdge T3 array
- Restore Sun StorEdge T3 array configuration
- Verify Sun StorEdge T3 array configuration
- Modify Sun StorEdge T3 array system parameters
- Display Sun StorEdge T3 array configuration status

If a Sun StorEdge 6910 or 6960 system's configuration is changed via the configuration utilities and the Storage Service needs to be replaced, if no other component connected to the SSP fails before the SSP is replaced, the Sun StorEdge T3 array and SVE settings can be recovered through the configuration utilities.[43] This only applies to the arrays and SVEs. Regarding the switches, it is again highly recommended that the user document switch configuration settings, in case of a failure that would require a rebuild of the switch configuration.

If Sun StorEdge T3 partner pairs are set to RAID 5 with two LUNs, all data is destroyed if the "setdefaultconfig" command is used via the CLI. This command sets all SVEs, switches, and Sun StorEdge T3 arrays to their default configurations.

[43]These settings are not saves, but the devices can be queried to determine how they were configured.

When trying to restore a Sun StorEdge T3 array configuration with a saved configuration from the snapshot file on the Storage Service Processor (using the "restoret3config" command via the CLI), a mount is performed on any LUN that is not mounted. Data might be lost, however, if the RAID configuration is different from the RAID configuration in the saved configuration.

Sun StorEdge T3 Array Management

Replacing a Sun StorEdge T3 Array

During configuration of the Sun StorEdge T3 arrays[44], a snapshot file of the configuration is saved on the Storage Service Processor. In the event that a Sun StorEdge T3 array needs to be replaced, the array configuration is restored from the static saved configuration from the snapshot file.

LUN Management

LUN Concatenation

LUN concatenation between Sun StorEdge T3 partner pairs is not supported. If a customer needs a LUN to span more than one Sun StorEdge T3 partner pair, host−based volume management, like VERITAS Volume Manager of Solstice DiskSuiteTM, needs to be used.

Resizing LUNs

If a customer needs to grow or shrink a LUN, all LUNs do not need to be taken offline (unmounted?). Only the LUN that needs to be resized needs to be taken offline. Please note that data in that particular LUN will be lost, however.

Replacing a LUN

During configuration of the Sun StorEdge T3 arrays[45], a snapshot file of the configuration is saved on the Storage Service Processor. In the event that a LUN is lost, the array configuration is restored from the static saved configuration from the snapshot file.

[44]Array configuration can be either the default configuration shipped from the factory or reconfiguration as a result of using the configuration utilities (via a menu−driven character user interface, individual commands or the Storage Automated Diagnostic Environment GUI).

[45]Array configuration can be either the default configuration shipped from the factory or reconfiguration as a result of using the configuration utilities (via a menu−driven character user interface, individual commands or the Storage Automated Diagnostic Environment GUI).

Storage Virtualization Engine (SVE)

Virtual and physical device map synchronization is used by the SVE. If an SVE fails, the second SVE of the pair maintains the I/O availability. All SVE pairs use a single device mapping of physical to virtual devices. A change to the physical or virtual mapping results in a re−synchronization of the device mappings throughout the SVE pairs. To accomplish the synchronization, each SVE pair is connected to one another through a dedicated zone through a redundant pair of Fibre Channel switch T_ports.

The SVE is designed to perform in multi−threaded, scalable environments; single−threaded environments can see a fairly significant overhead hit. But, as the SVEs in the Sun StorEdge 6900 series are configured, they perform very well in both latency and bandwidth environments.

When replacing an SVE, the data path can be failed−over to replace an SVE. The new SVE can be swapped and configured and then failed−back to resume its data path. It is highly recommended that the user wait until all I/O activity is completed before running the fail−back command or I/O errors and/or system panics could occur.

At the time of this writing, on−the−fly LUN carving, dynamic LUN expansion, and dynamic LUN sizing is not available.

Localization and Internationalization

The Sun StorEdge 6910 and 6960 systems are expected to be compliant with localization and internationalization policies by Q2FY03. Supported languages are French, Japanese, Korean, Simplified Chinese, and traditional Chinese.

Compatible Sun™ Software

- Sun StorEdge™ Instant Image 3.0.1, or higher
- Sun StorEdge Network Data Replicator (SNDR) 3.0.1, or higher
- Sun StorEdge Data Management Center 3.0, or higher
- Solstice Backup™ 6.0, or higher
- Solstice DiskSuite™ 4.2.1, or higher
- Sun StorEdge Traffic Manager (MPXIO) for multipathing management
- Sun™ SAM−FS 4.0 and Sun QFS 4.0
- Sun Cluster 3.0, update 2[46]

Compatible Third−Party Software

- VERITAS NetBackup (VxNBU) 3.2, 3.4, or higher
- VERITAS Volume Manager with DMP (VxVM/DMP) 3.2[47]
- VERITAS File System (VxFS) 3.3.3, 3.4, or higher
- VERITAS Cluster Server 2.0, or higher

Sun StorEdge 6910 and 6960 Systems Software Components

Storage Automated Diagnostic Environment 2.0

Storage Automated Diagnostic Environment 2.0 is a replacement for Network Storage Agent 2.1 and the StorTools™ 4.1 utility used in other Sun StorEdge products. The two figures below show the Storage Automated Diagnostic Environment main page and configuration page.

[46] The Sun StorEdge 6910 and 6960 systems are NOT qualified with Sun Cluster 2.2 software.

[47] Requires patch −01.

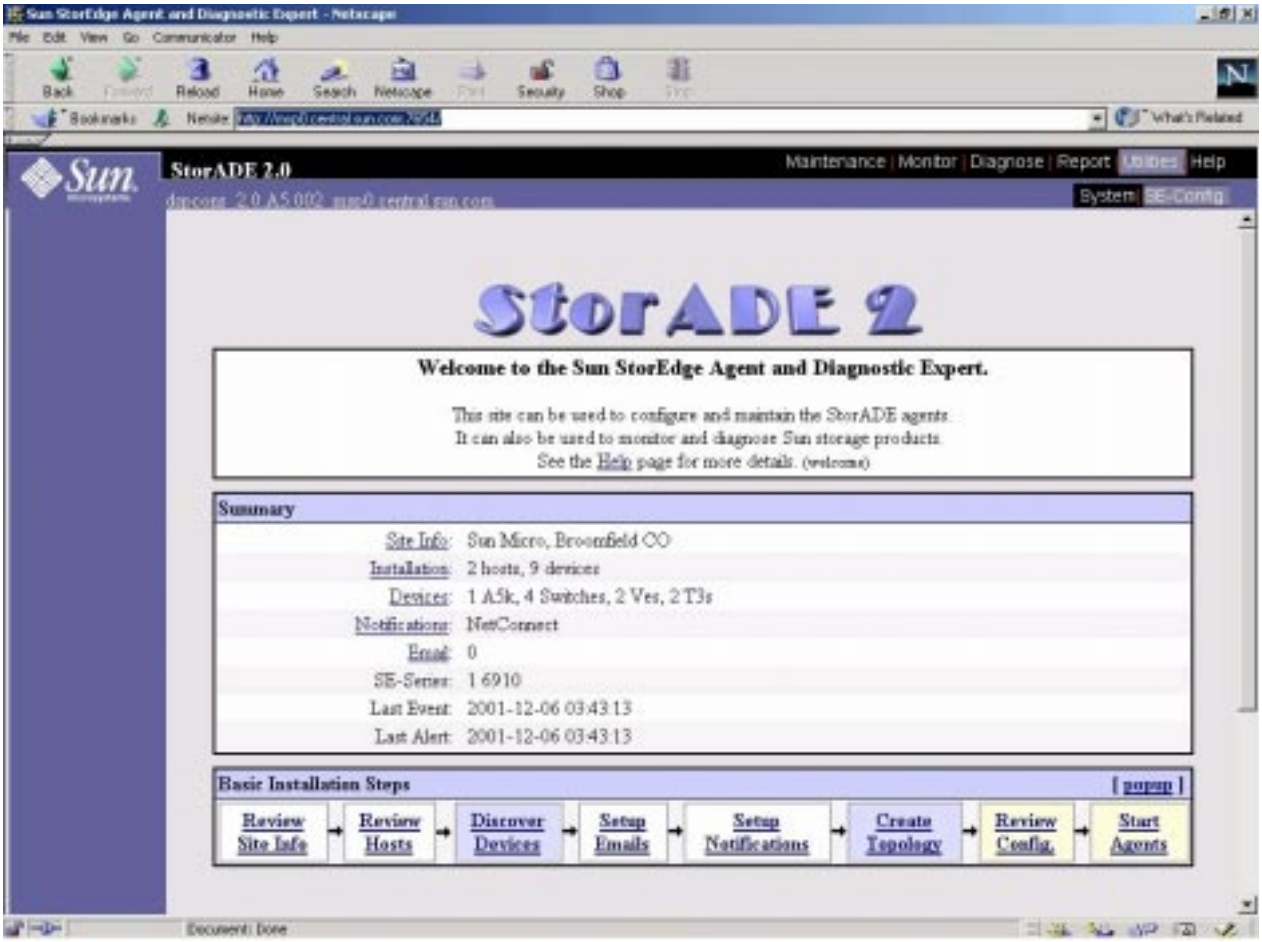

Figure 7. Storage Automated Diagnostic Environment main page

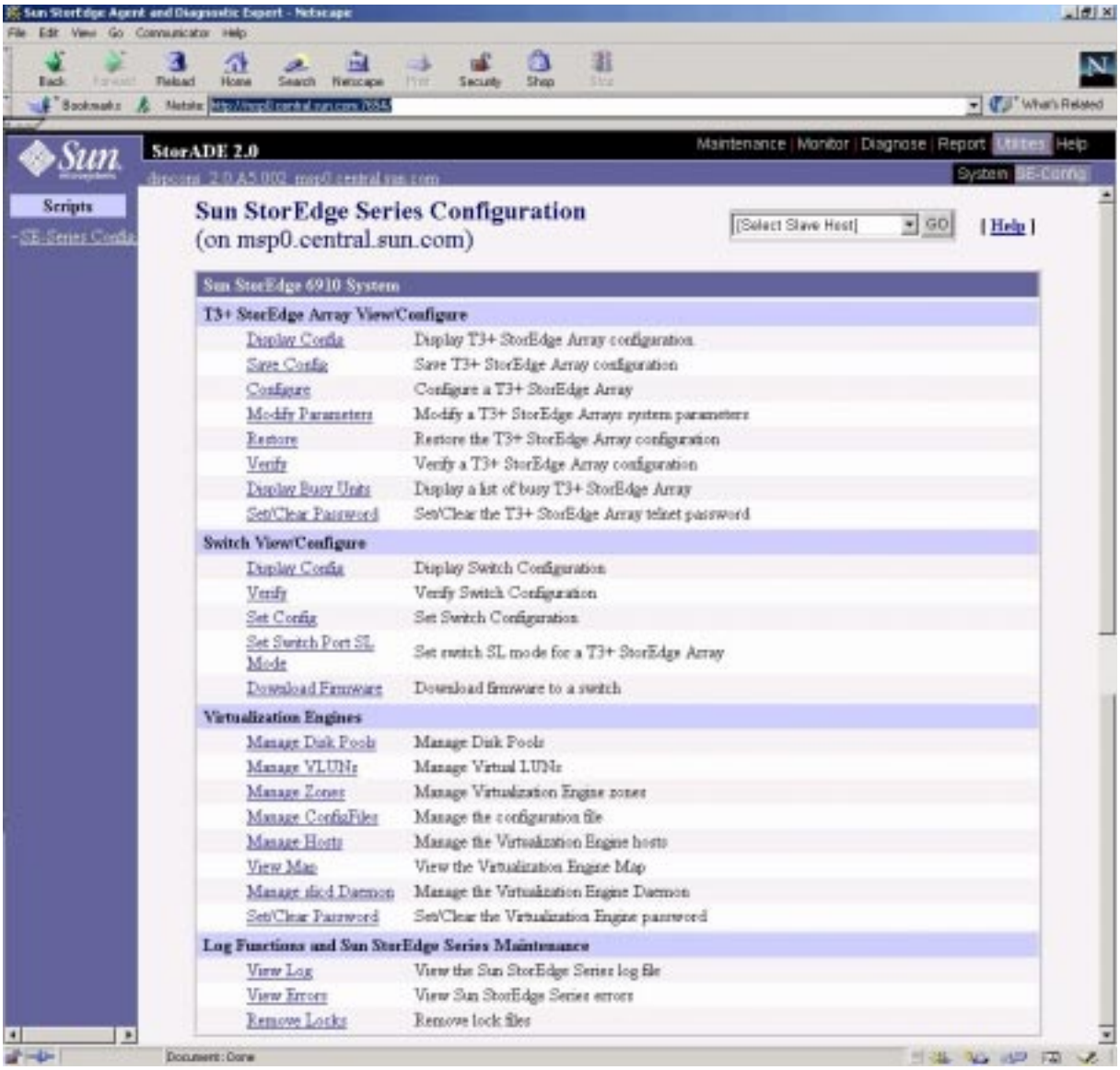

Figure 8. Storage Automated Diagnostic Environment configuration page

SANSurfer

The SANSurfer GUI must be run on a display outside of the SSP. Although this GUI package is supplied as part of the SSP software, it is used primarily as a place−holder for the switch firmware and should not be used otherwise.

Sun StorEdge Traffic Manager[48] Software

If Sun StorEdge Traffic Manager software is used for multipathing, a specific driver is needed at the host.

[48]Also known as MPXIO.

Sun Explorer Data Collector 3.5.2 Software

Sun Explorer Data Collector software is a collection of shell scripts that gather FC switch and Sun StorEdge T3 array information, bundles it into a compressed tar file and sends it to Sun Enterprise Services.

Sun Explorer Data Collector software also gathers patch/package and message information from the Storage Service Processor.

This software can only be run from machines that have direct Ethernet access to the switches and Sun StorEdge T3 arrays. As such, the only host that has that access is the Storage Service Processor.

Sun StorEdge Remote Response

Software to enable this service is installed on the SSP’s disk, but not enabled for use until additional hardware is installed and a contract is in place between the customer and Sun Enterprise Services for remote service support. Sun Enterprise Services must install the hardware and configure the systems to "phone home" when the Sun StorEdge 6910/6960 systems are installed (or at a later date upon the customer’s request).

The additional hardware includes a network terminal concentrator (NTC), which is needed to provide a modem connection point and facilitate a point−to−point connection from a remote Sun solution center. In addition, a modem is connected via an analog line to the remote Sun solution center. The modem is physically located outside of the Sun StorEdge 6910 and 6960 cabinets, so the customer must supply a power source for the modem. Obviously, too, the customer must supply an analog telephone connection for the service to work.

Ordering Information

Sun StorEdge™ 6910 and 6960[49] Systems

The naming conventions for part numbers is as follows:

- TB = The second generation of the Sun StorEdge™ T3 storage array (with 1−GB cache controller)
- 69X0 = 6910 for "small" SAN system, 6960 for "large" SAN system
- EC = Sun StorEdge 6960 expansion cabinet
- B = represents connectivity; N for N/A, B for 8−port FC switch, C for 16−port FC switch
- 2 = represents number of Sun StorEdge T3 arrays
- 655 or 1321 = represents approximate theoretical capacity in GB

Storage System	Part Number on Price List	Storage System Components	Drive Size	Raw Capacity
Sun StorEdge 6910	TB6910−B2−655	• One (1) rack • Four (4) 8−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • One (1) Sun StorEdge T3 partner pair • Two (2) Storage Virtualization Engines	36 GB	655 GB
	TB6910−B2−1321	• One (1) rack • Four (4) 8−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • One (1) Sun StorEdge T3 partner pair • Two (2) Storage Virtualization Engines	73 GB	1.321 TB
	TB6910−B6−1965	• One (1) rack • Four (4) 8−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • Three (3) Sun StorEdge T3 partner pairs • Two (2) Storage Virtualization Engines	36 GB	1.965 TB
	TB6910−B6−3963	• One (1) rack • Four (4) 8−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • Three (3) Sun StorEdge T3 partner pairs • Two (2) Storage Virtualization Engines	73 GB	3.963 TB

[49]Documentation does not ship with the Sun StorEdge 6910 and 6960 products. All documentation is available via a the web site at http://www.sun.com/products−n−solutions/hardware/docs/Network_Storage_Solutions/Midrange/index.html.

Storage System	Part Number on Price List	Storage System Components	Drive Size	Raw Capacity
Sun StorEdge 6960	TB6960−C2−655	• One (1) rack • Four (4) 16−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • One (1) Sun StorEdge T3 partner pair • Four (4) Storage Virtualization Engines	36 GB	655 GB
	TB6960−C2−1321	• One (1) rack • Four (4) 16−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • One (1) Sun StorEdge T3 partner pair • Four (4) Storage Virtualization Engines	73 GB	1.321 TB
	TB6960−C6−1965	• One (1) rack • Four (4) 16−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • Three (3) Sun StorEdge T3 partner pairs • Four (4) Storage Virtualization Engines	36 GB	1.965 GB
	TB6960−C6−3963	• One (1) rack • Four (4) 16−port switches • One (1) Ethernet hub • One (1) Storage Service Processor • Three (3) Sun StorEdge T3 partner pairs • Four (4) Storage Virtualization Engines	73 GB	3.963 GB
Sun StorEdge 6960 expansion cabinet	TBEC−N2−655	• One (1) rack • One (1) Sun StorEdge T3 partner pair • One (1) Ethernet hub	36 GB	655 GB
	TBEC−N2−1321	• One (1) rack • One (1) Sun StorEdge T3 partner pair • One (1) Ethernet hub	73 GB	1.321 TB

Sun StorEdge T3 Arrays

Part Number	Title and Shipping Configuration	Category
XT3BES−RR−22−655 ***(X = Field Install)***	655−GB Sun StorEdge T3 array for the enterprise, includes two arrays configured in one partner group, 18 x 36.4−GB, 10000−rpm, FC−AL drives	Additional Sun StorEdge T3 pairs are options that can be added in the field; max. of 2 can be added to • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 max. of 4 can be added to • TBEC−N2−655 • TBEC−N2−1321

Part Number	Title and Shipping Configuration	Category
TBEA−N2−655[50] ***(No X = Factory Install)***	655−GB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 36.4−GB, 10000−rpm FC−AL drives); rackmounted (in the factory) in one of the following: • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 • TBEC−N2−655 • TBEC−N2−1321	Additional Sun StorEdge T3 pairs are options that can be added during production; max. of 2 can be added to • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 max. of 4 can be added to • TBEC−N2−655 • TBEC−N2−1321
XT3BES−RR−22−1321 ***(X = Field Install)***	1.321−TB Sun StorEdge T3 array for the enterprise, includes two arrays configured in one partner group, 18 x 73.4−GB, 10000−rpm, FC−AL drives	Additional Sun StorEdge T3 pairs are options that can be added in the field; max. of 2 can be added to • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 max. of 4 can be added to • TBEC−N2−655 • TBEC−N2−1321
TBEA−N2−1321[51] ***(No X = Factory Install)***	1.321−TB Sun StorEdge T3 array for the enterprise (two arrays, each 9 x 73.4−GB, 10000−rpm FC−AL drives); rackmounted (in the factory) in one of the following: • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 • TBEC−N2−655 • TBEC−N2−1321	Additional Sun StorEdge T3 pairs are options that can be added during production; max. of 2 can be added to • TB6910−B2−655 • TB6910−B2−1321 • TB6960−C2−655 • TB6960−C2−1321 max. of 4 can be added to • TBEC−N2−655 • TBEC−N2−1321

Options —Hardware Kit for Sun StorEdge Remote Response Service

Part Number	Title and Shipping Configuration	Category
SG−XRRH−C1M1−A	Sun StorEdge Remote Response Hardware Kit includes: • 56K modem • Network terminal concentrator (NTC) • RJ45 cables, modem adapter • TELCO adapter • Installation Guide	For use in the following countries: Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom, and United States

[50] Although not available through WebDesk until February 6, 2002, these part numbers are orderable.
[51] Although not available through WebDesk until February 6, 2002, these part numbers are orderable.

Part Number	Title and Shipping Configuration	Category
SG−XRRH−C1M0−A	Sun StorEdge Remote Response Hardware Kit includes: • Network terminal concentrator (NTC) • RJ45 cables, modem adapter • TELCO adapter • Installation Guide	For use in countries not listed for Part Number SG−XRRH−C1M1−A; when ordering this part number, a modem must be purchased by the customer to enable the Sun StorEdge Remote Response service

Options —Power Cords

Part Number	Title and Shipping Configuration	Category
X3858A ***(X = Field Install)***	U.S./Canada power cord for Sun StorEdge 6960 expansion cabinet (NEMA L6−30P plug)	To be installed in the field into Sun StorEdge 6900 systems
X3859A ***(X = Field Install)***	International power cord for Sun StorEdge 6960 expansion cabinet (IEC 309, 32A, 250V plug)	To be installed in the filed into Sun StorEdge 6900 systems

Options —Installation Services

Further information about these services can be found in the section entitled "Support Services."

Part Number	Description
SE6900−INS−BASE	Sun StorEdge 6900 Series Installation
SE6900−INS−BASE−LT	Sun StorEdge 6900 Series Installation —Light
SE6900−PER−TRAY	Sun StorEdge 6900 Series Installation —per Sun StorEdge T3 tray
SE6900−PER−HOST	Sun StorEdge 6900 Series Installation —per each host
RR−START	Sun StorEdge Remote Response Installation

Options —Miscellaneous

Part Number	Description
X6737A	Longwave GBICs
RR−SE6910	Sun StorEdge Remote Response for Sun StorEdge 6910 system
RR−SE6960	Sun StorEdge Remote Response for Sun StorEdge 6960 system
RR−SE−EXPRK	Sun StorEdge Remote Response for Sun StorEdge 6960 expansion cabinet
RR−T3X2	Sun StorEdge Remote Response for Sun StorEdge T3 partner pair
PS−EO−69IAS−1	Implementation Assistance Service for the Sun StorEdge 6900 system

Ordering/Configuration Rules

- One of the following part numbers must be purchased to create the *base configuration* of a Sun StorEdge 6910 or 6960 system:

Sun StorEdge 6910	Sun StorEdge 6960
TB6910−B2−655	TB6960−C2−655
TB6910−B2−1321	TB6960−C2−1321
TB6910−B6−1965	TB6910−B6−3963
TB6960−C6−1965	TB6960−C6−3963

- The Sun StorEdge 6960 expansion cabinet can only be added to the Sun StorEdge 6960 system. Only one expansion cabinet can be ordered per Sun StorEdge 6960 base configuration. Each cabinet comes with one pair of Sun StorEdge T3 arrays and one Ethernet hub.
- Both 36.4−GB and 73.4−GB drives can be used within Sun StorEdge 6910/6960 systems. Drive sizes may be mixed within Sun StorEdge 6910/6960 systems, but not within Sun StorEdge T3 partner pairs.
- Only Sun StorEdge T3 partner pairs (Sun StorEdge T3 array with 1−GB cache controller) may be used within Sun StorEdge 6900 series.
- The Sun StorEdge 6910 system can hold a maximum of three Sun StorEdge T3 partner pairs. The Sun StorEdge 6960 system (without Sun StorEdge 6960 expansion cabinet) can hold a maximum of three Sun StorEdge T3 partner pairs. Part numbers for these maximum configurations are TB6910−B6−1965 and TB6910−B6−3963 for the Sun StorEdge 6910 system; part numbers TB6960−C6−1965 and TB6960−C6−3963 for the Sun StorEdge 6960 system.
- The Sun StorEdge 6960 system (with Sun StorEdge 6960 expansion cabinet) can hold a maximum of eight Sun StorEdge T3 partner pairs.
- Part numbers TBEA−N2−655 and TBEA−N2−1321 are factory−installed Sun StorEdge T3 partner pairs. For customers wishing to add Sun StorEdge T3 partner pairs after initial purchase of their Sun StorEdge 6910/6960 system, order appropriate quantities of XT3BES−RR−22−655 or XT3BES−RR−22−1321.
- When ordering XT3BES−RR−22−655 or XT3BES−RR−22−1321, do not order the X−option rail kit.
- A maximum of 7 host connections can be made to a Sun StorEdge 6910 system. A maximum of 14 host connections can be made to a Sun StorEdge 6960 system.
- Customers should purchase the Sun StorEdge 6900 Installation service or have a Sun−trained representative perform this installation.
- Customers must purchase one of two hardware kits (part numbers SG−XRRH−C1M1−A or SG−XRRH−C1M1−A) if they opt to subscribe to Sun StorEdge Remote Response.
- Customers opting for SSRR should only have a host LAN connection to the SSP if they install a firewall between their hosts and the storage systems.
- The FC switches are provided with shortwave GBICS. The customer can replace the shortwave GBICs with longwave GBICs. Shortwave and longwave GBICs can be mixed within a switch, but not within a zone.

- Each of the following part numbers is required to have two power cords. Select on the basis of the country (pulldown menu in wizard). Use X3858A for U.S. and Canada. Use X3859A for the rest of the world.
  - TB6910−B2−655
  - TB6910−B2−1321
  - TB6960−C2−655
  - TB6910−B6−1965
  - TB6960−C6−1965
  - TB6960−C2−1321
  - TBEC−N2−655
  - TBEC−N2−1321
  - TB6910−B6−3963
  - TB6960−C6−3963

- The following table depicts configuration possibilities for the Sun StorEdge 6910[52] system.

Base Configuration		**Additional Sun StorEdge T3 Partner Pair(s)**		**Resulting Capacity[53]**
Quantity	**Part Number**	**Quantity**	**Part Number[54]**	
1	TB6910−B2−655			655 GB
1	TB6910−B2−655	1	XT3BES−RR−22−655 or TBEA−N2−655	1.3TB
1	TB6910−B2−655	2	XT3BES−RR−22−655 or TBEA−N2−655	2.0 TB
1	TB6910−B6−1965			2.0 TB
1	TB6910−B2−1321			1.3 TB
1	TB6910−B2−1321	1	XT3BES−RR−22−1321 or TBEA−N2−1321	2.6 TB
1	TB6910−B2−1321	2	XT3BES−RR−22−1321 or TBEA−N2−1321	4.0 TB
1	TB6910−B6−3963			4.0 TB

- The following table depicts configuration possibilities for the Sun StorEdge 6960[55] system.

Base Configuration		**Additional Sun StorEdge T3 Partner Pair(s)**		**Sun StorEdge 6960 Expansion Cabinet**		**Resulting Capacity[57]**
Quantity	**Part Number**	**Quantity**	**Part Number[56]**	**Quantity**	**Part Number**	
1	TB6960−C2−655					655 GB
1	TB6960−C2−655	1	XT3BES−RR−22−655 or TBEA−N2−655			1.3 TB
1	TB6960−C6−1965					2.0TB
1	TB6960−C2−1321					1.3 TB

[52] Table does not consider mixing 36.4−GB and 73.4−GB drives within the Sun StorEdge 6910 system.
[53] Theoretical raw capacities indicated.
[54] Part number indicates a partner pair or two Sun StorEdge T3 arrays.
[55] Table does not consider mixing 36.4−GB and 73.4−GB drives within the Sun StorEdge 6960 system.
[56] Part number indicates a partner pair or two Sun StorEdge T3 arrays.
[57] Theoretical raw capacities indicated.

Base Configuration		Additional Sun StorEdge T3 Partner Pair(s)		Sun StorEdge 6960 Expansion Cabinet		Resulting Capacity
Quantity	**Part Number**	**Quantity**	**Part Number**	**Quantity**	**Part Number**	
1	TB6960−C2−1321	1	XT3BES−RR−22−1321 or TBEA−N2−1321			2.6 TB
1	TB6960−C6−3963					4.0 TB
1	TB6960−C6−1965			1	TBEC−N2−655	2.6TB
1	TB6960−C6−1965	1	XT3BES−RR−22−655 or TBEA−N2−655	1	TBEC−N2−655	3.3 TB
1	TB6960−C6−1965	2	XT3BES−RR−22−655 or TBEA−N2−655	1	TBEC−N2−655	3.9 TB
1	TB6960−C6−1965	3	XT3BES−RR−22−655 or TBEA−N2−655	1	TBEC−N2−655	4.6 TB
1	TB6960−C6−1965	4	XT3BES−RR−22−655 or TBEA−N2−655	1	TBEC−N2−655	5.2 TB
1	TB6960−C6−3963		XT3BES−RR−22−1321 or TBEA−N2−1321	1	TBEC−N2−1321	5.3 TB
1	TB6960−C6−3963	1	XT3BES−RR−22−1321 or TBEA−N2−1321	1	TBEC−N2−1321	6.6 TB
1	TB6960−C6−3963	2	XT3BES−RR−22−1321 or TBEA−N2−1321	1	TBEC−N2−1321	7.9 TB
1	TB6960−C6−3963	3	XT3BES−RR−22−1321 or TBEA−N2−1321	1	TBEC−N2−1321	10.6 TB
1	TB6960−C6−3963	4	XT3BES−RR−22−1321 or TBEA−N2−1321	1	TBEC−N2−1321	10.6 TB

Installation

Sun StorEdge℠ 6900 Installation

It is highly recommended that customers purchase this service or have a Sun−trained representative perform this installation.

Service	Part Number	Applies To ...	Description
Sun StorEdge℠ 6900 Installation	SE6900−INS−BASE	Factory Configurations	Sun StorEdge 6910 or 6960 base installation charge
Sun StorEdge 6900 Installation —Light	SE6900−INS−BASE−LT	Field Configurations	Ordered when subsequent capacity installation into a Sun StorEdge 6910 or 6960 base configuration
Sun StorEdge 6900 Installation —per Sun StorEdge T3 tray	SE6900−PER−TRAY	Factory and Field Configurations	Applies equally for both SE6900−INS−BASE and SE6900−INS−BASE−LT
Sun StorEdge 6900 Installation —per each host	SE6900−PER−HOST	Factory and Field Configurations	Applies equally for both SE6900−INS−BASE and SE6900−INS−BASE−LT

For a new Sun StorEdge 6910/6960 system, the customer would order a combination of SE6900−INS−BASE, SE6900−PER−TRAY, and SE6900−PER−HOST.

If a customer wants to add Sun StorEdge T3 partner pair(s) to a Sun StorEdge 6910/6960 system in the field, they would order a combination of SE6900−INS−BASE−LT, SE6900−PER−TRAY, and SE6900−PER−HOST.

This installation service includes the following:

- **Pre−install planning meeting**
  - Discuss existing customer storage and server configurations
  - Discuss number and type(s) of hosts to connect to storage system
  - Discuss allowable server, OS, and connectivity configurations
  - Discuss power and space requirements
  - Discuss patch requirements
  - Plan permissible Storage Service processor, switch and Storage Virtualization Engine parameter changes
  - Discuss optional complementary Sun Professional Services engagement offerings
  - Discuss Sun StorEdge Remote Response requirements around analog phone line, modem, private (management) LAN (if applicable)
  - Schedule on−site installation

- **Hardware installation**
  - Confirm site host, OS, storage, and LAN match planned configuration
  - Perform inventory check on all items
  - Install rack, arrays, switches, Storage Virtualization Engines, Storage Service Processor, and Ethernet hub
  - Perform Fibre Channel cabling according to Fibre wirelist
  - Perform Ethernet cabling according to Ethernet wirelist
  - Verify correct analog phone line is available for Sun StorEdge Remote Response (if applicable)
  - Verify correct modem (if needed) was purchased by customer for Sun StorEdge Remote Response (if applicable)
  - Install Sun StorEdge Remote Response Service network terminal concentrator (NTC) (if applicable)
  - Install modem for Sun StorEdge Remote Response (if applicable)
  - Connect NTC and modem cabling to Storage Service Processor (if applicable)
  - Power up Sun StorEdge 6910/6960 systems, NTC, and modem (if applicable)
  - Connect modem to customer's phone line (if applicable)
- **Storage Service Processor and Storage Service Processor LAN configuration**
  - Configure component IP addresses
  - Configure Storage Service Processor and Storage Service Processor Ethernet LAN
- **Storage array configuration and verification**
  - Verify hardware functionality
  - Configure to pre−planned RAID and storage parameters
  - Configure syslog
- **Switch configuration and verification**
  - Verify hardware functionality
  - Configure fabric, zoning, and port assignment as required
- **Virtualization engine configuration and verification**
  - Verify hardware functionality
  - Configure fabric, zoning, and port assignment as required
  - Configure LUN carving and masking within supported parameters
- **Application host(s) setup**
  - Verify Solaris™ Operating Environment patch(es), HBA, and driver levels
  - Assist with non−Solaris Operating Environment patch(es), HBA, driver analysis
  - Assist with non−Solaris Operating Environment host(s) with RAID/LUN configurations

- **Sun StorEdge Remote Response configuration and verification (if applicable)**
  - Contact remote Solution Center to initiate turn−on
  - Assist Solution Center with turn−on
  - Verify service initiation
- **Verification and turnover**
  - Verify storage/switch/virtualization connectivity to application host(s)
  - Verify Storage Service Processor configuration and Storage Service Processor LAN communication
  - Contact remote Solution Center to initiate turn−on of Sun StorEdge Remote Response (if applicable)
  - Assist Solution Center with turn−on of Sun StorEdge Remote Response (if applicable)
  - Verify service initiation of Sun StorEdge Remote Response (if applicable)
  - Have customer sign installation report

Sun StorEdge Remote Response Installation

It is highly recommended that customers have Sun or a Sun−trained representative perform this installation. Please note that this service is rolled into the Sun StorEdge 6900 Installation service. The SSRR Installation service is available for those customers that did not opt for SSRR at time of purchase and, at a later date than initial installation of the storage system, decided they would like to have SSRR.

This installation service consists of installing hardware (network terminal concentrator, modem, and associated cables) and configuring either the Sun StorEdge 6910 or 6960 system to "phone home."

The part number for this installation service is RR−START.

Each installation can support up to 48 Sun StorEdge T3 arrays and 12 switches located within either a Sun StorEdge 6910 or 6960 system. The installation service consists of the following activities:

- Site preparation review —Review environment and installation needs prior to on−site planning with customer, discuss analog phone line requirements, discuss modem requirements (if applicable), discuss private LAN requirements, discuss Sun StorEdge 6910 or 6960 system installation, schedule on−site installation
- On−Site installation planning —Unpack Hardware Kit components, review packing list and verify that existing and purchased equipment is available, verify analog phone line availability, verify correct modem was purchased by customer (if applicable)
- Hardware installation —Install network terminal concentrator (NTC); install modem; connect NTC and modem cabling to Storage Service Processor; power up Sun StorEdge 6910/6960 systems, NTC, and modem; connect modem to customer phone line
- Turn on Sun StorEdge Remote Response —Contact remote Solution Center to initiate turn−on, assist Solution Center with turn−on, verify service initiation
- System turnover —Sun turns the system over to the customer.

Support

The SunSpectrum℠ program is a service offering that allows customers to choose the level of service best suited to their needs. 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. Customers should check with their local Sun Enterprise Services representative for program and feature availability in their areas.

For information specific to the Sun StorEdge 6910 and 6960 systems, refer to:

`http://www.sun.com/service/support/products/storage/`

SunSpectrum program support contracts are available both during and after the warranty program. Customers may choose to uplift the service and support agreement to meet their business needs by purchasing a SunSpectrum contract.

The four levels of SunSpectrum support contracts range from SunSpectrum Bronze℠ level to SunSpectrum Platinum℠ level. Contact a Sun Enterprise Services representative for further details.

The SunSpectrum contract is for the entire Sun StorEdge 6910 or 6960 systems as a whole (part numbers TB6910−B2−655, TB6910−B2−1321, TB6960−C2−655, TB6960−C2−1321, TB6910−B6−1965, TB6910−b^−3963, TB6960−C6−1965, and TB6960−C6−3963). Each base configuration is a product in and of itself.

Each Sun StorEdge T3 array and Sun StorEdge 6960 expansion cabinet sold in addition to the base configurations require a separate Sun Spectrum contract.

Warranty

For the latest warranty information for the Sun StorEdge 6910 and 6960 systems, refer to:

`http://www.sun.com/service/support/warranty/features.html`

Warranty entitlement is for the entire Sun StorEdge 6910 or 6960 system as a whole (part numbers TB6910−B2−655, TB6910−B2−1321, TB6960−C2−655, TB6960−C2−1321, TB6910−B6−1965, TB6910−B6−3963, TB6960−C6−1965, and TB6960−C6−3963). Each base configuration is a product in and of itself.

Each additional Sun StorEdge T3 array and Sun StorEdge 6960 expansion cabinet sold in addition to the base configurations require separate warranty entitlement.

Contact a Sun Enterprise Services representative for further warranty details around the Sun StorEdge 6910 and 6960 systems.

Sun StorEdge Remote Response (SSRR)

Sun StorEdge Remote Response (SSRR) is a service offered by Sun Enterprise Services. This service is optional with the purchase of a Sun StorEdge 6910 or 6960 system. It is not included with the Sun product warranty or SunSpectrum program.

Sun StorEdge Remote Response Installation

There is a one−time installation charge in order to set this service up (Sun StorEdge Remote Response Installation —part number RR−START), which was discussed earlier in this document.

Features and Functionality

Monitoring via this service is provided for Sun StorEdge T3 arrays, switches, SVEs, and the SSP. The following are monitored alerts and events delivered by Storage Automated Diagnostic Environment as part of the SSRR service:

- **Monitored events**
  - Discovery/removal
  - Component state change
  - Communication lost/recovered
  - Statistical
  - Heartbeat
  - Agent install/deinstall
- **Sun StorEdge T3 array alerts**
  - T3−generated alarm
  - Communication established/lost
  - Controller state change
  - Power unit state change
  - Disk, loop card, and power unit addition/removal
- **Switch alerts**
  - Communication established/lost
  - State change
- **Storage Virtualization Engine alerts**
  - Communication lost
  - Discovery
  - Alarm
  - State change

Monthly Charges

The monthly charge for SSRR varies by product configuration and hours of coverage. Two monthly charge options are available, as follows.

Feature	Option 1	Option 2
Remote monitoring —hours of coverage	24x7x365	24x7x365
Remote diagnosis and on−site dispatch notification	M−F, local extended business hours (12 hours per day)	24x7x365

SunSpectrum Gold℠ contract customers (warranty and post−warranty) receive Option 1 and the monthly service charge is waived.

SunSpectrum Platinum contract customers (warranty and post−warranty) receive Option 2 and the monthly service charge is waived.

SunSpectrum Platinum warranty upgrade customers (warranty and post−warranty) receive Option 2 and the monthly service charge is waived.

SunSpectrum Gold contract customers (warranty and post−warranty) who do not upgrade to SunSpectrum Platinum but want 24x7x365 for remote diagnosis and on−site dispatch notification pay full price for Option 2.

Customers who do not maintain a SunSpectrum contract post−warranty must pay full price for either Option 1 or Option 2.

Part Numbers

The following are the part numbers for Sun StorEdge Remote Response provided by Sun Enterprise Services.

Part Number	Coverage
RR−SE6910	SSRR for Sun StorEdge 6910
RR−SE6960	SSRR for Sun StorEdge 6960
RR−SE−EXPRK	SSRR for Sun StorEdge 6960 cabinet
RR−T3X2	SSRR for each Sun StorEdge T3 partner pair

Sun Professional Services

Implementation Assistance Service for the Sun StorEdge 6900 System (PS−EO−69IAS−1)

Sun Professional Services provides an implementation assistance service for the Sun StorEdge 6910 and 6960 systems. Through this service, a Sun Professional Services Storage Engineer provides three days of on−site consultative assistance addressing issues beyond standard installation services, such as data management planning, backup and restore inclusion, and data migration. By using this service, the customer achieves maximum ROI because the storage configuration is available for production more quickly.

Sun Cluster Application Readiness Service (PS−PI−CLCAR−1)

This service helps ensure that every new Sun Cluster installation results in an appropriately configured system. This basic service provides the essential minimum implementation and project management services required to implement and configure new installation of either Sun Cluster 3.0 software. This service is limited to configurations of two cluster nodes. It provides for the establishment and testing of basic operational parameters and customer training for routine cluster maintenance. This service is mandatory for every new Sun Cluster installation.

Backup and Restore Assessment (PS−EO−DSBRV−1)

The Backup and Restore Assessment methodology delivers an assessment of an existing VERITAS NetBackup or Solstice Backup™ environment. The assessment helps ensure that the existing configuration and operational environment meet customer requirements. It reveals weaknesses or shortcomings in the areas of server/client configurations. Additionally, it reviews the historical operations of the backup and restore environment to help ensure the problems are not recurring or unknown. Finally, the service reviews the system management processes and personnel to help ensure operational continuity of the environment.

Tape Library Implementation (PS−EO−DSTLI−1, PS−EO−DSTLI−2, PS−EO−DSTLI−3)

The Tape Library Implementation Service delivers a working Sun StorEdge robotic tape library backup system (Sun StorEdge L1000, L180, and L700 libraries) with the hardware and backup and monitoring software components integrated together. This provides customers with a platform that can be used to develop and implement their production backup and recovery policies.

Additional Storage Services

Sun Professional Services offers other Storage Services that may be appropriate to a given storage environment. These services are generally custom priced engagements that can assist with the design and implementation of larger storage architectures. These services can also assist with the comprehensive review of backup and restore procedures, data replication design and implementation, and security issues.

Glossary

Block or blocksize	Often used to describe the amount of data sent or received by the host per I/O operation. Also used to describe the size of an atomic read/write operation to/from a disk. Block size, which is also known as stripe unit size, is the size of the data unit being "striped" across 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.
Cache	A buffer of high−speed memory filled at medium speed from main memory, often with instructions. A cache increases effective memory transfer rates and processor speed.
Cache hit	A read or write request for data that is already in cache. Therefore, a request can be serviced without needing to go to disk.
Controller unit	The standalone controller unit is the smallest possible array configuration. The architecture integrates disks, data cache, hardware RAID, power, cooling, uninterrupted power supply (UPS), diagnostic capabilities, and administration into a versatile, standalone component. The controller unit includes external connections to a data host (or hub or switch) and to a management network.
CRC error checking	Checking for frames that have been corrupted (some of the 1 bits changed to 0 bits, and vice versa), due to noise or collision.
DAS	Direct attach storage. Storage directly attached to servers/hosts (as opposed to SAN storage where storage is attached to a network of storage devices)
Disk array	A storage subsystem containing an arrangement or arrangements of multiple disk drives, designed to provide performance, high availability, serviceability, or other benefits.
DMP	Dynamic multipathing
ECC	Error correction code. Extra bits added to Words, or Double Words, that correct all single−bit errors, and detect all double−bit errors. A superior technology to parity, which detects, but does not correct, single−bit errors, and cannot detect double−bit errors.
E_port	An expansion port connecting two fabric switches.
Fabric	A group of interconnections between ports that includes a fabric element. A collection of switches and the connections between them.
Fiber	A wire or optical strand. Spelled *fibre* in the context of Fibre Channel.
Fibre Channel	A set of standards for a serial I/O bus capable of transferring data between two ports up to 100 MB/sec. Fibre Channel supports point−to−point, arbitrated loop, and switched topologies. Fibre Channel can be implemented with either optical fiber (note spelling) or copper.

FRU	Field replaceable unit. A component which can be removed and replaced during service in the field.
F_port	On a Fibre Channel switch, a port that supports an N_port.
GBIC	Gigabit interface converter. A standard form factor which provides a hot−pluggable connection into a Fibre Channel device.
HBA	Host bus adapter
Heterogeneous hosts	Application servers running different (disparate) operating systems which are attached to the same storage system.
Hot−pluggable	A hot−pluggable 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	Drive(s) within a storage system held in reserve to replace any other drive when it fails. Hot−spares are continuously powered up and spinning, but are not actually part of the array because they contain no data. This allows the array processor to have immediate access to a functioning drive for possible reconstruction of lost data when a disk fails.
Hot−swappable	A hot−swappable component can be installed or removed by simply pulling the component out and putting the new one in. The system either automatically recognizes the component change and configures itself as necessary or requires 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 dedicated bandwidth device for connecting fiber cables.
In−band	Transmission of a management protocol over the Fibre Channel network.
Initiator	On a Fibre Channel network, typically a server or workstation that initiates transactions to disk or tape targets.
I/O	Input/output
I/O rate	A measure of a devices 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.
ISL	Interswitch link. ISLs connect two switches via an E_port.
LED	Light emitting diode
Longwave GBIC	Gigabit interface converter designed for transmission of data over long (10 km) distances.
Loss of sync	An indication of low level failure which might be related to a GBIC, port, or cable.
LUN	Logical unit number. A numbering sequence for devices connected to a computer.
LUN concatenation	The stringing together of multiple LUNS as one.

LUN carving	The slicing of of a large LUN into smaller LUNs or creating smaller virtual drives from physical LUNs.
LUN masking	Security feature used to restrict access to a given LUN by a particular host.
Master Service Processor (MSP)	Storage Service Processor that acts as the point of aggregation for a network of Storage Service Processors.
Mirror	To duplicate data from a primary location to a secondary location, so that the data is still available if the primary location fails.
Mirrored cache	Redundant copies of data residing in cache —the (write) data residing in cache which has not yet been written to the hard disks is duplicated for failover operation.
Mirroring (RAID)	Redundant storage of data, achieved by duplicating files (so there is always a primary file and a copy of the primary file) onto separate disks.
Multipathing	The ability to manage two or more physical or logical paths to a given target or device.
Network	An arrangement of nodes and connecting branches, or a configuration of data processing devices and software connected for information exchange.
Network terminal concentrator (NTC)	A modem connection point for Sun StorEdge℠ Remote Response offering. Helps facilitate a point−to−point connection from a remote solution center.
N_Port	A Fibre Channel port in a 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.
NTC	Network terminal concentrator —see above.
OFDG	Offline diagnostics
OLTP	On−line transaction processing.
Out−of−band	Transmission of a management protocol outside of the Fibre Channel network, typically over Ethernet.
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.Parity is one form of data path protection used by hardware components to ensure proper transmission of data. A single parity bit is either asserted or deasserted in parallel with the data being sent, dependent upon the balance of ones and zeros in the data. If even parity is employed, a one bit is asserted on the parity line if the number of ones in the data is odd, otherwise it is deasserted.
Parity error handling	Parity error handling refers to the processing of the data when the parity does not match the data sent, signifying an error condition. A single parity bit can only be used to detect a single or odd number of bit errors. error correction codes (ECC) provide a more stable medium with their ability to correct single bit errors and detect multiple bit errors using encoded polynomials. In the context of Fibre Channel switches, they contain counters to collect and report any internal parity errors detected by their hardware.

Partner group (or partner pair)	Two controller units providing redundant data and management paths and mirrored cache duplexing (which provide controller failover and path failover capability).
Path failure	Path failure occurs when I/O to a unit is interrupted for any reason other than for a controller failure —the failure could be in a cable, could be in a host adapter, or could occur because of a non−I/O root cause such as removal of an application host system I/O board. Regardless of the cause of the interruption, I/O requests targeted at a LUN eventually time out. The I/Os are then redirected to the alternate path for that LUN.
Point−to−point	A topology where exactly two ports communicate.
Port	An access point on a device for attaching a link.
PPP	Another way to say point−to−point.
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 which 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, availability, and cost characteristics.
RAID 0	RAID level 0, or striping, without parity or mirroring protection. Data is distributed evenly at the block level among disks for performance. No redundancy is provided, and the loss of a single disk causes the loss of data on all disks. Use this level for high−speed streaming of large file reads (for example, video) of non−critical data which is easily available elsewhere within the organization.
RAID 1 (1+0)	RAID level 1 (1+0), or mirroring with striping. Data is stored at the file level. Files reside on separate disks, and two copies of the data are kept. Use this level for mirroring the host operating system and/or application programs or for creating a high−traffic log volume.
RAID 5	RAID level 5, or striping with distributed parity. Both data and parity information are striped across the drives. Because of parity, if a single drive fails, data can be recovered from the remaining drives. Two drive failures cause all data to be lost. (Alternatively can use: Both data and parity are distributed evenly across all the disks in the array at the block level. No single disk can compromise the integrity of the data.) RAID 5 balances the optimization of performance, reliability and cost. Use this level for most applications which do not require the special characteristics of the above RAID levels.
RAID 5 (7+1) with standby hot spare	Sun StorEdge T3 arrays have nine disks. Eight are used for RAID 5 —seven data for and one for parity. The ninth disk is used as a standby hot spare.
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.

SAN	Storage area network. SAN architecture uses high−performance, high−capacity Fibre Channel switches to connect storage islands to servers. This approach provides physical connectivity, facilitating information sharing or simplifying management across servers.
Segment	An overly used term; in the context of the Sun StorEdge T3 array, 1/8 of a cache buffer. In the Sun StorEdge T3 array, a segment is the smallest size of I/O possible between cache and disk. Segment size is 2, 4, or 8 KB, depending on block size.
Serial transmission	Data communication mode where bits are sent in sequence in a single fiber.
Shortwave GBIC	Gigabit interface converter designed for transmission over a maximum distance of 500 meters.
Slave Service Processor (SSP)	Storage Service Processors in a network of Storage Service Processors.
SSP	Storage Service Processor
Stripe size	Total amount of data in a disk stripe; that is, the block size multiplied by number of data disks in the stripe.
Stripe width	Total number of disks in a disk stripe.
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.
SVE	Storage Virtualization Engine
Switch	The name of an implementation of the fabric topology. A fabric element that implements a fabric. The fabric element that allows each port of a switch to be connected to any other port on that switch. A collection of switches implement a fabric and provide the network through which any device can communicate with any other device.
Syslog	The internal log file maintained by Sun StorEdge T3 arrays to track events and alerts as well as informational and notice messages. This log file can be sent periodically to a host server for evaluation using the syslogd(1M) function.
Target	A disk array on a Fibre Channel network.
Telemetry stream	Stream of data generated by monitoring agents.
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.
Transfer rate	The rate at which data is transferred, usually measured in Megabytes (MB) per second.
Virtualization	The pooling of data from multiple storage devices (arrays) into what appears to be a single device managed from a central console.
VLUN	Virtual LUN

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.
WWN	World Wide Name
Zone or zoning	Provided by fabric switches, a function that allows segmentation of node by physical port, name, or address.

Materials Abstract

Unless otherwise noted, all materials are available on SunWIN.

Collateral	Description	Target Audience	Distribution	Token # or COMAC Order #
Just The Facts				
– *Sun StorEdge™ 6900 Series, Just the Facts*	Reference Guide (this document)	Sales Tool	SunWIN, Reseller Web	319223
– *Sun StorEdge T3 Array with 1−GB Cache Controller, Just the Facts*	Reference Guide	Sun SE	SunWIN, Reseller Web	311985
– *Sun StorEdge Network FC Switch−8 and Switch−16, Just the Facts*	Reference Guide	Sun SE	SunWIN, Reseller Web	128888
Customer Presentations				
– *Sun StorEdge 3900 and 6900 Series NDA Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	329172
– *Sun StorEdge 3900 and 6900 Series Customer Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	329885
– *Sun StorEdge 3900 and 6900 Series Product Positioning Presentation*	Presentation	Sales Tool	SunWIN, Reseller Web	328721
– *Sun StorEdge 6900 Series Elevator Pitch*	Customer Presentation	Sales Tool	SunWIN, Reseller Web	328720
– *Sun StorEdge T3 Array Customer Presentation*	Presentation Overview; Slide Notes for Presentation	Sales Tool	SunWIN, Reseller Web	120838
– *Sun StorEdge T3 Array with 1−GB Cache Controller Customer Presentation*	Addendum to Customer Presentation	Sales Tool	SunWIN, Reseller Web	312720
Technical Presentations				
– *Sun StorEdge 3900 and 6900 Series Technical Presentation*	Technical Presentation	Sales Tool	SunWIN, Reseller Web	319226
– *Sun StorEdge T3 Array Technical Presentation*	Presentation with Slide Notes	Sales Tool	SunWIN, Reseller Web	120839
Competitive Presentations				
– *Sun StorEdge 3900 and 6900 Series Competitive Presentation*	Competitive Presentation	Sales Tool	SunWIN, Reseller Web	319228
– *Sun StorEdge T3 Array Competitive Presentation*	Competitive Presentation	Sales Tool	SunWIN, Reseller Web	120840

Collateral	Description	Target Audience	Distribution	Token # or COMAC Order #
Miscellaneous Presentations				
– *Sun StorEdge T3 Array Multi−Platform Presentation*	Presentation with Slide Notes	Sales Tool	SunWIN, Reseller Web	125114
References				
– *Sun StorEdge 6900 Series Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	319221, DE1565−0
– *Sun StorEdge 6900 Series Pocket Facts*	Fast Facts	Sales Tool	SunWIN, Reseller Web	328814
– *Sun StorEdge T3 Array Quick Reference Card*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web	73691
– *Sun StorEdge T3 Array for the Enterprise Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	117451, DE1165−3
– *Sun StorEdge T3 Array Fast Facts*	Fast Facts	Sales Tool	SunWIN, Reseller Web	120364
White Papers				
– *Sun StorEdge T3 Array Performance Tuning White Paper*	Technical Brief	Training	SunWIN, Reseller Web	119879
– *Sun StorEdge T3 Array with 1−GB Cache Controller Architecture White Paper*	Technical Brief	Training	SunWIN, Reseller Web	311986
– *Fibre Channel Technology from Sun Microsystems*	Technical Brief	Training	SunWIN, Reseller Web	65659
– *Fibre Channel versus Alternative Storage Interfaces: An Overview*	Technical Brief	Training	SunWIN, Reseller Web	65663
Quote Sheets				
– *Sun StorEdge T3 Array Customer Quote Sheet*	Quote Sheet	Sales Tool	SunWIN, Reseller Web	119896, FE1270−0
– *Sun StorEdge T3 Array Partner Quote Sheet*	Quote Sheet	Sales Tool	SunWIN, Reseller Web	119934
Success Stories				
– *Not Yet Available* << >>				
Competitive Beat Sheets				
– *Not Yet Available* << >>				

Collateral	Description	Target Audience	Distribution	Token # or COMAC Order #
External Web Sites				
– *Sun StorEdge 6910 and 6960 Main Page*	`http://www.sun.com/storage/midrange/6900`			
– *Sun StorEdge T3 Array for the Enterprise Information*	`http://www.sun.com/storage/t3es`			
– *Fibre Channel Association*	`http://www.fibrechannel.com`			
– *Fibre Channel Loop Community*	`http://www.fcloop.org`			
Internal Web Sites				
– *Storage Products Internal Site for the Sun StorEdge 6910 and 6960 Systems*	`http://webhome.ebay/networkstorage/products/6900/index.html`			
– *Storage Products Internal Site for the Sun StorEdge T3 Array for the Enterprise*	`http://webhome.ebay/networkstorage/products/T3ES`			
– *Switch Information*	`http://webhome.ebay/products/switch/index.html`			
– *Configuration Rules Page*	`http://webhome.ebay/networkstorage/performance/confrules`			
– *Resources Web Site*	`http://webhome.ebay/networkstorage/contacts/`			
– *Network Storage Sales Center (Help Desk)*	`http://webhome.ebay/networkstorage/salesupportctr`			
– *SunSpectrum℠ Program Information*	`http://service.central/TS/ESP/SunSpectrum/Feature_Matrix/index.html`			

FAQs

Sun StorEdge™ 6910 and 6960 systems Frequently Asked Questions are not included in this document. They are kept as separate documents because they are frequently updated. This way, customers can find them in the same place and know that they are up−to−date.

There are now two separate FAQ documents, as follows:

- Internal use only = Sun StorEdge 6910 and 6960 systems INTERNAL FAQs, respectively

  `http://webhome.ebay/networkstorage/products/` under Sun StorEdge 6910

  `http://webhome.ebay/networkstorage/products/` under Sun StorEdge 6960
- External use = Sun StorEdge 6910 and 6960 systems EXTERNAL FAQs, found on

  `http://www.sun.com/storage/midrange/6900`