

Sun StorEdge™ 5210 NAS Appliance

Just the Facts

Table of Contents

Sun StorEdge 5210 NAS Appliance

Positioning.....	4
Introduction.....	4
Product Family Placement.....	5
Product Availability.....	6
Product Shots of the StorEdge 5210 NAS Appliance.....	7
Key Features.....	8
Key Messages.....	10
Value.....	10
Innovation.....	10
Choice.....	11
Target Markets.....	12
Sun Software Support.....	15
Third Party Application Support.....	15
Relevant Standards Supported.....	15
Features and Benefits.....	16
Enabling Technology.....	22
Technology Overview.....	22
SCSI RAID Controller.....	22
Flash Disk Module for Operating System.....	22
Storage.....	22
2U Chassis.....	22
Motherboard Board Information.....	23
StorEdge 5210 Expansion Unit.....	24
Software/Operating System.....	27
64-bit Journaling File system.....	27
File Sharing for UNIX (NFS) and Windows (CIFS).....	28
Active Directory Services.....	30
Sun StorEdge File Checkpoint.....	31
Sun StorEdge File Replicator.....	34
High Availability Bonds: (NIC Failover / Port Aggregation).....	36
Operation.....	37
Recovery.....	38
System Architecture.....	39
Overview.....	39
Hardware Components.....	39
Reliability, Availability and Serviceability (RAS).....	41
Reliability.....	41
Availability.....	41
Serviceability.....	41
Tape Backup and Restore.....	43
Server Management.....	45
IPMI.....	45
System Monitoring.....	45
SMTP.....	47
SNMP.....	48
Telnet.....	49
LCD Keypad.....	50
Syslog/Remote Syslog.....	50
Sun StorEdge 5210 NAS Appliance Specifications.....	51
Sun StorEdge 5210 EU Specifications.....	54
Requirements and Configuration.....	58

Client Operating System Support.....	58
Software Support Matrix.....	59
Peripherals Support Matrix.....	59
Ordering Information.....	61
Warranty, Service and Support.....	64
Warranty.....	64
Sun Spectrum Instant Upgrades.....	64
Enterprise Installation Service.....	64
Knowledge Services.....	64
Professional Services.....	65
Glossary.....	66
Materials Abstract.....	72
Competitive Information.....	74
Q&A.....	77
Appendix A.....	81
Application: GIS Imaging.....	81
Application: File Sharing/Database.....	82
Application: VoIP/Unified Messaging.....	83
Application: Data Warehouse/Data Mining.....	84
Application: Medical Imaging.....	85

Revision:

July 2004:

- Corrected Internal HDD speed from Ultra 320 to Ultra160

August 2004:

- Corrected weight
- Added “File Locking Caveat”
- Added support for fiber gigabit Ethernet standard

December 2004:

- Added support for additional clients and software
- Added content for configurations with 2 RAID controllers
- Added content for StorEdge File Replicator (remote replication)
- Removed restriction stating NFS naming for LDAP is not supported

January 2005:

- Updated product photo's
- Expand Q&A

February 2005:

- Various minor grammatical & minor technical corrections

June 2005:

- Added support for direct attach/3-way back configurations; Enterprise Backup Software 7.2; file systems limits

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Positioning



Figure 1. Sun StorEdge 5210 NAS Appliance

Introduction

The Sun StorEdge 5210 NAS Appliance is Sun's newest generation NAS (Network Attached Storage). It is a work group storage solution ideally suited for departmental, workgroups, distributed enterprises, and small- to medium-sized companies with a need to consolidate storage, improve availability, share information, and reduce management costs. Purpose-built for simple operation, the StorEdge 5210 NAS Appliance combines high performance with low maintenance requirements to create a versatile, NAS solution for mixed NFS/CIFS environments.

The SE5210 NAS is based on a dedicated, storage-optimized OS and Xeon hardware platform. It typically requires minutes to install and less than three minutes to boot, and delivers high availability with minimal maintenance.

Featured is a 64-bit journaling file system, checkpoints, RAID 5, battery-backed cache, hot-swappable drives and power supplies, global spares, and support for a UPS. The file system aids in ensuring data integrity across unforeseen events such as power outages. Sun StorEdge File Checkpoint creates "checkpoints" (also known as snapshots) that provide static images of the file system, enabling rapid recovery of mistakenly deleted files.

The SE5210's space-saving design conserves precious IT real estate, requiring only 2U of rack space. It accommodates six 146GB Ultra-160 SCSI disk drives for a maximum internal capacity of 876GB (raw).

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



With the addition of up to three optional Sun StorEdge 5210 2U, 12-drive SCSI Expansion Units, the total capacity can be expanded to over 6TB (raw).

All Sun StorEdge 5210 NAS Appliance models include:

- Operating System with a user license for an unlimited number of users
- CIFS and NFS file protocol support
- Sun StorEdge File Checkpoint (snapshot)
- A base NAS with six 146GB drives
- Dual redundant power supplies
- Embedded dual 10/100/1000 Gigabit Ethernet NIC ports
- Configuration with optical (MMF) NIC support

Product Family Placement

The Sun StorEdge 5210 NAS Appliance offers quick installation, simplicity of configuration and ease of management that scales in capacity from 876GB to over 6TB and marks the entry point for the Sun NAS family. The StorEdge 5210 NAS Appliance provides customers with high-performance file serving and file storage.

Table 1. DAS, SAN, NAS comparison

<i>Criteria</i>	<i>DAS</i>	<i>SAN</i>	<i>NAS</i>
Cost	Inexpensive, but difficult to manage. Fundamental cause for the IT "Islands of Data" problem.	Very Expensive and Labor Intensive and difficult to manage	Inexpensive and Easy to Manage
Connectivity	Minimal, only a single connection per Disk	Good, multiple connections per Storage Device	Excellent, can be in the hundreds or thousands
Performance	Moderate to Fast, depending on Technology	Extremely Fast	Fast and in many cases, higher performance than DAS.
Price/Performance	Marginal due to high administrative overhead and lack of manageability	Moderate due to expensive hardware and high labor costs	Excellent due to inexpensive hardware, easy to manage and minimal labor costs
Storage Management	Marginal, accomplished "server by server" contributing to the "Islands of Data" IT problem.	Storage Management tools are available but some lack maturity. Data availability problems may plague LUN management functionality such as expanding LUN's "on the fly" as contrasted with NAS Logical Volume Management.	Built-In to Filer Platforms. Volume Management, DTQ/User Quotas & Snapshotting provide abstract layer storage management not available in SAN or DAS environments.
Storage Sharing	None.	Storage is consolidated but not shared. But, fundamentally, same as DAS. Centrally managed "Islands of Data" Platform.	Hardware is shared and Data is shared, fundamentally an optimum functional solution.
Data Sharing	None, this is what causes "Islands of Data" problem.	None, this is what causes "Islands of Data" problem.	All data sharable. Resolves the "Islands of Data" dilemma.
IT Management	Difficult, causes IT Management problems such as extended outages and undue risk to production data	Moderately Difficult, multiple connectivity options as well LUN management tooling enables Best Practices but can be cumbersome due to proximity to Server Support software systems and data.	Excellent, NAS Logical Volume Manager, Mirroring and Snapshotting separates data from Server Infrastructure providing built-in protection to production data during IT Management functions.

<i>Criteria</i>	<i>DAS</i>	<i>SAN</i>	<i>NAS</i>
Backup/Restore	Difficult due to loss of Data Availability when backing up mission critical highly volatile file system(s). This is exacerbated by the "Islands of Data" architecture	Better, data is separated from production support systems, proximity to B/R tooling is enabled by FC SAN connectivity.	Excellent due to file system features that enables B/R Best Practices. Features include Snapshotting as well as ability to participate in SAN Connectivity to B/R tooling. Snapshots enable uninterrupted access to Production Data at all times.
OLTP (Low Transaction Rate)	On board DAS, could work well, but IT management issues marginalize the implementation.	Excellent. Server and SAN I/O Throughput exceeds the I/O and Network requirement.	Excellent. Server and Network I/O throughput exceed the requirement for performance. Snapshotting enables application processes that enhance processing of data.
OLTP (Medium Transaction Rate)	Marginal. Other disadvantages as well as peak workloads may exceed ability to preserve performance	Excellent. Server and SAN I/O Throughput exceeds the I/O and Network requirement.	Very good. Server workload and Network I/O will meet this requirement. Care should be taken that txn levels don't exceed the network's ability to transport data to/from the Filer's NAS File system.
OLTP (High Transaction Rate)	Marginal, depending on disk based technology. FC Implementation would work well, but IT Management issues marginalize data availability. High Txn environments exceed typical SCSI performance and are usually not recommended.	Excellent. Server and SAN I/O Throughput meets or exceeds the I/O and Network requirement.	Marginal. Network throughput and overhead impacts overall application performance.
CAD/CAM	Good, single user(s) mode only. Can expect users to move/copy drawings/designs to local workstations due to inadequate server performance.	Good, but wastes the storage in single user mode. Lack of data sharing capability will inhibit CAD/CAM design collaboration processes.	Excellent. Shared Storage enables multiple users to reference the data across platforms and OS architectures due to File Level Locking. Home Directory support functionality enables multiple users/projects on the NAS File system. Snapshotting and other data protection mechanisms enable change control of the CAD/CAM design(s).

Product Availability

• Sun Product Introduction (Presto)	July 13, 2004
• WEBDESK Orderability	July 13, 2004
• Public Announcement	September 14, 2004
• Revenue Release (RR)	July 30, 2004
• General Availability (GA)	August 17, 2004

Product Shots of the StorEdge 5210 NAS Appliance

Figure 2. Front View



Figure 3. Rear View

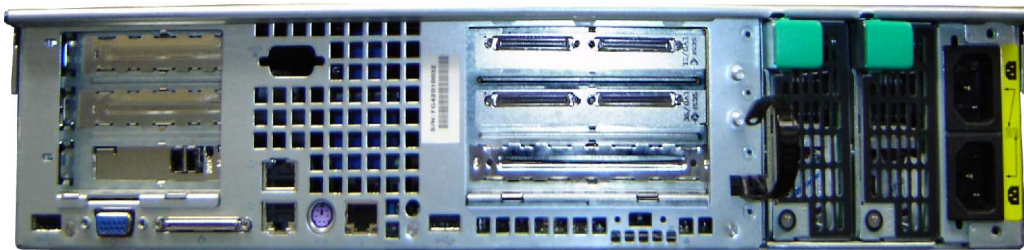


Figure 4. StorEdge 5210 NAS Appliance and StorEdge 5210 Expansion Units



Sun StorEdge 5210 NAS Appliance

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06/16/05



Key Features

The initial release of the Sun StorEdge 5210 NAS Appliance includes the following features:

Hardware

Feature	Specifications
Motherboard	Intel Xeon class Server motherboard with 533MHz Front Side Bus and dual PCI-X 64bit/100 Bus
Processor	Intel Xeon 3.06GHz with 512KB Level 2 cache
Maximum number of CPUs	One
Default Memory	4GB, DDR RAM
Expansion Slots	6 PCI-X
Network Ports	Dual embedded 10/100/1000 Gigabit Ethernet ports; optional MMF (optical fiber) 1 or 2-port 10/100/1000 Ethernet NIC
Boot Disk	Reliable 256MB Flash media
Hard Disk Drives	Six hot-swappable Ultra160 SCSI LVD, 1-inch high (low-profile)
Supported Drives	146GB, 10,000rpm
Hardware RAID	Up to two 2-port Ultra320 SCSI with battery backed cache
RAID Level Support	RAID 5
Default Internal Storage	<ul style="list-style-type: none">Raw: 876GB (6x146GB drives)Usable: 532GB (RAID Group 4+1 and 1 hot spare; 133GB/disk usable after formatting)
LCD Keypad Interface	LCD interface on the front of the unit for easy setup and visual status notification
Bezel	Supplied with standard configuration
Cooling	Redundant fans
Power Supply	Dual 500W redundant hot-swappable power supplies
Rack Height	2U (3.5").
Dimensions	H 3.5" x W 19" x D 25.51"
Expansion Module	Up to 3 StorEdge 5210 12-drive Expansion Units each having: <ul style="list-style-type: none">Raw: 1.75TB (12x146GB drives)Usable: 1.33TB/EU (RAID Group 10+1 and 1 hot spare; 133GB/disk usable after formatting)
Warranty	2 years, 1 st year on site, 2 nd year 15 day return to depot

Software

Feature	Specifications
Operating System	StorEdge NAS OS, a highly efficient storage-optimized Operating System
File System	64-bit Journaling File system., with Dynamic Volume Expansion
File Access Protocols	CIFS/SMB, NetBIOS, NFS v2 and v3, FTP
(Point-in-time Copies (snapshots	Checkpoints and Fast Checkpoint Restore support
Quotas Support	User, Group, and Directory level quotas support
Directory and Name Services	AD (LDAP, Kerberos v5), NT 4.0 Multiple Master Domains (MMD), DNS, WINS, NIS, NIS+, Local files
Supported Clients	Solaris, IBM AIX, HP-UX, Red Hat Linux, SUSE Linux, and Microsoft Windows
Dynamic Shares Support	Autohome shares feature
Remote Management	SNMP, Remote Syslog
System Administration	Web GUI (HTTP/Java based), Telnet, Console Command Line Interface (CLI)
Mail Services	SMTP
System Monitoring	<ul style="list-style-type: none"> • Disk subsystem via SCSI Enclosure Services (SES) • Fans, power supplies, temperature, voltages via IPMI protocol • UPS • Network monitor
Tape Backup	<ul style="list-style-type: none"> • NDMP v2 and v3 • Backup with full Unicode • “Remote Configuration” backup support
RAID Manager	Integrated through Web-based GUI
Optional Software	StorEdge File Replicator for IP-based remote replication

Key Messages

With the introduction of the Sun StorEdge 5210 NAS Appliance, Sun continues to offer customers value, innovation and choice.

Value

- **Simplified Management:** The StorEdge 5210 NAS Appliance provides an intuitive installation wizard for easy setup and configuration, and advanced software features that simplify network storage management. This simplified management enables organizations to consolidate dedicated storage from multiple servers and to scale as capacity requirements grow. The browser-based user interface with remote web administration enables system management and monitoring from anywhere in the world.
- **Investment protection:** The StorEdge 5210 NAS Appliance incorporates state-of-the-art components that allow a seamless integration into any existing network infrastructure. It enables organizations to consolidate storage, reducing unused pools of expensive storage, and to scale as capacity requirements grow. Combined with simplified management, maximized system availability, and no additional user license fees required, the StorEdge 5210 NAS Appliance provides an effective investment protection for current and future growth requirements.
- **World-class Services :** Sun's world-class service organization will provide the same high level of service and support for your StorEdge 5210 NAS Appliance as it provides for a multi-million dollar Sun storage solution implementation. Internal automated diagnostics and remote notification capabilities, combined with a design that implement redundant components, help simplify the serviceability of your filer.
- **Sun's "One-Stop Shop":** Buy your StorEdge 5210 NAS Appliance, software, service, consulting and training from Sun's "One-Stop Shop." Sun makes it easy – we understand secure enterprise network storage computing. Sun has what you need and Sun is here to help you.

Innovation

- **Advanced Technology:** The Sun StorEdge 5210 NAS Appliance combines software and hardware technology in an easy-to-manage, high performance storage appliance. The Sun NAS operating system is optimized for file serving and file storage and uses a 64-bit journaling file system specifically designed to ensure data integrity. Sun StorEdge File Checkpoint and File Replicator are important applications that provides an additional level of data protection. The hardware design is based on the server-class Intel Xeon platform with dual PCI-X buses that provide excellent performance.
- **Compact Design:** The system architecture of the StorEdge 5210 NAS Appliance offers two built-in 10/100/1000 Gigabit Ethernet ports, a single external Ultra320SCSI multimode (SE/LVD) port, two serial ports, and 6 PCI-X slots for expandability, all within a compact 2U form factor design.
- **Robustness:** The journalized file system helps to ensure data integrity across unforeseen events such as power outages. Checkpoints provide static images of the file system enabling rapid recovery of mistakenly deleted files or objects, and facilitating backup of the system. Combined with hardware

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



RAID, battery-backed RAID cache, hot swappable drives, global spares, redundant hot-swappable power supplies and optional UPS backup, the StorEdge 5210 NAS Appliance provides exceptional robustness.

- **Scalability:** The StorEdge 5210 NAS Appliance has six internal hard disk drives, 4GB of memory and ships standard with six PCI-X slots. Six 146GB drives yields a raw capacity 876GB. The standard configuration can support the connection of up to 3 StorEdge 5210 Expansion Units for an additional raw capacity of 5.256TB (36 x 146GB drives).

Choice

- **Multiple Architectural Choices:** Sun offers choices in capacity and network connectivity to help tailor the StorEdge 5210 NAS Appliance to the customers environment.

Target Markets

The StorEdge 5210 NAS Appliance is a work group network attached storage filer ideally suited for departmental, workgroups, distributed enterprises, and small- to medium-sized companies with UNIX networks environments and running any of the following applications:

- Oil & GAS exploration (seismic data retrieval & analysis)
- Technical Computing (CAD/CAM Engineering)
- Imaging (Document, Medical, GIS)
- Home Directory/File Sharing
- VoIP, Video (Non-Streaming)
- Web Server Consolidation Storage
- DW/DM (Data Warehouse/Data Mining)

Some applications impose extremely high and sustained transaction-per-second loads, require very high QoS (low latency and low latency fluctuation) and have very high availability requirements necessitating fault-tolerance and/or failover capabilities. Examples of such applications are credit card transaction processing and airline ticketing. Other applications, such as Microsoft Exchange 2000, are designed to only run on DAS (Direct Attached Storage) or SAN (Storage Area Networks) devices¹. The StorEdge 5210 NAS would not be well-suited to these environments. Other Sun products such as the StorEdge 6300 series and the StorEdge 9900 series are specifically designed to meet the requirements of these applications.

The following chart lists applications with particular vertical markets. The checkmark does not necessarily indicate that the application is specific for that industry, but that a company within that industry could have a need for the listed application. For example, Home Directory/File Sharing is not a Telco application, but a company in the Telco industry could use the StorEdge 5210 NAS Appliance to provide Home Directory/File Sharing capabilities to its employees.

Application/Industries	Telco	Education	Mfg.	Gov't	Financial	Health Care	Retail	Business Services
Imaging (Document, Medical, GIS)	✓	✓	✓	✓	✓	✓	✓	✓
Home Directory/File Sharing	✓	✓	✓	✓	✓	✓	✓	✓
CAD/CAM			✓					
VoIP/Video	✓							
Web Server Consolidation Storage	✓	✓	✓	✓	✓	✓	✓	✓
DW/DM	✓	✓	✓	✓	✓	✓	✓	✓
Email (SendMail, Notes)	*	*	*	*	*	*	*	*
Microsoft Exchange	X	X	X	X	X	X	X	X
OLTP	X	X	X	X	X	X	X	X

Legend:

- ✓ = Recommended for StorEdge 5210 NAS Appliance.
- X = Not recommended with StorEdge 5210. Other Sun products should be used.
- * = Non notable installations on this application

¹ In early 2004 Microsoft announced NAS device support for Microsoft Exchange if NAS devices are built on Windows Storage Server 2003 and pass the Microsoft qualification process. This announcement by Microsoft does not state that Exchange will not work on NAS devices that are not based on WSS03 (most other vendors use a proprietary NAS implementation). It just says that Microsoft will not provide support for it

Sun StorEdge NAS OS provides advanced software features that facilitate the deployment of StorEdge 5210 in the recommended applications. The table below lists the main software features that apply for the specific applications, along with the benefits that these features provide in those application environments.

Features/Application	Imaging	Home Dir/ File Sharing	CAD/ CAM	VoIP/ Video	Web Server Consolidation Storage	DW/DM
Checkpoints	✓	✓	✓	✓	✓	✓
StorEdge File Replicator	✓			✓	✓	✓
Heterogeneous Access	✓	✓	✓			
Dynamic Volume Expansion	✓	✓	✓	✓	✓	✓
Quotas Support		✓	✓			
Autohome Shares		✓	✓			

Sun StorEdge File Checkpoint: Enables the creation of point-in-time images of a StorEdge NAS file system taken at the volume level. Creation speeds are almost instantaneous, without disrupting normal operation, and consume minimal storage space. While the active file volume can be modified with read/write operations, a virtual volume produced at the time of checkpoint creation remains available in a static, read-only state.

- Provide a facility for self recovery of lost and/or accidentally deleted objects
- Provide for business continuance without requiring massive expenditures for completely redundant or mirrored systems
- Increase backup window, easing the burden on administrators to complete backup operations between production cycles, and obviates the need to undergo length-time and operator-intensive tasks such as restores from tape
- Facilitates migration to / from new applications

StorEdge File Replicator: An optional StorEdge 5210 NAS Appliance application that provides IP-based remote replication of data. Individual StorEdge NAS systems volumes can be mirrored from any system to any other system (even StorEdge NAS systems from different families).

- Provides for business continuance, even in the face of catastrophic loss of the primary (source) system
- Fast reversion from source to target, providing maximum data availability and protection
- Network (Ethernet) based mirroring means lower cost, and provides the ability to exploit technology familiar to users and without requiring expensive gateways

Heterogeneous Access : Enables file-level access over an IP-based Ethernet network for NFS, CIFS, and FTP file access protocols.

- Enables robust and safe file sharing in heterogeneous UNIX, Windows, and Linux environments

Dynamic Volume Expansion: Provides the capability to add storage to a file system without downtime, maintaining data availability (note that SCSI requires that the system is powered down to add a drive expansion module).

- Downtime due to capacity limitations eliminated
- Can be effected during normal business operations

Quotas Support: Allows for the restriction of disk space or number of files written to volumes in the StorEdge 5210 NAS Appliance. This limit can be determined for a user or group (user or group quota) or for a directory (directory tree quota).

- Enables administrators to quickly allocate space to departments or individuals
- Enables administrators to partition large, individual volumes from a capacity standpoint, providing for volume-like control of space allocations but without requiring them to administer multiple actual volumes
- Simple backup policies (e.g., volume-based full, differential, incremental backups) can be retained across the entire volume, even if capacity is being managed locally

Autohome Shares: Automatically creates temporary SMB/CIFS shares when a user logs on to the system and removes the shares when the user logs off.

- Facilitates IT Administrator's management tasks by eliminating the need to create and manage shares manually for potentially thousands of users

Sun Software Support

- VERITAS NetBackup v5.x
- Enterprise Backup Software 7.2
- StarOffice v7

Third Party Application Support

- Oracle (Database)
- Adobe Acrobat Suite
- Microsoft Office
- BakBone

Relevant Standards Supported

The following standards are supported on the Sun StorEdge 5210 NAS Appliance:

- Java™ technology
- Intelligent Platform Management Interface (IPMI)
- IEEE 802.3 - Ethernet (10Mb/s)
- IEEE 802.3U - Ethernet (100Mb/s)
- IEEE 802.3ad – Link aggregation/Port Aggregation Protocol
- IEEE 802.3ab - Ethernet (1000Mb/s, Twisted Pair) Relevant standards supported
- IEEE 802.3z – Ethernet (1000Mb/s, Fiber) with multimode fiber NIC
- SNMP versions 1 and 2
- NDMP versions 2 and 3

Features and Benefits

Features	Benefits
RELIABILITY	
Flash-resident OS	<ul style="list-style-type: none"> OS resides on flash disk, which is more reliable than a traditional magnetic disk
Hardware RAID	<ul style="list-style-type: none"> Independent hardware RAID disk subsystem is packed with error detection and correction capabilities, battery backup (BBU) technology, ensuring the highest possible system reliability
AVAILABILITY	
Redundant Server Power Supplies	<ul style="list-style-type: none"> Reduces system outages in the event of StorEdge 5210 NAS Appliance power supply failure
Redundant Cooling Fans	<ul style="list-style-type: none"> Reduces system outages in the event of cooling fan failure
Redundant Disk Subsystem Power Supplies (each Expansion Module)	<ul style="list-style-type: none"> Reduces system outages in the event of StorEdge 5210 Expansion Unit power supply failure
NIC Failover	<ul style="list-style-type: none"> Provides for a redundant path to the same IP address on the server through a different switch and using a cooperative (with the host) Failover topology
Link-down Failover	<ul style="list-style-type: none"> Enables the system to deal intelligently with an intermittent link problem but sustain a simple port swap or switch by an administrator User-configurable for the number of outages within a specified period
Port Aggregation	<ul style="list-style-type: none"> Enables the use of the same IP address across multiple NIC ports from a single switch, increasing bandwidth and providing some degree of fault tolerance
SERVICEABILITY	
<p>Multiple components are hot-swappable:</p> <ul style="list-style-type: none"> Server head power supplies Disk subsystem power supplies Disk subsystem I/O modules Disk Drives 	<ul style="list-style-type: none"> Ensures that the maximum level of data availability is provided by eliminating downtime when failed components need to be replaced or when proactive maintenance is performed
Dual-boot OS	<ul style="list-style-type: none"> Enables the user to quickly and easily backtrack to a prior version of the OS should problems manifest during or subsequent to an OS upgrade operation
Tool-less Access	<ul style="list-style-type: none"> Facilitates maintenance by eliminating the need for tools when servicing the system (most components)
Indicator LEDs	<ul style="list-style-type: none"> Enables operations personnel to easily identify problematic components and prevents mistakes in servicing
DIAGNOSTICS	

Email Diagnostics	<ul style="list-style-type: none"> Enables Sun's support representatives or customers to quickly get a clear and comprehensive report describing system configuration and health
Memory Tracking Facilities	<ul style="list-style-type: none"> mbuf tracking for network issues malloc tracking
Onboard Packet Capture	<ul style="list-style-type: none"> Enables Sun's support representatives to create packet capture sequences describing particular protocol errors, thereby empowering the Tech Support team to diagnose customer situations more quickly
Automated Diagnostic Gathering	<ul style="list-style-type: none"> Gathers and saves diagnostics in the event of system problem
MONITORING	
Disk Subsystem Monitoring via SCSI Enclosure Services (SES)	<ul style="list-style-type: none"> Standards-based disk subsystem monitoring for enclosure, controller, power supply, fan and disk health
UPS Monitoring	<ul style="list-style-type: none"> RAID controller cache switched to write-thru mode if living off of battery (UPS) power Graceful shutdown effected if battery charge drops below acceptable range System does not revert to write-back mode until on AC power and battery sufficiently charged
IPMI Support	<ul style="list-style-type: none"> Enables the system to monitor its own server components (power supplies, fans – including the dedicated processor fan and temperature) and inform the user should any problems be discovered, thereby preventing downtime due to catastrophic failure
NOTIFICATION	
LCD Posting	<ul style="list-style-type: none"> Provides a local reference enabling an administrator to get a picture of overall system health when viewing the unit in its immediate presence
Syslog (Local)	<ul style="list-style-type: none"> Enables the user to exploit a standard and familiar facility for providing log-based information
Remote Syslog	<ul style="list-style-type: none"> Enables the administrator to log StorEdge NAS OS events on a remote system (usually in concert/context with events from other systems) using a standard and familiar facility
SNMP Support	<ul style="list-style-type: none"> Provides for simple integration of StorEdge NAS into an environment where systems are monitored centrally using familiar, industry-standard tools (Sun NetManager, Computer Associates Unicenter, IBM Tivoli, HP OpenView)
SMTP Email	<ul style="list-style-type: none"> Provides a simple, effective and ubiquitous mechanism for critical system event notification
FILE SYSTEM	
Dynamic Volume Expansion	<ul style="list-style-type: none"> Volume expansion can be effected during normal business operations (note that SCSI requires that the system is powered down to add a drive expansion module) Downtime due to capacity limitations eliminated

64-bit File system.	<ul style="list-style-type: none"> • File system. scales to 16TB volume sizes – larger volume size support eases administrator’s management tasks by reducing the number of objects that they must manage • Up to 512 file systems • 7 TB+ LUN capacity handling provides more than enough capacity to consume even the largest RAID sets
Journaling File system. (JFS)	<ul style="list-style-type: none"> • Journaling – a two-phase commit operation – helps to ensure file system integrity across unforeseen events like power outages. In the two phase commit process, the first phase of journaling happens on NVRAM on the RAID controller. The second phase commits the data to disk thus ensuring data integrity. (See ‘On-disk Journaling’) • Enhances data availability by obviating the need for lengthy file system check operations subsequent to power outages or other unplanned events • Aids with data integrity by journaling both metadata and user data (for synchronous writes), ensuring that the client and filer have a consistent perspective of the on-disk data
On-disk Journaling	<ul style="list-style-type: none"> • The StorEdge NAS products journal to disk – as opposed to journaling to an in-head NVRAM card. The lack of data on the head unit precludes any possibility of a data integrity issue due to head unit failure or malfunction.
Directory Tree Quotas	<ul style="list-style-type: none"> • Enables administrators to allocate space quickly to departments or individuals • Enables administrators to partition large, individual volumes from a capacity standpoint, providing for volume-like control of space allocations but without requiring them to administer multiple actual volumes • Simple backup policies (e.g., volume-based full, differential, incremental backups) can be retained across the entire volume, even if capacity is being managed locally
SUN STOREDGE FILE CHECKPOINT	



Implementation	<ul style="list-style-type: none"> • Provides for business continuance without requiring massive expenditures for completely redundant or mirrored systems • Point-in-time image of file system increases backup window, easing the burden on administrators to complete backup operations between production cycles • Creation speeds are sub-second, almost instantaneous, providing administrators a very useful, powerful tool which obviates the need to undergo lengthy and operator-intensive tasks such as restores from tape • Sophisticated technology retains only those file system blocks that actually change, e.g., a change to a 16k portion of a 3GB file would create a checkpoint of size 16k, enabling administrators to exploit the capability without drastically increasing space requirements • Facilitates migration to / from new applications • Checkpoints use a “copy-on-write” technology which is the technique of duplicating disk blocks only as they are modified. • Checkpoints provide a facility for self recovery of lost and/or accidentally deleted objects
StorEdge File Checkpoint Scheduling	<ul style="list-style-type: none"> • Provides for automatic creation of checkpoints based upon a user-defined schedule • Provides for user-defined retention criteria and automatic deletion of checkpoints at specified intervals
Local Directory Checkpoint Access (LDCA)	<ul style="list-style-type: none"> • Enables users to self-recover (i.e., without administrator assistance) prior versions of key files in the event they are accidentally deleted • Obviates administrator involvement, restore from tape drives etc. in the recovery process
Fast StorEdge File Checkpoint Restore	<ul style="list-style-type: none"> • Provides for a metadata-effected restore of a checkpointed file • Facilitates recovery of accidentally-deleted data – even by a user • Does not necessitate recovery of an entire volume (as does some competitor implementations)
DATA PROTECTION FACILITIES	
Backup	<ul style="list-style-type: none"> • Remote/over the LAN utilizing NDMP with VERITAS NetBackup Server and NDMP option

StorEdge File Replicator: Remote Mirroring (option)	<ul style="list-style-type: none"> • Provides for business continuance, even in the face of catastrophic loss of the primary (source) system • All writes communicated in time order from source to target, guaranteeing a consistent view of the state of user data at the remote site, any point in time. (Note that asynchronous mirroring does not guarantee that the state of the local and remote sites is identical or changes simultaneous, only that each site is consistent and updates in the same sequential order.) • When promoted to source (or master), the remote system always provides access to every in-order transaction it received from the original source (master), thereby providing the optimal architecture for data preservation in an asynchronous mirroring model • Preserves write ordering, ensuring that files remain consistent on the mirror target, and ensuring that up-to-the-second updates are available should mirror promotion occur • Individual StorEdge NAS Appliance volumes can be mirrored from any system to any other Sun StorEdge NAS family system, providing the user with flexible and cost-effective options for assuring data availability • Fast reversion from source to target, providing maximum data availability and protection • Network (Ethernet) based mirroring means lower cost, and provides the ability to exploit technology familiar to users and without requiring expensive gateways.
OTHER	
IP Aliasing	<ul style="list-style-type: none"> • Enabler for active/active NIC's • End user can set up a single port with multiple IP addresses, facilitating network management and topology layout
Multi-byte Character Support	<ul style="list-style-type: none"> • Unicode is supported, facilitating deployment of StorEdge NAS throughout the world
DHCP	<ul style="list-style-type: none"> • Facilitates installation in environments where DHCP is active, enabling the system to acquire an IP address (which is posted on the LCD) dynamically, which the user can then access to setup the system
Installation Wizard	<ul style="list-style-type: none"> • Facilitates installation by automatically detecting first-time access and leading the user through an intuitive, 10-15 minute set of dialogs, after which the StorEdge NAS system will be largely ready to use
LCD Keypad	<ul style="list-style-type: none"> • Simplifies installation by communicating success or failure, and acquired IP address if successful • Provides the ability to effect a 'soft' shutdown from the front panel • Provides the ability to set an IP address should DHCP fail • Posting area for communication of system problems (e.g., disk failures, fan failures, power supply failures etc.)

Multiple Administration Interfaces <ul style="list-style-type: none"> • Web GUI • Telnet 	<ul style="list-style-type: none"> • Provides the user with a choice of a user interface, enabling them to select and use the interface with which they feel the most comfortable
SSH Support	<ul style="list-style-type: none"> • Provides for secure, remote menu access to StorEdge NAS administrative facilities
Native Administration Tool Support	<ul style="list-style-type: none"> • Facilitates administration thorough the provision of support for tools with which the administrator is already familiar, e.g., Windows Explorer can be used to set directory/file permissions
Comprehensive Quota Support <ul style="list-style-type: none"> • User Quotas • Group Quotas • Default Quotas 	<ul style="list-style-type: none"> • Enables the administrator to simply and easily prevent rogue applications or users from consuming too much disk space. Default quotas provide for a simple mechanism to set a global limit for all users and/or groups without setting each user/group individually
Cross-Protocol Support	<ul style="list-style-type: none"> • Simplifies the administrator’s storage management tasks by providing for access in heterogeneous environments, enabling administrators to create and manage storage without artificially partitioning it between Unix and Windows clients • Facilitates file sharing between groups and users in the enterprise
User/Group Mapping	<ul style="list-style-type: none"> • Facilitates administration in heterogeneous environments by enabling the administrator to map Unix users/groups to Windows users/groups, either through automatic means or manually
Cross-Protocol File Locking	<ul style="list-style-type: none"> • Enables robust and safe file sharing in heterogeneous environments. Cross-protocol file locking is limited to blocking NFS writes to a file when a SMB/CIFS client has the file open. The converse is not implemented, in part because the often stateless nature of NFS access makes it difficult to determine when a file is being modified via NFS.
Cross-Protocol Security Mapping	<ul style="list-style-type: none"> • Guarantees security by providing for consistent security policies for objects created through one file system protocol (e.g., Unix) and then accessed through another (e.g., Windows)
Permission Synthesis	<ul style="list-style-type: none"> • Facilitates securing of data by synthesizing permissions during access of objects via non-creating protocols – for example, Windows permissions are synthesized if an object created under Unix is accessed through Windows
NTP Support	<ul style="list-style-type: none"> • Enables the administrator to utilize industry-standard means of synchronizing StorEdge NAS time with network time (the clocks of all other servers on the network)
FTP	<ul style="list-style-type: none"> • Provides a very fast, familiar and industry-standard tool for uploading and downloading files to StorEdge NAS
Autohome Shares	<ul style="list-style-type: none"> • Temporary SMB/CIFS shares that are automatically created when a user logs on to the system and removed when the user logs off • IT Administrator’s do not have to create and manage shares manually for potentially thousands of users

Enabling Technology

Technology Overview

The Sun StorEdge 5210 NAS Appliance utilizes the following technologies:

- SCSI RAID controller
- Flash Disk Module for Operating System
- SCSI Storage
- 2U chassis dual redundant power supplies and fans
- Intel Xeon Server-class Motherboard and CPU
- Software/Operating System

SCSI RAID Controller

The StorEdge 5210 NAS Appliance utilizes up to two dual port SCSI 160 RAID controllers. The main features of this controller are:

- Dual channel Ultra160 SCSI. For the 1st RAID controller one channel is allocated for 6 internal drives, and the second channel for an optional SE5210 Expansion Unit. For the 2nd RAID controller, both channels are used for connection of up to 2 additional StorEdge 5210 Expansion Units
- 64-bit,66 MHz/133 MHz compliant
- 128MB cache, ECC SDRAM
- Battery backup module for cache memory

Flash Disk Module for Operating System

The Sun NAS Operating System resides on a 256MB solid-state Flash Disk Module that connects directly to the IDE port. The main features the Flash Disk Module are:

- Solid-State (no moving parts)
- High Shock and Vibration Limits
- Rugged and compact
- 512 Byte Sector and ECC Defect Management Compatible to IDE Hard Disk Drives

Storage

The StorEdge 5210 NAS Appliance supports six internal redundant and hot-swappable internal Ultra160 SCSI hard disk drives (HDDs). The filer also supports up to 3 external SE5210 Expansion Units for an additional 36 (3 x 12) redundant hot-swappable hard disk drives.

2U Chassis

The 2U chassis is a standard 19" rack-mountable with dual redundant and hot-swappable 500 watt power supplies and redundant fans. The chassis' front contains multiple LEDs indicators. Refer to the Server Architecture section for a detailed diagram of all the components on the front of the chassis.

Motherboard Board Information

The Sun StorEdge 5210 NAS Appliance is based on the Intel® Xeon-class Server Board SE7501WV2. The main features of the motherboard are listed below.

- Support for one Intel® Xeon™ processor with 512KB L2 Advanced Transfer Cache, Hyper-Threading Technology, and a 533MHz system bus.
- Support for 4 GB of registered ECC DDR200/266 SDRAM
- Two integrated Intel® PRO/1000 MT Server Gigabit Network Connections (Intel® 82546EB controller)

StorEdge 5210 Expansion Unit

Figure 5. Front panel of StorEdge 5210 Expansion Unit

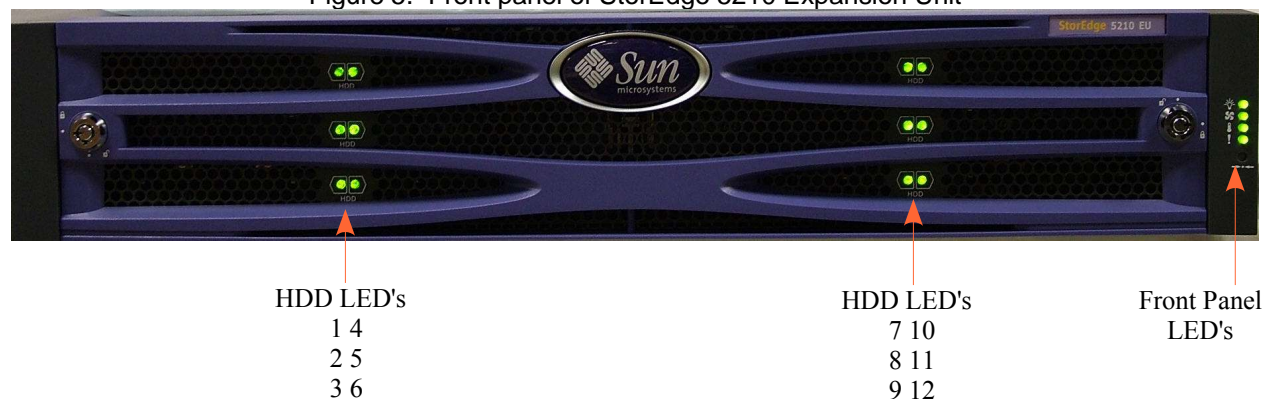


Figure 6. Rear of StorEdge 5210 Expansion Unit



The Sun StorEdge 5210 Expansion Unit enclosures are rackmountable mass storage subsystems. The 2U-high Sun StorEdge 5210 Expansion Unit utilizes the Ultra160 LVD SCSI interface both internally to the drives and externally to the host ports.

Each Sun StorEdge 5210 Expansion Unit RAID controller/drive array holds up to twelve Ultra160 LVD SCSI disk drives.

The midplane for one (single concatenated) or two (dual split) SCSI buses is quickly and easily configured via a short external patch cable (the cable is included with the array). Attaching the cable to create a single-bus configuration sets certain disk slots with unique SCSI target IDs on that bus. The label on the front of the chassis identifies the target IDs.

Dual hot-swap/redundant load-sharing/load-balancing 100 to 240VAC power supply units each have separate power inputs and contain two high-velocity (52 CFM) fans with detection circuitry to monitor degraded performance provides superior temperature control.

The enclosure reporting monitor (EMU) maintains the enclosure environmental control and status. The EMU monitors all internal voltages per power supply. Seven temperature sensor locations and fan speeds from each are monitored by the EMU. The EMU controls front and rear panel display LEDs and buzzer alarm. The drive array supports dual failover EMU modules for fully redundant event monitoring safety.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



The Sun StorEdge 5210 Expansion Unit support SAF-TE protocol (SCSI Accessed Fault-Tolerant Enclosures) for reporting the environmental information from the EMU's onto the in-band SCSI bus.

Key Architectural Features

- All FRU's are easily accessible from the front or rear of the array
- Each array supports up to twelve hot-plug, 1-inch high (low-profile) Ultra160 SCSI LVD disk drives
- Colored LED indicators provide FRU status as well as enclosure environmental and hardware status
- Auto SCSI termination technology supported on external drive SCSI ports
- Single-bus or dual-bus configurations by simple external jumper cable connection
- Intelligent event monitor unit (EMU) monitors enclosure environmental information such as sensing various temperature sensors and obtaining voltage output status from each power supply – each EMU can enable the buzzer alarm for audible alerts
- Dual enclosure reporting monitors with failover control provides redundancy event monitoring security
- Auto detection of major components installed such as disk drives, fan/power supplies units, and RAID controllers are monitored by the EMU
- Embedded SAF-TE protocol interface for in-band enclosure (array) reporting capability
- Compact, low-profile VHDCI connectors on the host and drive I/O port modules for high density cable capability
- Dual redundant power supply/fan assemblies provide high availability (for example, can take inputs from separate power grids)
- AC power supplies feature load-sharing balancing and auto-ranging AC voltage input capability
- Four 52 CFM axial fans provide high availability redundancy and excellent cooling (two fans in each power supply FRU)
- Dynamic disk drive storage expansion within and across arrays

Software/Operating System

The Sun NAS Operating System has been designed for the sole purpose of high-performing file serving and file storage. It utilizes the following technologies:

- 64-bit Journaling File system.
- File Sharing for NFS and CIFS clients
 - Unified Lock Management
- Active Directory Services
- Sun StorEdge File Checkpoint
- Sun StorEdge File Replicator (optional)
- High Availability Bonds (NIC Failover/Port Aggregation)

64-bit Journaling File system.:

The StorEdge NAS OS file system is a 64-bit journaling file system that guarantees file system integrity across unforeseen events, such as power outages, enhancing data availability by obviating the need for lengthy file system check operations subsequent to power outages or other unplanned events. The OS supports up to 512 file systems with file systems scaling up to 16TB in volume size, simplifying an IT administrator's management tasks since larger volume sizes reduces the number of objects they must manage.

Journaling ensures file system consistency and fast recovery in the unlikely event of a system crash. The OS maintains a log or journal of the block level activity that has taken place on disk as directed in the two phase commit process.

The two phase commit process is similar to a typical data base environment. When a client executes a transaction, the first phase of the commit process, a write, either synchronous or asynchronous, as determined by the transaction, initiates an entry in the StorEdge NAS memory; the meta-data and content (data-data). In the event of a synchronous write, both the meta-data and the content are subsequently written to disk and the transaction is journaled. Conversely, in a asynchronous write, the content and meta-data are written to memory with only the meta-data being journaled allowing for greater performance and lower latency as experienced by the client and/or transaction. However, due to the architecture of asynchronous writes in both NFS and SMB the client and StorEdge systems will have a consistent perspective of data on disk.

The second phase, the commit, as dictated by the client, "flushes" the content left in the StorEdge memory, as with a asynchronous write, to disk and subsequently a notification is sent to the client from the filer of the content being written to disk. At this time, content is also flushed from the client's cache thus "completing" the transaction.

In the unlikely event of an abnormal shutdown of the filer, any lost data can be recreated because any updates to the metadata in directories and bitmaps are written to the journal. This alleviates the need for fsck's.

With this journaling methodology filers can recover from an abnormal shutdown in a few minutes as opposed to requiring a costly, time-consuming consistency check. The journaling file system not only returns the data to the pre-crash configuration but also recovers unsaved data and stores it in the location it would have been stored had there not been an unexpected interruption.

Drawbacks encountered due to costly NVRAM topologies are non-existent by journaling to industry standard hard drive technologies. Since the data is on disk, there is no dependency on batteries to maintain journal information, for it is on fault-tolerant RAID drives.

In the event that the file system needs to be expanded, an available LUN can be assimilated by an existing volume via a simple operation. This feature provides for the dynamic expandability through the addition of unallocated extension segments while the filer is online and accepting data I/O. As such, this feature allows an administrator the flexibility to allocate storage on an as needed basis. Because of the dynamic scalability of a file system (volume), what was once a time consuming task requiring system downtime can be accomplished without the traditional negatives associated with such a task. Available storage made simple.

File Sharing for UNIX (NFS) and Windows (CIFS)

The Sun StorEdge 5210 NAS Appliance delivers secure file services for CIFS and NFS clients. The integration of these two security models presents a challenge due to the many differences between these protocols. Windows file servers use access control lists, or ACL's, to specify access rights for defined lists of users and groups. NFS servers use traditional UNIX permissions - user/group/world - that specify a limited set of permissions. The Sun StorEdge 5210 NAS Appliance provides an integrated security model in which Windows ACL's and UNIX permissions are simultaneously maintained for file system objects, and which preserves the semantics and features of the native security models.

With file system support for both CIFS and NFS security, the Sun StorEdge 5210 NAS OS provides an integrated model for file sharing between Windows and UNIX systems. This model includes support for NFS permissions, Windows ACL's, Windows Domain integration, and cross-platform services like credential mapping. The Sun StorEdge 5210 NAS Appliance also supports network name resolution via Network Information Services (NIS, NIS+), the Berkeley Domain Name System (DNS) and Microsoft Windows Internet Naming Service (WINS). The following are notable aspects of the design:

- The key to the Sun StorEdge 5210 NAS Appliance support for cross-platform file sharing is credential mapping. Credential mapping enables users with both NFS and CIFS user accounts to seamlessly exercise their ownership and access rights from either client platform via an association (or mapping) between the two accounts. This association can be created automatically, or it can be established manually in environments where the Windows and UNIX account names do not match. Credential mapping facilitates file sharing between the platforms by mapping each NFS user or group to a CIFS user or group and vice versa. This allows users to assign access rights to a user or group from either platform using that platform's native toolset.
- Files created via NFS are classified as UNIX files and files created via CIFS are classified as Windows files. Windows files typically have security descriptors associated with them while UNIX files do not. Editing or copying a UNIX file (a UNIX-created file) using a CIFS client will add a security descriptor to it, and cause it to be reclassified as a Windows file. Removing the security descriptor from a Windows file (possible only when configured by the administrator to allow this) will cause the file to be reclassified as a UNIX file. For native file service requests (NFS to UNIX files and CIFS to Windows files) the security model honors the native CIFS or NFS access conventions. For non-native requests, a heuristic model is employed to synthesize permissions of the native (or creating) protocol. The guiding principle for Sun StorEdge 5210 NAS Appliance cross-platform file access is that a user will not be granted greater access via a non-native protocol than would have been granted via the native protocol.
- As with Windows systems, each Sun StorEdge 5210 NAS Appliance will establish membership in a Windows Domain. When a user connects to a Sun StorEdge 5210 NAS system, the user is

authenticated by a Domain Controller (DC) using pass-through security. Domain membership and pass-through authentication allow the Sun StorEdge 5210 NAS Appliance to take advantage of Windows availability and scalability features, such as Primary (PDC) and Backup (BDC) Domain Controllers and inter-Domain trust relationships. An access token, obtained from the Domain Controller, is used to identify the user and contains the user's ID and the ID of each group of which the user is a member. The access token is used to represent the user when an attempt is made to access secured objects, such as files and directories.

- Windows files and directories are secured via security descriptors (SD). Each SD contains the ID of the object owner, the ID of the owning group and an access control list (ACL). The ACL is a list of access control entries (ACE), each of which grants or denies specific access rights to a specific user or group.
- The CIFS security model implemented on the Sun StorEdge 5210 NAS Appliance is the standard Windows security model. Each request to access an object contains a set of desired access rights. These desired access rights are checked against the access control information defined in the object's security descriptor to determine whether access should be granted or denied.
- The Sun StorEdge 5210 NAS Appliance provides support for several Windows built-in local groups. These groups are the standard Windows solution for assignment of system wide privileges for common administration tasks. A well-known example is the backup/restore privilege granted to the Backup Operators group. These groups can contain users from either the local domain or trusted domains. The Domain Admins group of the domain which the Sun StorEdge 5210 NAS Appliance is a member of is automatically given membership in the local group Administrators. This behavior is expected from Windows Domain member servers, and therefore improves compatibility.
- The Sun StorEdge 5210 NAS Appliance automatically creates administrative CIFS shares for each volume. This provides access to all files and directories for Domain Administrators without the need to create shares at the root level. Again, this behavior is expected from Windows Domain member servers and improves compatibility with Windows and Windows-aware applications.
- The Sun StorEdge 5210 NAS Appliance provides file access from Windows systems via CIFS/SMB with support for either share level security or Windows Domain security. When used in a domain environment, Sun StorEdge 5210 NAS Appliance users are authenticated with a Domain Controller using pass-through authentication. In the workgroup security mode, access is authenticated locally on the Sun StorEdge 5210 NAS Appliance using a share password. ACL's are not used in workgroup mode, resulting in what we would designate as a "UNIX file". Workgroup security is weak in comparison to Windows Domain Security, and is generally not recommended.
- File Locking. The Sun StorEdge 5210 NAS Appliance employs an integrated file locking mechanism that supports the following file locking schemes:
 - Windows (CIFS) whole-file locks
 - Windows (CIFS) byte-range locks
 - Windows (CIFS) Opportunistic locks (optional file locks acquired at file open time, "breakable" by CIFS file access)
 - UNIX (NFS) byte-range locks (advisory locks, via lockd and statd)

In addition to supporting single-protocol file locking, the Sun StorEdge 5210 NAS Appliance also protects user data with the support of an integrated cross-platform file locking mechanism. This functionality prevents NFS clients from writing to files that are open via the CIFS protocol.

File locking caveats:

- Level II Opportunistic Locks (oplocks) are not supported.
- Cross-protocol file locking is limited to blocking NFS writes to a file when a SMB/CIFS client has the file open. The converse is not implemented, in part because the often stateless nature of NFS access makes it difficult to determine when a file is being modified via NFS.

Active Directory Services

Active Directory is the Windows directory service that provides access to domain information such as users, groups and shared resources. Active Directory clients access this information on the network using the Lightweight Directory Access Protocol (LDAP). The AD relies on the Internet Domain Name System (DNS) to provide name resolution services. DNS is the industry standard service used throughout the Internet to resolve hostnames to Internet Protocol (IP) addresses. The DNS provided with AD supports the ability for clients to dynamically update their entries in the DNS database; this is known as dynamic DNS. Sun StorEdge NAS OS supports LDAP version 3, which is defined in RFC2251. Further information is also available on the Microsoft web site.

To support Windows environments, Sun StorEdge NAS OS provides the ability to publish shares in AD and update DNS records using dynamic DNS. AD clients can then access Sun StorEdge NAS OS shares by looking in the Active Directory. Shares appear in AD as folder objects that point directly to the appropriate shares on Sun StorEdge NAS OS. Share can be placed in any container in which a share folder object can be created. One of the properties of a share folder object is its UNC name. The Universal Naming Convention (UNC) name specifies both the server on which the share exists (i.e. server.sun.com) and the name of the share, i.e. \\sun.com\sharename. AD provides the ability to control access to share objects within the directory service, in addition to any access controls placed on the Sun StorEdge NAS OS directory being shared.

Sun StorEdge NAS OS supports Kerberos version 5 authentication for secure AD and dynamic DNS updates. Kerberos uses secret-key cryptography to provide a network authentication protocol for client/server applications. Each secure AD or dynamic DNS update is performed within the context of an AD user. Sun StorEdge NAS OS communicates with a Key Distribution Center (KDC), which normally resides on a domain controller, to authenticate the user prior to performing an update²

The AD domain is equivalent to concatenating the NT domain name and the DNS domain name. For example, if the NT domain is SALES and the DNS domain name is sun.com, the AD domain would be sales.sun.com.

The username and password provide the user credentials used to authenticate AD updates. The user must be a valid Window user, defined in AD, that has the administrative rights required to perform secure AD updates, e.g. a Domain Administrator.

The User Container field specifies the container in which the username resides; for example, the administrator user resides in the users folder. The field format is in LDAP distinguished namenotation, without the domain. Thus, for the administrator user, the container would be specified as: cn=users

If the user definition resides in an organizational unit folder (for example, user_folder) then the container would be specified as: ou=user_folder

² If the administrator user is used to update AD or DNS and the update fails then the DES encryption keys required for Kerberos may have to be regenerated by changing the administrator user password. This is only required for the administrator user and the previous password can be reused.

If the user resides in a sub-container folder of a parent folder, then the container would be specified as: ou=sub_folder,ou=parent_folder. Note the reverse order definition.

Sun StorEdge NAS OS provides support for dynamic DNS, which can be used to automatically update the IP address and hostname of a Sun StorEdge NAS OS server. In an AD environment, it is important that the DNS information is correct since AD clients will use DNS to locate the Sun StorEdge NAS OS when they access shared resources.

Sun StorEdge NAS OS updates DNS when it boots up or when DNS settings are saved. Dynamic DNS must also be enabled in DNS. Sun StorEdge NAS OS can update a DNS using the secure or non-secure mechanisms. It will first attempt to update DNS using the non-secure method. If this fails, it will try the secure method. In order for Sun StorEdge NAS OS to update a DNS zone securely, the zone has to be an AD integrated zone, meaning the zone is stored in AD. Sun StorEdge NAS OS will use Kerberos to authenticate an AD user before DNS can be updated securely.

Sun StorEdge File Checkpoint:

Sun StorEdge File Checkpoint is a point in time image (or “checkpoint”) of a file system taken at the volume level that resides on a NAS device. While the active file system(s), can be modified with read / write (R/W) operations, the “copy” or logical image can only be read and is not modifiable. It is a virtual and static read-only point-in-time “copy” of the active file system. A “copy” or “copies” co-exist with existing, live, file system(s). One should not consider a point in time image as a true “back-up” of the active file system. Its virtual existence is directly relational to the live physical file system's existence.

While the functionality of using Sun StorEdge File Checkpoint is diverse and vast, the process of implementing and managing checkpoints is simple. When a checkpoint is requested by an authorized user or is automatically “taken”, the time required and performance overhead are negligible to both the network infrastructure and the live, active file system.

Access to checkpoints is provided via multiple protocols: NFS and CIFS clients. There can be up to sixteen (16) checkpoints maintained at any one time per file system (volume) on a NAS device.

Sun StorEdge File Checkpoint Applications

- **Rapid File Recovery:** When files are modified or deleted accidentally, checkpoints can be used to quickly access a recent image of the file.
- **Online backup of files:** With its checkpoint feature, Sun NAS OS allows the flexibility to backup large file systems without worrying about data being changed during the backup process. This exclusive feature ensures that such file systems will always be backed up in a consistent state.
- **Database backups:** By checkpointing database files on a StorEdge NAS, it is not necessary to take a database offline during the time it takes to back it up. Instead, the database can be paused momentarily, then a checkpoint taken. The checkpoint will contain an image of the database files at a given point in time, which in turn can be backed up at the user's convenience.

Sun StorEdge File Checkpoint Benefits

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- **Reduced Recovery Time:** point in time images dramatically reduce the time it takes to recover lost or damaged files and file systems. Recovering files from tape is no longer the only option. Point-in-time images of the active file system (volume) are accessed in a read-only state and accessed via CIFS share or NFS mount point assuming proper access rights.
- **User Satisfaction:** In the event of lost, corrupted, or damaged files, system administrators are no longer faced with the complex task and lengthy process of recovering to a “clean” version of the file in question. In a Windows environment, accessed through CIFS share, the file can be “dragged” and dropped” from the checkpoint folder into the proper volume. From a NFS mount point, the file in question can be copied from the checkpoint directory to the proper location.
- **Reduced Cost (TCO):** Lower TCO is achieved, in the event of recovering lost, damaged, or corrupted files, in time savings of the administrators doing the recovery. The time usually spent in searching archived files on tape, the “normal” wear-and-tear of tapes and tape devices, and having to do multiple recoveries in the event the wrong file being recovered allows for time better spent doing more meaningful tasks.

Sun StorEdge File Checkpoint Explained

The Sun StorEdge NAS OS file system has inodes, which are data structures within the file system holding specific file related information, including the addresses of data blocks. As shown in Figure 1, a live file volume has inodes that describe the addresses of the blocks that compose any given file volume. This addressing is achieved by using pointers to reference the data blocks that are stored elsewhere on disk.

Sun StorEdge NAS OS creates a checkpoint by maintaining all pointers to disk blocks currently in use at the time of the checkpoint. As illustrated in Figure 2, when the checkpoint is taken, a new inode is created to maintain existing pointers to data blocks. Any changes made to files after a checkpoint has been established will result in updates to the current set of pointers. Figure 3 shows the state of the volume after data blocks are updated. This process is similar to when changes are made to non-checkpointed volumes, which also update pointers to point to the new disk blocks.

Because of this adherence to standard volume update processes, performance degradation with checkpoints is limited. The overhead experienced was a zero change in file system size, and 5% performance degradation in terms of iops on a standard benchmark applied to checkpointed volume. It is important to note that the benchmark imposed a very high proportion of write operations against the file system, therefore degradation is actually quite minimal. Actual effects on performance will vary depending on a number of factors including file system size, number of files, number of delete operations, depth of directories, average file size, and outstanding number of checkpoints.

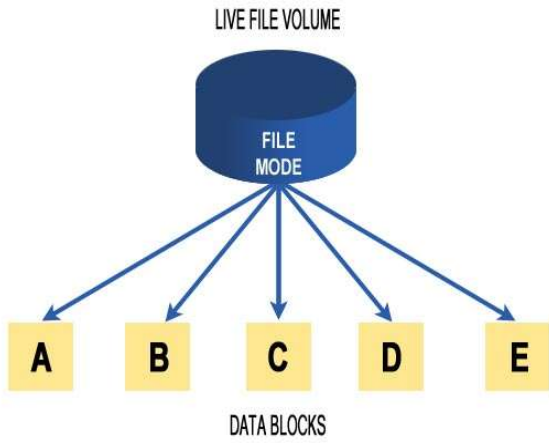


Figure 6 Normal file volume before checkpoint is taken

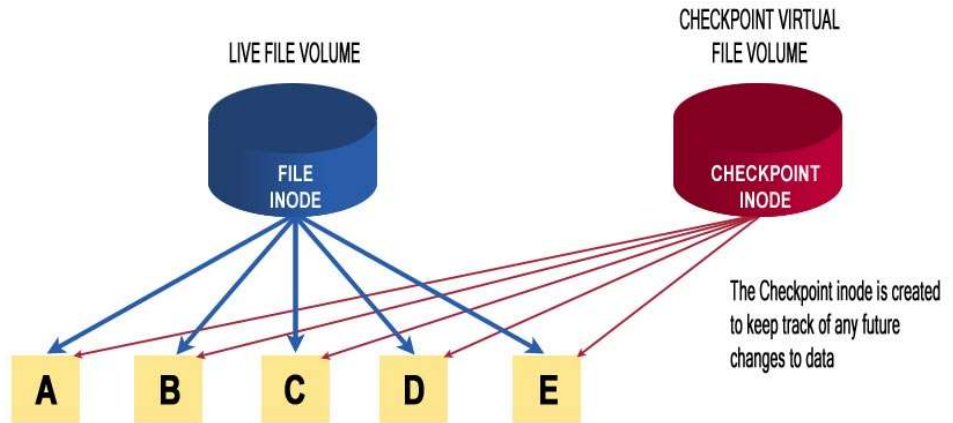


Figure 7 . File volume after checkpoint is taken

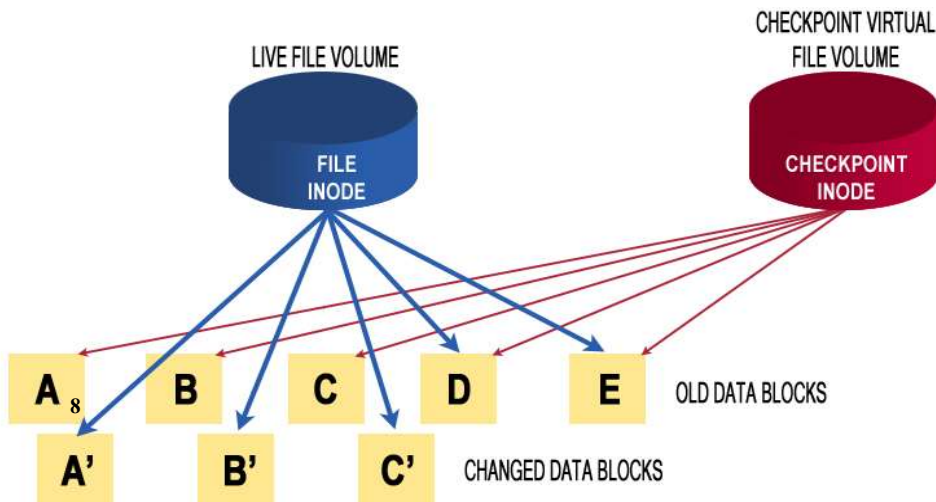


Figure 3. New data blocks are created when files are updated

Sun StorEdge File Replicator

Leveraging the Sun NAS OS's advanced journaling file system, the StorEdge File Replicator application can be used to create a copy of a volume on a remote StorEdge NAS Appliance. This is performed using the Safe Asynchronous Mirroring (SAM) architecture which ensures file system consistency at both source and target. The following are important aspects of the StorEdge File Replicator architecture:

Source/Target Interconnection

A StorEdge File Replicator implementation consists of a target and source file volume, along with the interconnecting TCP/IP network that is responsible for propagating the data between them. The target StorEdge NAS Appliance can be located virtually any distance from the source. The target StorEdge NAS Appliance can be on the same campus as the source, or on the other side of the world, as long as the interconnecting network has sufficient bandwidth to carry the data across. There are three options:

- **One-to-One Mirroring:** This is the most straightforward and popular approach to mirroring. There are one Master system and one Target system in this configuration and is described above.
- **Many-to-One Mirroring:**
In Many-to-One mirroring, several Master systems are mirrored to a single Mirror target. Many-to-One mirroring is frequently used by customers for Disaster Recovery purposes, to collect exact duplicates of multiple systems at multiple remote locations at a single, central site, where recovery scenarios can be centrally managed.
- **Bi-directional Mirroring:**
Bi-directional Mirroring refers to the ability for systems at sister locations to mirror to each other. For instance, a system in Los Angeles may be configured to mirror its volumes to a sister system in Houston, which in turn and simultaneously mirrors its volumes to the Los Angeles system. In the event either site experiences a problem, the data is readily available at the sister site.

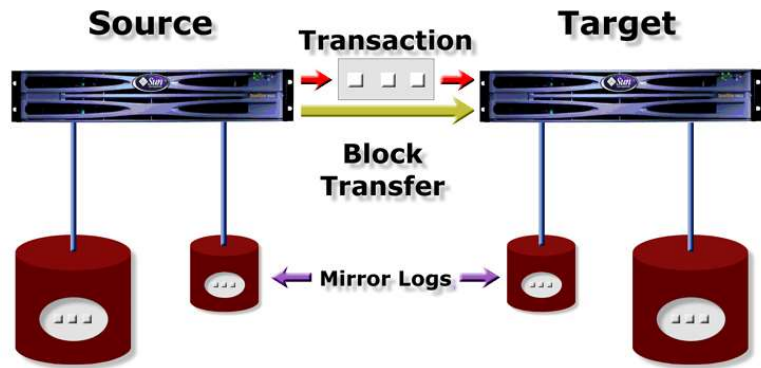
Block-level Mirroring

With StorEdge File Replicator, data replication is performed at the block level. All checkpoints, symbolic links, and other data structures existing on the target will be identical to those of the source volume. In fact, once the source and target have been synchronized, the target will be an exact, block-level image of the active disk. StorEdge File Replicator's block-level implementation dramatically reduces the required bandwidth on the interconnecting network by transmitting only those data blocks that have changed. For example, if only a single 4 KB block of a one hundred megabyte (MB) file is updated, only that 4 KB block is transferred, not the entire 100 MB file.

Safe Asynchronous Mirroring (SAM)

In order to ensure data protection without compromising source StorEdge NAS Appliance performance or introducing source checkpoint latency, StorEdge File Replicator was architected with Safe Asynchronous Mirroring technology, a unique asynchronous replicating scheme that utilizes database technology

to ensure file system integrity. On both ends of the mirror, there are dedicated mirror logs that log changes to both source and target file systems. Updates to a target StorEdge NAS Appliance are comprised of a series of write transactions, each containing a number of data block updates. The figure on the right shows the mirror logs and the transactions propagating between StorEdge File Replicator source and target. Each transaction is sent from source to target in an ordered fashion and entered into the target mirror log. Each of these write transactions contain a number of key file system updates such as inode delete and update.



Data Integrity

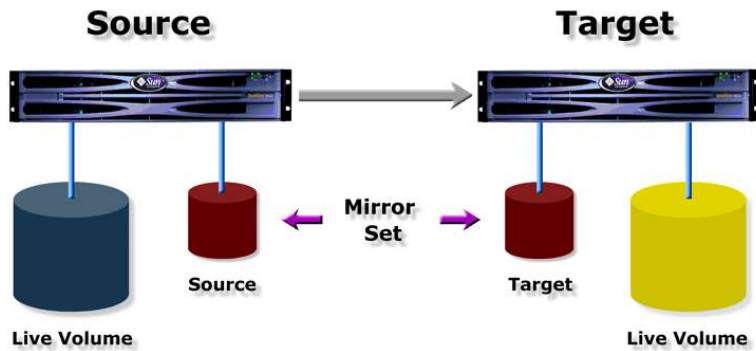
Extensive effort has gone into ensuring that the target's data does not lag that of the source, thereby maintaining a high state of synchronization. Due to the asynchronous architecture of StorEdge File Replicator, the target may lag the source volume by an amount of time depending on the source StorEdge NAS Appliance's load and the speed of the network connection. StorEdge File Replicator mirrors on a block level to ensure high performance, but does not commit data to the target volume on transactional boundaries. This guarantees the integrity of the file system on the target and also preserves write ordering.

Error Handling

The SAM architecture also aides in handling broken network connections between the source and target. If the intraconnecting link is temporarily broken, the mirror log on the source continues to record file system block changes, serving as a buffer for unsent data. When the link is reestablished, the logged data can then be propagated to the target StorEdge NAS Appliance. This ensures that temporary link-down scenarios can be gracefully handled and that the target data is brought in sync with the source in a timely fashion.

Deployment of Target StorEdge NAS Appliance

StorEdge File Replicator replicates data at the volume level. Both of the mirrored StorEdge filers need not be identical and can have other normal, active volumes. This provides the IT manager the flexibility to decide which volume to mirror, and to utilize both filers for other file serving purposes.



Management

The source StorEdge NAS Appliance acts as the focal point for StorEdge File Replicator management. Configurations are performed on the source StorEdge NAS Appliance, which in turn affects the configurations changes on the target StorEdge NAS Appliance. Sun NAS OS's Java-based graphical user interface (GUI) provides an intuitive and easy-to-use browser-based interface for StorEdge File Replicator management. Management can be performed on any browser-equipped workstation that can access the target StorEdge NAS StorEdge NAS Appliance's network. This fits with StorEdge NAS's appliance approach, simplifying data management by eliminating the need to install additional software on management workstations.

StorEdge File Replicator Applications

StorEdge File Replicator can be used to help address many data management challenges facing IT professionals today:

Disaster Recovery: Without a reliance on slow tape media, StorEdge File Replicator eliminates the need for lengthy tape restores. StorEdge File Replicator enhances recovery time in case of a complete loss of data, as businesses can now access mission-critical data from an online backup on a mirror StorEdge NAS Appliance. With StorEdge File Replicator properly configured, the target, or mirror, is assured to be an accurate, near realtime representation of the offline source StorEdge NAS Appliance. The StorEdge target file volume can be brought online quickly to ensure uninterrupted operations.

Backup: A StorEdge File Replicator target volume may be dedicated for backing up source volumes. Without affecting production operations, replicated data can be backed up on the target. StorEdge File Replicator enhances operations by moving backup I/O to the remote volume. This shadow processing capability reduces CPU load on the production StorEdge NAS Appliance, streamlining operations.

High Availability Bonds: (NIC Failover / Port Aggregation):

The following describes the High Availability (HA) bond features available on the Sun StorEdge NAS OS. In addition, it may also be used to configure a network interface card (NIC) failover.

Network interface bonding is a method of grouping multiple physical NIC's together to form a single logical NIC. NAS systems support bonding for two distinct environments; load sharing and redundancy.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Load sharing bonds are referred to as **port aggregation (PA)** bonds, or Fast EtherChannel. Redundancy bonds are known as high availability (HA) bonds. There can be a maximum of 4 bonds per filer head.

Port aggregation bonds are used for two different purposes. First, PA bonds can increase the effective network connection bandwidth and secondly, to provide one form of NIC fault tolerance in which the system can tolerate a NIC failure and still provide a path to the network. If a NIC fails, the connection will continue to operate on the remaining operational NIC's.

When establishing a bond, there are considerations to keep in mind. All NIC's in a PA bond must be connected to the same switch and both ends of the network connection must support this form of bonding. In other words, when a Fast EtherChannel NIC is connected to a switch the switch must support Fast EtherChannel technology. Additionally all of the member NIC's must participate in the sending and receiving of packets with each end, the switch and the NIC being responsible for performing load-balancing across the switch's configured ports. The NIC selection algorithm uses the destination IP address as part of the port selection criteria to ensure that all packets to the same host are sent via the same NIC. This will minimize out-of-order packets which can have a detrimental effect on network performance.

High Availability (HA) bonds provide fault tolerance through **NIC failover**. This is an active-passive configuration in which one NIC within the bond is active and handling network traffic while the remaining NIC's are passive backup devices. In the event that the active NIC fails, the system will automatically switch over to one of the backup NIC's in the bond. In this configuration no support is required from the switch and there is no single switch restriction. The member NIC's of an HA bond may be of disparate types and may be connected to different switches or hubs -- avoiding a single point of failure at the switch or hub.

Table 1 provides a comparison of the features of port aggregation (PA) and high availability (HA) bonds.

	<i>HA</i>	<i>PA</i>
Load sharing	No	Yes
Bandwidth scalability	No	Yes
Switch support required (i.e. Fast EtherChannel protocol)	No (any hub/switch)	Yes

Table 1 Bond feature comparison; at GA, one single-port MMF NIC and two on-board 10/100/1000 Ethernet ports provide all supported connectivity.

High Availability (HA) Bond

From an operational point of view, an HA bond works exactly like a single stand-alone NIC. Administration is performed on the master NIC within the bond but with the additional features that each type of bond provides. A bond can have up to 9 IP aliases as in a single stand-alone NIC. User administration tasks, such as changing an IP address, adding a netmask, and deleting aliases, etc., are done through the (master) bond itself and not on the slave NIC's.

Operation

When a bond NIC is configured the main NIC becomes the active NIC of the bond. All packets directed to the bond are sent and received through the active NIC. Once a HA bond is up and running, the link

status of the active NIC is periodically monitored. If the link status is down then the NIC is considered failed and a backup NIC with a “good” link status is selected and configured to be the active NIC of the bond.

The time it takes for a NIC failover process to complete is minimal. Fail over time is usually less than a few seconds and is dependent on the type of NIC's that are being used in the bond. For link media that supports speed negotiation such as the 'emc' and 'fxp' NIC, the driver takes a little longer to complete its initialization. Transmission latency introduced to the HA bond software is minimal since no complex decision needs to be made at transmission time. There is no additional latency on packet reception since incoming packets do not go through the bond software.

Recovery

A NIC recovery is performed thus switching the active NIC back to the main NIC. This usually is done to restore network traffic back to the main NIC which might be a higher bandwidth link (1000T) than the backup NIC (100T). The Telnet and WEB GUI are enhanced to support NIC recovery operations.

System Architecture

Overview

The StorEdge 5210 NAS Appliance can be mounted in industry-standard 19-inch equipment racks. A slide-rail/extension kit may be ordered with the filer; this slide-rail/extension kit allows you to mount each of these filers into a StorEdge Rack.

Hardware Components

The StorEdge 5210 NAS Appliance is 3.50 inches (87 mm) high, 16.93 inches (430 mm) wide and 25.51 inches (648 mm) deep. The airflow direction is from front to back and internal fans are included. I/O ports are located on both the front and rear panels. Informational LEDs are located on the front panel. Access to the two power connections is at the rear of the chassis.

Figure 9. StorEdge 5210 NAS Appliance front



Figure 10. Front LED & I/O detail (with bezel removed)

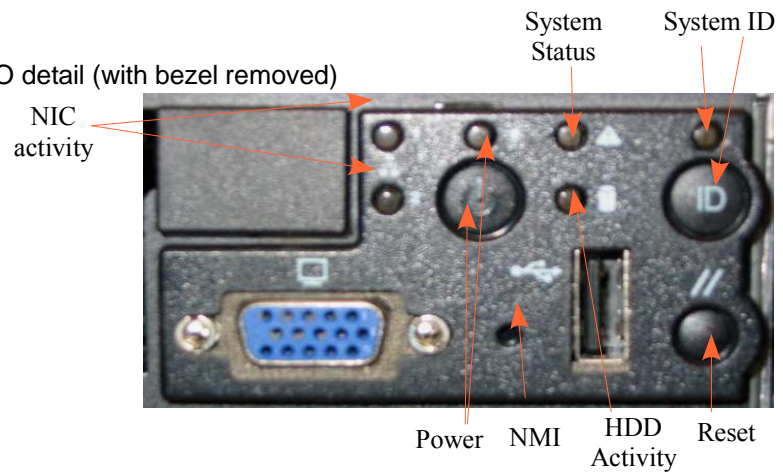


Figure 11. StorEdge 5210 NAS Appliance back

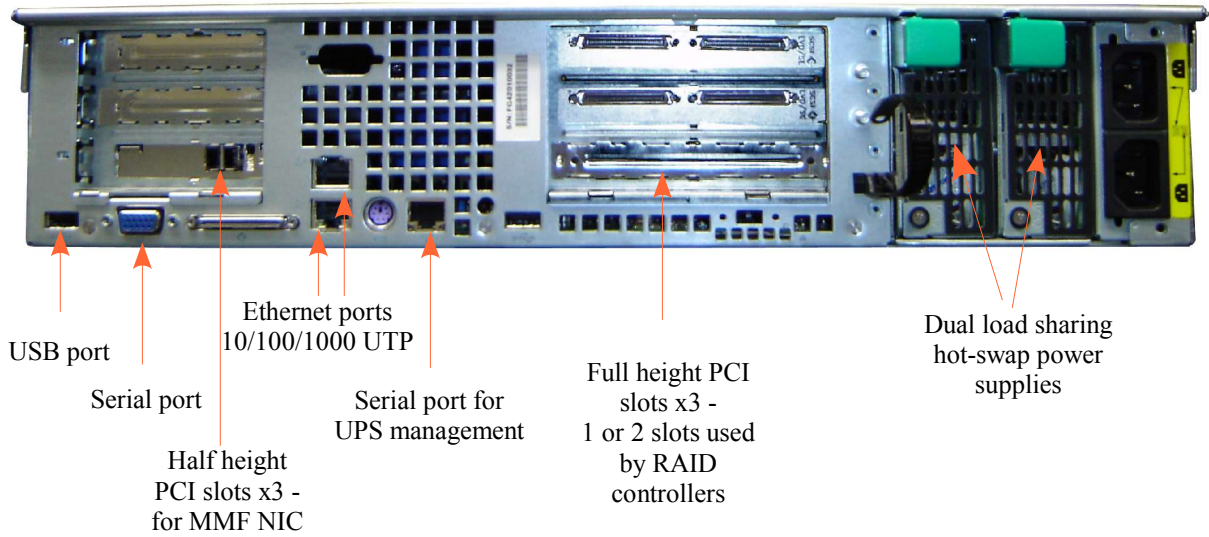


Figure 12. StorEdge 5210 NAS Appliance front – no bezel



Reliability, Availability and Serviceability (RAS)

Reliability

- Hardware RAID with error detection and correction capabilities
- Battery-backed RAID cache
- Flash-resident Operating System enhances reliability
- System monitoring and diagnostic of Sun StorEdge 5210 NAS Appliance (power supplies, fans – including the dedicated processor fan and temperature) and StorEdge 5210 Expansion Unit components. Informs the user should any problems be discovered, aiding in the reduction of downtime due to catastrophic failure
- ECC on data cache
- Error checking and correction on disk drives
- Spare cylinders and skip sectors on disk drives

Availability

- Dual hot-swappable redundant load-sharing/load-balancing auto-sensing 110V AC/240V AC power supplies with individual power cords
- Redundant cooling fans
- NIC Failover provides for a redundant path to the same IP address on the server through a different switch and using a cooperative (with the host) failover topology
- NIC Port Aggregation enables the use of the same IP address across multiple NIC ports from a single switch, increasing bandwidth and providing some degree of fault tolerance
- Journaling File system. guarantees file system integrity across unforeseen events such as power outages enhancing data availability by obviating the need for lengthy file system check operations subsequent to power outages or other unplanned events
- Sun StorEdge File Checkpoint “checkpoints” (also known as Snapshots), provide static images of the file system enabling rapid recovery of mistakenly deleted files or objects, and facilitating backup to tape
- Dynamic Volume Expansion provides the capability to add storage to a file system without system downtime, maintaining data availability
- UPS management port ensures the graceful shutdown of the StorEdge 5210 NAS Appliance in the event of an extended power outage.
- StorEdge File Replicator is an optional software application that allows mirroring, through a TCP/IP network, of Sun StorEdge NAS Appliance volumes from one StorEdge NAS Appliance to another StorEdge NAS Appliance anywhere in the world. It provides for business continuance (data availability) in the event of a catastrophic loss of the primary (source) system. When this occurs, the target may be promoted to source (master) and it takes over all the requests to the failed system.

Serviceability

- Drive Access to all drives is accomplished from the front panel
- Tool-less access facilitates maintenance by eliminating the need for tools when servicing the system (most components)

- Hot-swappable disk drives easily accessible from the front of the system
- Hot-swappable dual redundant hot-swappable power supplies easily accessible from the rear of the system
- Dual-boot OS enables the user to quickly and easily backtrack to a prior version of the OS should problems manifest during or subsequent to an OS upgrade operation
- Embedded system diagnostics tools enable Sun support representatives to quickly get a clear and comprehensive report describing the configuration and health of the system. It also enables support representatives to create packet capture sequences describing particular protocol errors, thereby empowering them to more quickly diagnose and service customer situations
- Fault indicator LEDs are present on the front and rear of the system to easily identify problematic components and prevent mistakes in servicing. A fault indicator LED stays on following a fault even if the system has been powered off (but is still connected to the power source)

Tape Backup and Restore

One of the primary goals of enterprise storage management is to back up and restore information in a timely, secure, and cost effective manner over enterprise wide operating systems.

Companies need high-performance backup and the ability to back up data to local media devices. While the data itself may be distributed throughout the enterprise, its cataloging and control must be centralized. The emergence of network-attached storage and dedicated file servers makes storage management more challenging.

Network Data Management Protocol (NDMP) recognizes that these issues must be addressed. NDMP is an opportunity to provide truly enterprise-wide heterogeneous storage management solutions - permitting platforms to be driven at a departmental level and backup at the enterprise level.

The Sun StorEdge 5210 NAS is supported in certain direct attach, 3-way, and “remote” back up configurations utilizing NDMP:

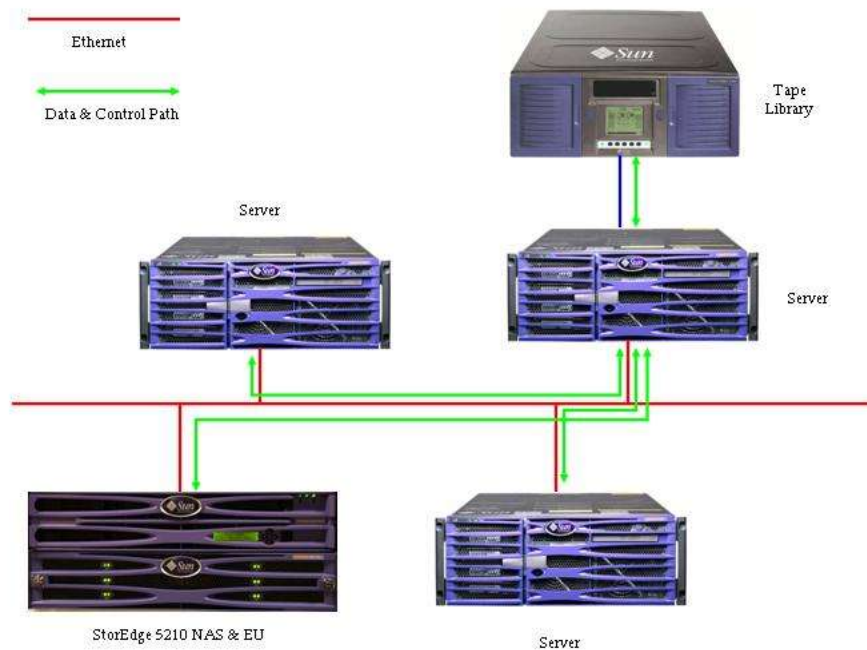


Figure 13. “Remote back up” configuration

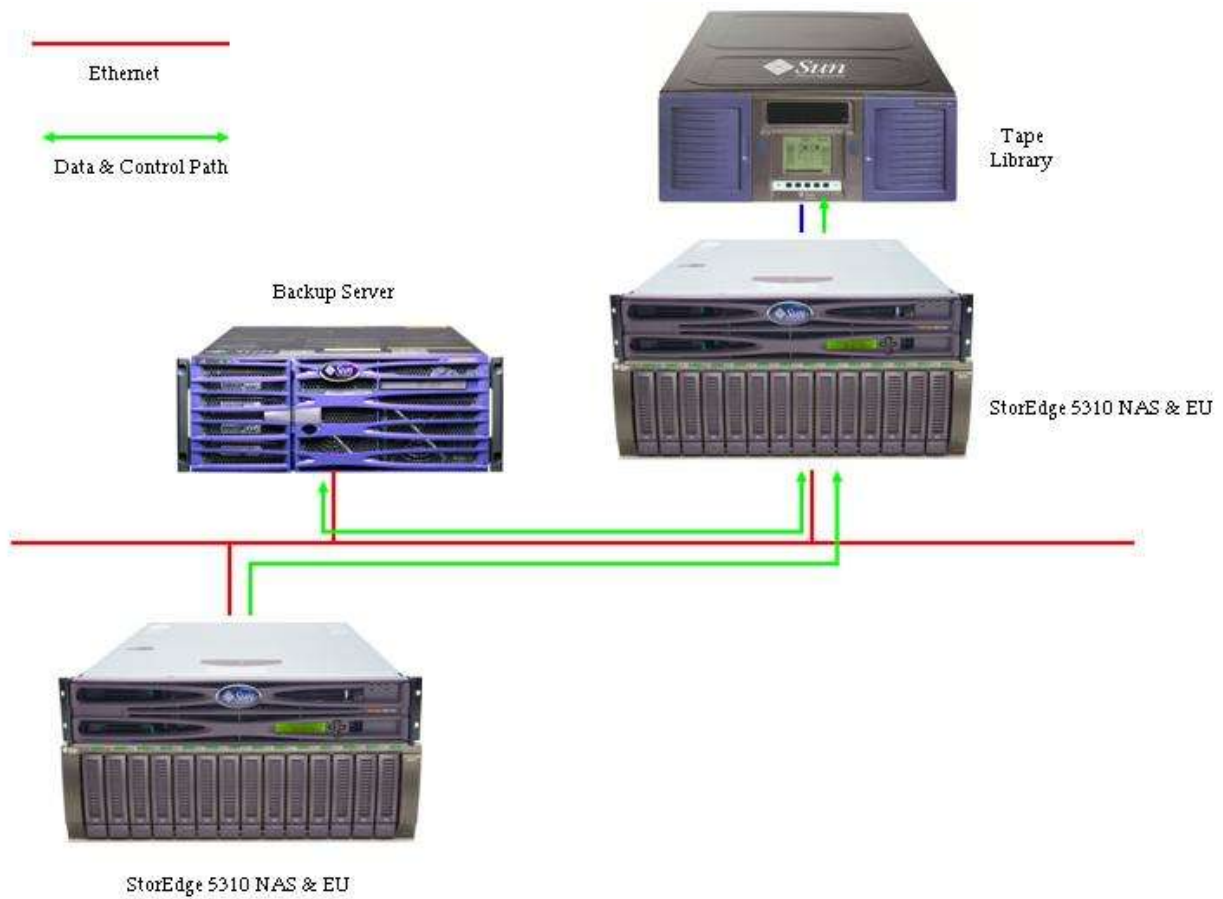


Figure 14. 3-way backup configuration

Please see the SE5x10 WWW (SunWIN/Partner Document Library #414203) for details regarding supported configurations, NDMP tiering, etc.

Server Management

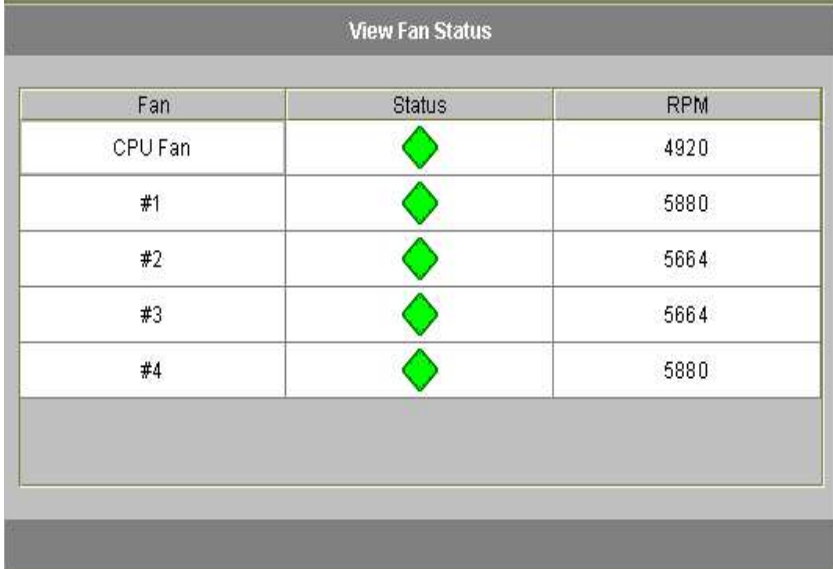
Management of the Sun StorEdge 5210 NAS Appliance is eased by the browser-based user interface with remote web administration for system monitoring from anywhere in the world. The following are protocols and tools that are used to provide system monitoring and management for the StorEdge 5210 NAS Appliance .

IPMI

The OS utilizes Intel's environmental protocol, IPMI (Intelligent Platform Management Interface), to manage and report hardware component statistics. It enables the system to monitor its own server components (power supplies, fans – including the dedicated processor fan and temperature) and inform the user should any problems be discovered, thereby preventing downtime due to catastrophic failure.

System Monitoring

Environmental statistics, such as **fan speeds, chassis temperatures, power, and voltage statuses** are easily viewed through a JAVA based GUI (Graphical User Interface). This offers the NAS administrator a clear, pictorial view of the integrity of the filer. From this color, graphical depiction of the environmental statuses, appropriate actions can be taken to correct approaching problems or feel confident in how the machine is running and functioning.



Fan	Status	RPM
CPU Fan	◆	4920
#1	◆	5880
#2	◆	5664
#3	◆	5664
#4	◆	5880

Figure 14. View Fan Status

Figure 15. Temperature status panel

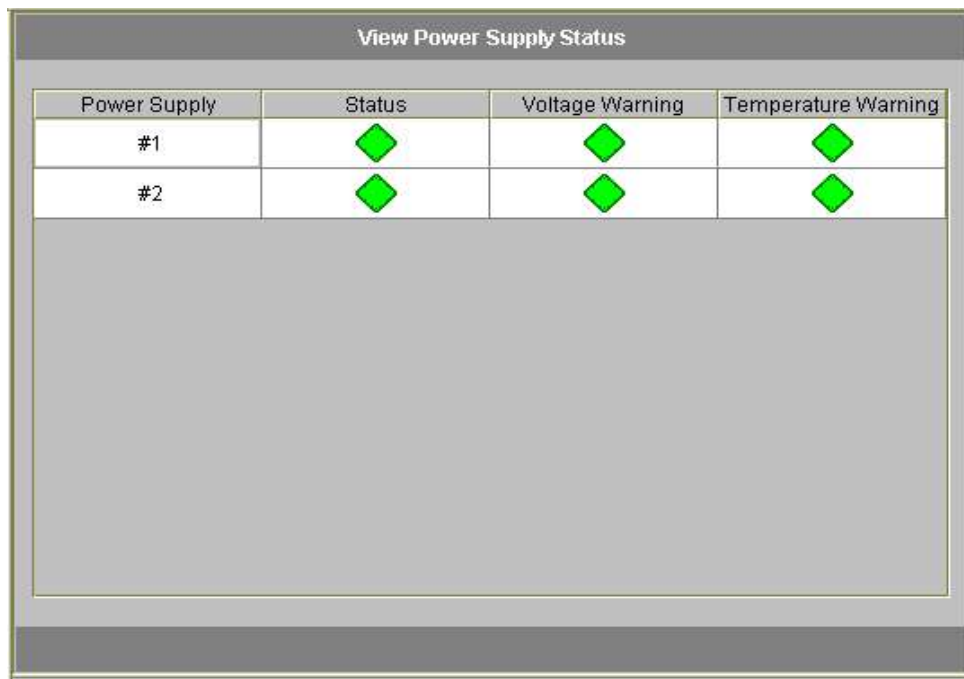
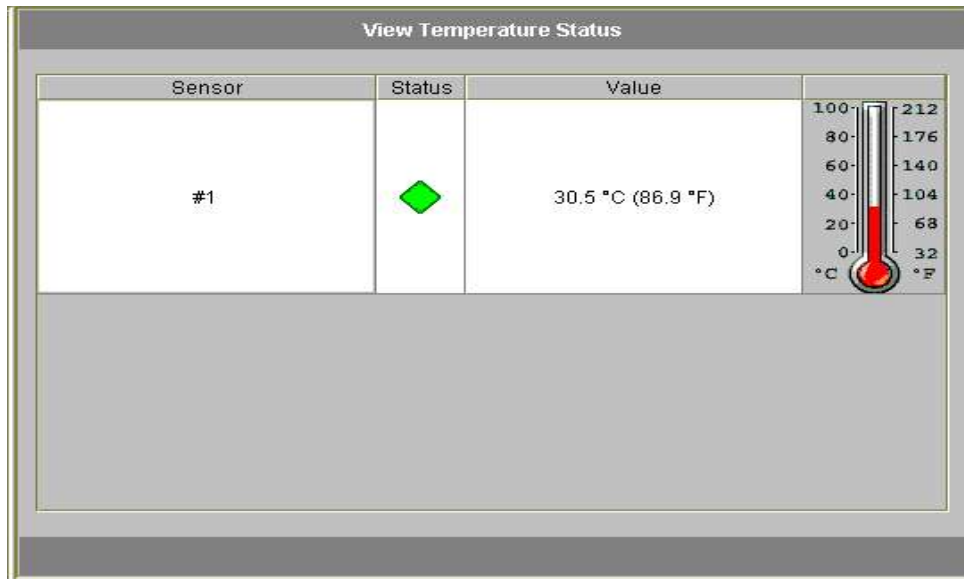


Figure 16. Power Supply status panel







View Voltage Regulator Status		
Voltage Regulator	Status	Current Value
+12V		12
+5V		5.25
+3.3		3.48
Standby		5.01
-5V		-5.07
-12V		-12.24

Figure 17. Voltage Regulator Status panel

SMTP

Using SMTP, an administrator can establish Email notification through a SMTP server. This information can contain either SMTP (Simple Mail Transfer Protocol) server name, as well as designate email notification recipients. In the event of a system error, StorEdge NAS OS will send a detailed email message to recipients via the SMTP server based off of a “Notification Level”. Effectively, the administrator will be notified if/when the filer encounters situations that have been predefined thus providing quicker and timelier attention to those situations.

This “Notification Level” is set system wide and determined when the recipient is added. One of three levels can be chosen:

- **Disk subsystem monitoring via SCSI Enclosure Services (SES):** Standards-based disk subsystem monitoring for enclosure, controller, power supply, fan and disk health.
- **Errors Only:** The server will notify recipients when the system detects errors but not warnings.
- **Errors and Warnings:** The server will notify recipients of all errors and warnings.
- **None:** Effectively disables the email notification option. StorEdge NAS OS will not send any notifications. If “NONE” is chosen as the option, the system should be configured for diagnostic emails at minimum to ensure that proper notification is not missed.

Recipient email addresses are displayed in the **List** box. Once an error has been detected, StorEdge NAS OS logs it in the system log file and sends an email notifications and warnings to the listed recipients as designated.

SNMP

Simple Network Management Protocol is an industry standard to monitor and manage diverse network devices. Supporting SNMP allows the administrator to establish “if/then” rules through SNMP compliant tools allowing faster resolution to adverse scenarios.

One simply enables SNMP by selecting the “Enable SNMP” checkbox in the SNMP administration window. Other attributes are:

- **Server SNMP Community:** SNMP community to which the StorEdge NAS belongs
- **Contact Info:** Name of the person who is responsible for this StorEdge NAS
- **System Location:** The network location which can be logical or physical
- **Destination IP Address:** The TCP/IP address for the server you wish to designate as an SNMP trap destination in the event of system errors
- **Port #:** Port to which StorEdge NAS will send traps
- **Version:** SNMP protocol version (1 or 2)
- **Community:** Community string for the trap destination

Telnet

A Telnet session offers two distinct realms of functionality. The first is an administrative, “green screen” window into the StorEdge NAS OS. From this interface an administrator, security permitting, has the ability to manage all operating functions of the NAS device. As with the GUI, the administrator can alter operational characteristics, configuration parameters, or access controls in a menu driven format.

Secondly, Telnet access allows an administrator, via a secure format, to access a CLI (Command Line Interface). From the CLI, the administrator may issue UNIX style commands furthering operational alterations to the StorEdge NAS OS. Standard MAN and HELP functions detail commands furthering the ease-of-use message.

LCD Keypad

The StorEdge 5210 NAS Appliance offers an LCD interface on the front of the unit. The LCD provides a local reference point enabling an administrator to get a "picture" of the overall system health. From the LCD, an administrator has the ability to dynamically set network accesses by setting the GATEWAY, IP address, SUBNET, and NETMASK. The Administrator can also perform system shutdowns and restarts from this panel. Utilizing the "Left/Right" and "Up/Down" arrows, and the "Select" "Exit" buttons, navigating the panel options is made as simple as possible for a NAS administrator.

Syslog/Remote Syslog

Further expanding an administrator's ability to track system activity, a log may be generated and stored locally. Or, the Network System Logger, SYSLOGD, may be enabled. In either instance, storing logs locally or remotely, the administrator can capture a combination of eight (8) different types of messages: emergency, alert, critical, error, warning, notice, info, and/or debug.

If the administrator requires granularity when enabling SYSLOGD, a Facility Value can be identified. Following is a list of Facility Values that the administrator can choose from:

- **Kern:** Messages generated by the kernel
- **User:** Messages generated by random user processes
- **Mail:** The mail system
- **Daemon:** System or network daemons
- **Auth:** Authorization systems such as "LOGIN"
- **Syslog:** Messages generated internally by SYSLOGD
- **LPR:** Line printer spooling system
- **News:** Reserved for USENET network news system
- **Uucp:** Reserved for UUCP system
- **Local0 – Local7:** Reserved for local use

Sun StorEdge 5210 NAS Appliance Specifications

Processors

Processor	One 3.06GHz Intel Xeon processor
Cache	512-KB Level 2

Memory

6 DIMM slots, registered DDR-266 ECC SDRAM
System supports 4 GB

Standard/Integrated Interfaces

Network	Two 10/100/1000BaseT Ethernet ports
Serial	One RJ-45 serial port
SCSI	One Ultra320SCSI multimode (SE/LVD)
Expansion bus	Two internal PCI-X 64bit/100MHz

Mass Storage

Internal Disks	<ul style="list-style-type: none"> Six Ultra-160 SCSI 146GB 10K HDDs One 4+1 RAID group and one hot spare
External Disk	<ul style="list-style-type: none"> Up to 3 Sun StorEdge 5210 Expansion Units, supports 12 x 146GB HDDs One 10+1 RAID group and one hot spare per StorEdge 5210 Expansion Unit

Power Supply

Equipped with two power supplies. Second is for redundancy	
Maximum DC output	500W

Environment

AC Power	100-240 V, 50/60Hz, 500W
Operating Temperature	<p>10° C to 35° C (50° F to 95° F) (<i>stand-alone server</i>)</p> <p>10° C to 30° C (50° F to 86° F) (<i>in a rack-environment at sea level</i>)</p> <p>* Subtract 1° C from the maximum temperature for every 500-meter increase in altitude. (Tested to 3000m at 24° C [75.2° F])</p> <p>10% to 90% relative humidity, at 27° C max, wet bulb (noncondensing)</p>
Non-operating Temperature	-40° C to 65° C (-40° F to 149° F), up to 93% relative humidity, noncondensing
Altitude (operating)	<p>10° C to 30° C (50° F to 86° F) (<i>stand-alone server for all altitudes</i>)</p> <p>10° C to 25° C (50° F to 77° F) (<i>in a rack-environment at sea level</i>)</p> <p>* Subtract 1° C from the maximum temperature for every 500-meter increase in altitude. (Tested to 3000m at 19° C [66.2° F])</p>
Altitude (non-operating)	Up to 12000 m

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Regulations

Meets or exceeds the following requirements:	
Safety	IEC60950, UL/CSA60950, EN60950
RFI/EMI	FCC Class A, Part 15 47 CFR, EN55022, CISPR 22
Immunity	EN55024
Certifications Safety EMC	cULus Mark, TUV GS Mark, CE Mark CE Mark (93/68/EEC), FCC authorized Class A, VCCI, BSMI, CTICK

Dimensions and Weight

Chassis	
<ul style="list-style-type: none"> • Height • Width • Depth • Weight 	3.50 in. (87 mm) 16.93 in. (430 mm) 25.51 in. (648 mm) 62 lb. (28.1 kg)
Enclosure	Fits into a standard 19-inch wide rack

Software/Operating System

Feature	Specifications
Operating System	Storage-optimized Operating System
File System	<ul style="list-style-type: none"> • 64-bit Journaling File system. • 16TB per file system; up to 512 file systems • Sun StorEdge File Checkpoint “checkpoints” • Online extensible/expandable capacity • NTFS streams support • Quotas: user, group and directory tree • Unicode
File Access Protocols	CIFS/SMB, NetBIOS, NFS v2 and v3, FTP
Directory and Name Services	AD (LDAP, Kerberos v5), NT 4.0 Multiple Master Domains (MMD), DNS, WINS, NIS, NIS+, Local files
Network Services	<ul style="list-style-type: none"> • DHCP • NTP • RDATE • Network Status Monitor

Feature	Specifications
Access Control	<ul style="list-style-type: none"> • NT4.0 Access Control Lists and Access Tokens • UNIX credentials and permissions • Credential mapping • Directory tree quotas • User and Group Quotas • Sun StorEdge File Checkpoint “checkpoints” • SMB/CIFS Shares • UNIX exports • Approve lists, trusted host lists, netgroups • Cross-platform file locking (limitations) • Cross-platform authentication
Supported clients	A client is any computer on the network that requests file services from the StorEdge 5210 NAS Appliance. In general, if a client implementation follows the NFS version 2 or 3 protocol or the CIFS specifications, it should work with and is supported in the StorEdge 5210 NAS Appliance.
Remote Management	<ul style="list-style-type: none"> • SNMP • Remote Syslog
System Administration	<ul style="list-style-type: none"> • Web (HTTP/Java based) GUI • Telnet • Rlogin • Rsh • SSH • Console Command Line Interface (CLI)
Mail Services	SMTP
System Monitoring	<ul style="list-style-type: none"> • Disk subsystem via SCSI Enclosure Services (SES) • Fans, power supplies, temperature, voltages via IPMI protocol • UPS • Network monitor
Tape Backup	<ul style="list-style-type: none"> • NDMP v2 and v3 • Backup with full Unicode • “Remote backup” and direct attach/3-way configurations supported w/NDMP
Setup and Configuration	Web-based GUI
RAID Manager	Integrated through Web-based GUI

Sun StorEdge 5210 EU Specifications

Physical Specifications

Description	
Height	3.45 inches
Width	17.56 inches (body)
Depth <ul style="list-style-type: none"> • Main chassis • Chassis with fan modules • Chassis with fan modules and handles 	18.0 inches 20.0 inches 21.0 inches
Weight (fully loaded with 12 drives)	53.25 lb.

Environmental Specifications

Feature	Specifications
Temperature	
Operating	-5°C to 50°C (short term, 96 hours) Standalone = 5°C to 40°C (continuous) Rack = 5°C to 35°C (continuous) MIL-STD-810F <ul style="list-style-type: none"> • High Temperature, Method 501.4 (+49°C, 16 Hr dwell) • Low Temperature, Method 502.4 (-10°C, 16 Hr dwell)
Nonoperating	-40°C to 65°C MIL-STD-810F <ul style="list-style-type: none"> • High Temperature, Method 501.4 (+71°C, 16 Hr dwell) • Low Temperature, Method 502.4 (-40°C, 16 Hr dwell)
Stock	55°C, 80% RH @ 5 hours -10°C @ 10 hours 20°C, 10% RH @ 5 hours
Cold Starts	5 times powered on at 2°C MIL-STD-810F Low Temperature, Method 502.4 (Exploratory, with 2 Hr dwell at each level and the start-up at: 5°C, 0°C, -5°C, -10°C)
Humidity	

Feature	Specifications
Operating	10 to 90% RH, 38°C max. (noncondensing) MIL-STD-810F, using Method 507.4, 5 cycles total Cycle description <ul style="list-style-type: none"> • 95% RH @ 60°C, 16Hr, nonoperating • 95% RH @ 30°C, 22 Hr • 4 Hr Op • 95% RH @ 20°C, 6 Hr, nonoperating • 95% RH @ 30°C, 5 Hr • 4 Hr Op
Nonoperating	0% to 93% RH, 27°C max. (non-condensing) MIL-STD-810F, using Method 507.4, 5 cycles total Cycle description <ul style="list-style-type: none"> • 95% RH @ 60C, 16Hr, nonoperating • 95% RH @ 30°C, 22 Hr • 4Hr Op • 95% RH @ 20°C, 6 Hr nonoperating • 95% RH @ 30°C, 5 Hr • 4 Hr Op
Altitude	
Operating	70 kPa (approx. 3,000 meters) @ 40°C, standalone 70 kPa (approx. 3,000 meters) @ 35°C, rack MIL-STD-810F, using Method 500.4 15,000 ft @ 40°C
Nonoperating	19.3 kPa (approx. 12,000 meters) 0°C MIL-STD-810F, using Method 500.4 40,000 ft @ ambient temperature
Shock	
Operating	5.0 g's, 11ms, half-sine (x, y, and z axis) MIL-STD-810F, Method 516.5, Procedure I, Figure 516.5-10 3 Pulses at 5 g's 3 pulses at 14 g's 3 pulses at 20 g's (positive Saw Tooth) 3 pulses at 20 g's (negative Saw Tooth)
Nonoperating	15 g's, 11ms, half sine (x, y, and z axis) MIL-STD-810F, Method 516.5, Procedure I, Figure 516.5-10 3 Pulses at 5 g's 3 pulses at 14 g's 3 pulses at 20 g's (positive Saw Tooth) 3 pulses at 20 g's (negative Saw Tooth) MIL-STD-810F, Bench Handling, Method 516.5, Procedure VI
Vibration	
Operating	Standalone = 0.20 g's, 5 Hz to 500 Hz to 5 Hz, swept-sine (5 sweeps in x, y, and z axis) Rack = 0.15 g's vertical and 0.1 g's horizontal, 5 Hz to 500 Hz, swept-sine MIL-STD-810F, Method 514.5, Category 21 (Watercraft – marine vehicles) 2 Hr random from 1 Hz to 100 Hz, with up to 0.0010g ²

Feature	Specifications
Nonoperating	Standalone = 1.0 g's, 5 Hz to 500 Hz to 5 Hz, swept-sine (5 sweeps in x, y, and z axis) Rack = 0.5 g's vertical and 0.25 g's horizontal, 1.0 Octaves per minute, 5 Hz to 500 Hz, swept-sine MIL-STD-810F, Method 514.5, Category 4 (Truck/trailer/tracked – restrained cargo) Vertical Axis: 1.04 g-rms Transverse Axis: 0.204 g-rms Longitudinal Axis: 0.704 g-rms
Inclination	15 degrees, 4 tests off the XY-plane

Compliance

Standard	Specifications
Safety	
IEC 60950 (C22.2-60950) (EN60950) (UL60950)	CUL Notice of Authorization
EMC and Safety	Telcordia GR-1089-CORE test report
Emissions and Immunities	
RF Radiated Emissions	CISPR22 (EN55022), Class B – European Union FCC Part 15, Class B – USA, Industry of Canada
Conducted Emissions	CISPR22 (EN55022), Class B – European Union FCC Part 15, Class B – USA, Industry of Canada
Harmonic Emissions	IEC 61000-3-2:2000 (No Limits) – European Union
Voltage Flicker	IEC 61000-3-3:1995/A1:2001 (No Limits)
ESD Immunity	CISPR 24 (EN55024; 8kV Contact, 15kV Air) IEC 61000-4-2
RF Field Immunity	CISPR 24 (EN55024, 10V/m) IEC 61000-4-3
Electrical Fast Transient/Burst Immunity	CISPR 24 (EN55024; 1kV I/O, 2kV Power) IEC 61000-4-5
Surge Immunity	CISPR 24 (EN55024; 1kV I/O, 1kV Power L-L, 2kV Power L-G) IEC 61000-4-5
RF Conducted Immunity	CISPR 24 (EN55024; 3V I/O and Power) IEC 61000-4-6
Power Frequency Magnetic Field Immunity	CISPR 24 (EN55024) IEC 61000-4-8
Voltage Dip and Interruption	CISPR 24 (EN55024; 0v/0.5cycle, 70% V/0.5sec, 0V/5sec)
Voltage Dips/Short Interruptions/Voltage Variation Immunity	IEC 61000-4-11
NEBS Compliance (Environmental and Physical)	Telcordia GR-63-CORE, Level 3 (No margin requirement) (Telco, -48VDC Only) GR-1089-CORE
ETSI (Environmental and Emissions)	EN 300 386

Standard	Specifications
MIL-STD-810F	Method 500.4 Altitude Method 501.4.High Temperature Method 502.4.Low Temperature Method 507.4.Humidity Method 509.4.Salt Fog Method 514.5.Category 4 Transportation Vibration Method 514.5.Category 21 Watercraft Vehicle Method 516.5.Functional Shock (15G.s operational) Method 516.5.Bench Handling
Acoustic Noise	ISO 7779:1988

Product Safety by Country

Country	Standard
U.S.	UL Listed to UL60950:2000, 3rd Edition
Canada	CSA Standard CAN/CSA-C22.2 No. 60950-00 3rd Edition
Germany	TUV
European Union	EN60950:2000
Japan	Part of World-wide CB Scheme
Australia	Part of World-wide CB Scheme
Argentina	Resolution 92-98 (S-Mark)
Germany	GS mark (ergonomics)(Rheinland)

Electromagnetic Compatibility/Interference by Country

Country	Standard
U.S.	FCC #47, Part 15, Subpart B, Class A (standalone minimum)
Canada	ICES-003
Japan	VCCI Class A
European Union	EN 55022:1998 Class A (standalone minimum)
Australia/New Zealand	AS/NZS 3548:1996
Taiwan	BSMI CNS 13438 Class A (Standalone minimum)
Germany	Same as European Union
Argentina	S mark

Requirements and Configuration

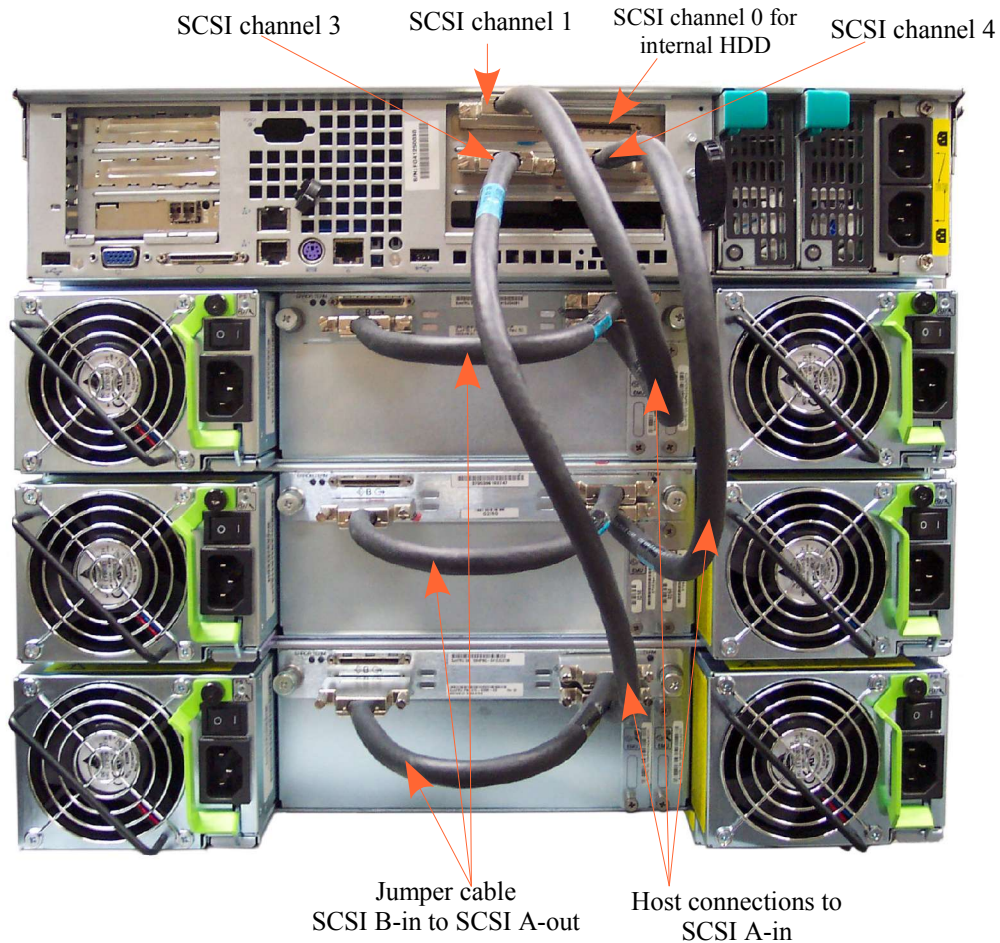


Fig. 18 Rear of StorEdge 5210 NAS Appliance (top) and StorEdge 5210 Expansion Units (bottom)

Note: Channel 0 of the 1st RAID controller card is used for the internal disks of the StorEdge 5210 NAS Appliance. Therefore this channel is not available for external use. Only one SCSI channel is available for the attachment of the StorEdge 5210 Expansion Unit – channel 1

Client Operating System Support

A client is any computer on the network that requests file services from the StorEdge 5210 NAS Appliance. In general, if a client implementation follows the NFS version 2 or 3 protocol or the CIFS specifications, it should work with and is supported with the StorEdge 5210 NAS Appliance.

Software Support Matrix

<i>Category</i>	<i>Vendor</i>	<i>Application</i>	<i>Operating System</i>
Database	Oracle	9i release 2	Solaris 9
Productivity	Sun	StarOffice 7 and later	Solaris 8 and later, Windows NT 4.0 (with SP 6), 2000 (with SP2 or latest), 2003 (with latest SP), XP (with latest SP)
	Microsoft	Office 2000 and later	Windows NT 4.0 (with SP 6), 2000 (with SP2 or latest), 2003 (with latest SP), XP (with latest SP)
	Adobe	Acrobat Suite	Solaris 8 and later, Windows NT 4.0 (with SP 6), 2000 (with SP2 or latest), 2003 (with latest SP), XP (with latest SP)
Backup	VERITAS ¹	NetBackup™ Server 5.x and later with NDMP option	Solaris 8 and later

1. Veritas NetBackup 5.x with NDMP option only supported in a “remote configuration”. Support for other backup configurations and backup applications is scheduled for a future announcement. For additional information on Veritas NetBackup with NDMP see the “Veritas NetBackup for NDMP System Admin Guide” on <http://support.veritas.com>

Peripherals Support Matrix

<i>Category</i>	<i>Description</i>
Cables	Used for connecting the StorEdge 5210 EU to the StorEdge 5210 NAS ² . All cables are SCSI VHDCI/VHDCI. Part numbers: <ul style="list-style-type: none"> • X1136A 0.8m • X1137A 1.2m • X1138A 2m • X3830B 4m • X3831B 10m
Rack	Sun StorEdge cabinet SG-XARY030A
Rackmount Kit	StorEdge 5210 NAS Appliance: XTA-5200-2URK-19U
	StorEdge 5210 Expansion Unit: XTA-3000-2URK-19U
Power cords	Power cord appropriate for installation requirements to be ordered as an x-option.

2. The StorEdge 5210 Expansion Unit ships with a 1 foot jumper and 1.5 foot host connection SCSI VHDCI/VHDCI cables. Longer cables may be ordered as x-options if required.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Expansion

The StorEdge 5210 NAS Appliance supports the following expansion feature:

- Up to three StorEdge 5210 Expansion Units
 - Requires 2 PCI RAID controllers in the StorEdge 5210 NAS Appliance

Please consult the “What Works With What” for the most current information on support.

Ordering Information

Ordering Notes

- All StorEdge 5210 NAS Appliance and StorEdge 5210 Expansion Units ship with documentation on CD. There is no hardcopy documentation with the exception of the “Quick Start Guide” and the “Safety and Compliance Guide”.
- The StorEdge 5210 NAS Appliance and StorEdge 5210 Expansion Unit ship with dual power supplies standard. Appropriate power cords are to be ordered.
- The StorEdge 5210 NAS Appliance and StorEdge 5210 Expansion Unit are rack ready and do not include rack mount kits – to be ordered separately.
 - XTA-5200-2URK-19U for the StorEdge 5210 NAS Appliance
 - XTA-3000-2URK-19U for the StorEdge 5210 Expansion Unit
- StorEdge 5210 Expansion Units ship with two VHDCI/VHDCI SCSI cables: a 1' jumper and a 1½' host connection cable for attachment to the StorEdge 5210 NAS Appliance. Longer SCSI cables may be ordered as detailed in the Ordering Flowchart in the World Wide Configuration Guide.
- Maximum of 3 StorEdge 5210 Expansion Units per StorEdge 5210 NAS Appliance (StorEdge 5210 NAS Appliance must have 2 RAID controller cards).
- One StorEdge File Replicator license required for each StorEdge NAS Appliance used for data replication. This means at least 2 StorEdge File Replicator licenses must be ordered to implement data replication. See the Q&A section for more detail.
- All StorEdge 5210 pricing is category “P”.

Part Number Format Description

The basic system configuration can be determined from the components of each part number. Here is an example part number, with each component explained.

Example: XTA5210R11A1NU876

- X: x-option
- T: Sun StorEdge product designator
- A: Number of CPU's
 - A=1
 - B=2, etc.
- 5210: Product model number
- R: Rack Ready
- 11: Array Group – number of controller and storage trays
 - 01 = Expansion Unit, 1 storage tray
 - 11 = NAS head, controller + storage (6 x 146GB HDD's)
- Input power
 - A = AC
 - D = DC
- 1: Number of RAID controllers per tray
- N: NIC options
 - - = None
 - G = (2) 10/100/1000 UTP Ethernet ports
 - N = (1) single-port MMF 10/100/1000 NIC + (2) UTP 10/100/1000 ports
 - M = (1) dual-port MMF 10/100/1000 NIC + (2) UTP 10/100/1000 ports
- U = drive type
 - U = 146GB 10k RPM
- 876 = Raw capacity in GB

Sun StorEdge 5210 NAS Part Numbers

<i>Part Number</i>	<i>Description</i>
XTA5210R11A1GU876	Sun StorEdge 5210 NAS Rack Ready Appliance; 1x3.06GHz CPU, 4GB Memory (4x1GB DIMMs), 2x10/100/1000 Ethernet Ports, Internal RAID card, 6x146GB 10k RPM Ultra320 SCSI disk, 2-Internal AC Power Supplies
XTA5210R11A1NU876	Sun StorEdge 5210 NAS Rack Ready Appliance; 1x3.06GHz CPU, 4GB Memory (4x1GB DIMMs), 2x10/100/1000 Ethernet Ports, 1x10/100/1000 MMF Ethernet Port, Internal RAID card, 6x146GB 10k RPM SCSI disk, 2-Internal AC Power Supplies
XTA5210R11A1MU876	Sun StorEdge 5210 NAS Rack Ready Appliance; 1x3.06GHz CPU, 4GB Memory (4x1GB DIMMs), 2x10/100/1000 Ethernet Ports, 2x10/100/1000 MMF Ethernet Port, Internal RAID card, 6x146GB 10k RPM SCSI disk, 2-Internal AC Power Supplies
XTA5210R11A2GU876	Sun StorEdge 5210 NAS Rack Ready Appliance; 1x3.06GHz CPU, 4GB Memory (4x1GB DIMMs), 2x10/100/1000 Ethernet Ports, 2 internal RAID cards, 6x146GB 10k RPM SCSI disk, 2-Internal AC Power Supplies

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



<i>Part Number</i>	<i>Description</i>
XTA5210R11A2MU876	Sun StorEdge 5210 NAS Rack Ready Appliance; 1x3.06GHz CPU, 4GB Memory (4x1GB DIMMs), 2x10/100/1000 Ethernet Ports, 2x10/100/1000 MMF Ethernet Port, 2 internal RAID cards, 6x146GB 10k RPM SCSI disk, 2-Internal AC Power Supplies
XTA5210R01A0-U1752	Sun StorEdge 5210 Storage Expansion Unit; 12x146GB 10k RPM Ultra160 SCSI disks
SFR29-LCO-W929	Sun StorEdge File Replicator (remote replication); License Only; 1 per StorEdge 5200 NAS filer
SFR29-LCO-WD29	Sun StorEdge File Replicator (remote replication); License Only; 1 per StorEdge 5200 NAS filer; 90-day eval license. Eval period begins on day of purchase.

Warranty, Service and Support

Warranty

The Sun StorEdge 5210 comes with a two year warranty. Year one provides next business day on-site support and year two provides 15 day Parts Return support.

Sun Spectrum Instant Upgrades

Warranty coverage can be upgraded to standard Silver, Gold, 7x24 Gold or Platinum coverage utilizing Sun Spectrum Instant Upgrades. Sun Spectrum Instant Upgrades allow you to obtain the coverage that best supports your business environment through a variety of service levels including phone and on-site response times, escalation options, event monitoring, account management and skills assessments. Sun Spectrum Instant Upgrades also allow you to maintain consistent support levels in your IT environment with the ability to maintain all your Sun products at the same service level.

Enterprise Installation Service

Installation and configuration of the Sun StorEdge 5210 including installation planning, site audit, acceptance testing and system turnover. The scope of the installation for the SE5210 is expected to get the SE5210 to a basic level of functionality including:

- Planning the Installation
- Installing the SE5210 NAS Server and SE5210 Storage Expansion Unit
- Powering on the System Locally
- Connecting the Grounding Cable
- Connecting the Power Cables
- Establishing a Serial Connection
- Establishing Initial Configuration for one LUN
- Setting and Verifying Default Configuration

Knowledge Services

EA-111 Sun Spectrum Education Account

Help your customers stay ahead of constantly changing technologies by investing in their enterprise's most important asset -- people.

Thousands of students each year are trained by Sun and its authorized centers through Web-based courses and at training sites located in more than 60 countries.

Sun Education's historical business manages a portfolio of IT curriculum focused on Sun technology sold and delivered to Sun external audiences in classroom, CD-ROM, and web formats.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Professional Services

Storage Migration Service - This service can help customers safely transfer data from one storage system to another storage system, without pulling their internal resources from other critical business tasks.

Sun Professional Services can offer multiple levels of consulting services to ensure a smooth data migration from the existing storage to the SE5210. Sun Professional Services offers a wide range of data management and migration services to accommodate most customer environments and circumstances. Contact local Sun Professional Services for further details and quotation for the specific customer environment.

External - <http://www.sun.com/service/sunps/index.html>

Internal - <http://mymarketing.central/>

Glossary

1U	One rack unit as defined by the Electronic Industries Alliances (EIA). A vertical measurement equal to 1.75 inches.
2U	Two rack units; a vertical measurement equal to 3.5 inches.
AC	Alternating Current.
Access Control	Limits user access to resources on a computer network, most commonly by requiring a user name and password. Usually a single logon is sufficient to authenticate, or verify, a user.
Access Rights	Permissions granted to user accounts to allow access to such system resources as file systems, applications, and directories. For example, read-only access allows a user to open or list a file without being able to make changes to the file. Users who are granted access rights to a directory usually have the same access rights to all subdirectories.
AD	Short for Active Directory Service. AD is a Windows 2000 namespace that is integrated with the Domain Name System (DNS). AD stores domain information such as users, groups, and shared resources and makes that information available to Active Directory clients.
Alias IP Address	Multiple IP addresses assigned to a single port, in addition to the primary IP address. All IP aliases for a port must be on the same physical network and share the same netmask and broadcast address as the first or primary IP address.
Authentication	The process of validating that the user attempting to logon is truly the owner of the account.
Autohome Shares	Temporary SMB/CIFS shares that are created when a user logs on to the system and removed when the user logs off.
Block or Block Size	Also known as stripe unit size, block size is 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 as well as the size of the data unit being "striped" across disks.
Boot Up	The process of starting a computer. Booting up involves checking all hardware components, initializing system components, and loading the operating system.
Browser	Software used for access to information on the World Wide Web. Microsoft Internet Explorer and Netscape Navigator are examples of browsers. See also Web Browser.
Cache	Cache is the DRAM based staging area used to provide higher performance to applications for reads and writes. During reads, the RAID controller tries to keep the latest and most often accessed data in the cache and also tries to pre-stage the cache with future data during sequential accesses. For writes, cache is used to provide delayed writes to the drives. This delays the parity calculations and drive writes during RAID 5 operations. More optimization and advanced staging algorithms thus provide better performance.
Checkpoint	A point-in-time image of a StorEdge NAS file system taken at the volume level. While the active file volume can be modified with read/write operations, a virtual volume produced at the time of checkpoint creation remains available in a static, read-only state.
CIFS	Stands for Common Internet File System. An enhanced version of the SMB file-sharing protocol that allows groups of users to work together and share documents over the Internet in the same way as in local area networks.
Density	Number of units in a given amount of space.

DHCP	Stands for Dynamic Host Configuration Protocol. DHCP provides a mechanism by which a computer can acquire an IP address automatically when it connects to the network. DHCP allows more flexible and efficient use of network resources than static IP addresses.
DNS	Short for Domain Name System. A network service that translates domain names into IP addresses. If you have multiple DNS servers on your network, and one DNS server can't translate a domain name, it asks another one, and so on, until the IP address is found. See also Domain Name System.
Domain	A group of computers and devices on a network that are administered as a unit with common rules and procedures.
Domain Name	A name that identifies a domain. See also Domain. The domain name can be the company name, division name, facility name, department name, or other descriptive name.
Domain Name System	The network server that maintains the list of all host names in a domain. StorEdge NAS OS uses the name server to translate domain names to the corresponding IP address. See also DNS.
DTQ	Stands for Directory Tree Quota. A directory tree quota is a quota, or limit, to the space or the number of files that a directory tree (a directory and its subdirectories) can occupy.
Ecache	External cache. Memory cache external to the CPU chip, also referred to as L2 cache.
ECC	Error Correcting Code. A type of memory that corrects errors on the fly.
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.
Ethernet	A network communication system developed and standardized by DEC, Intel, and Xerox using baseband transmission, CSMA/CD access, logical bus topology, and coaxial cable. The successor IEEE 802.3 standard provides for integration into the OSI model and extends the physical layer and media with repeaters and implementations that operate on fiber optics, broadband, and unshielded twisted pair.
Ethernet 10/100/1000BaseT	The most widely used LAN access method defined by the IEEE 802.3 standard; uses standard RJ-45 connectors and telephone wire. 100BaseT is also referred to as Fast Ethernet. 1000BaseT is also referred to as Gigabit Ethernet.
Field Replaceable Unit	A component which can be removed and replaced during service in the field.
File Sharing	A feature that allows users of networked computers to make files available to other users.
File Volume	File systems created from partitions that have available space. If the file volume does not use up all the available space in a partition, the remaining space is automatically allocated into the next partition. See also Partition.
File Volume Extension	See Segment.
Filer	A Network Attached Storage device focused solely on file service and file storage
FRU	Field Replaceable Unit.
FTP	File Transfer Protocol. A client-server protocol which allows a user on one computer to transfer files to and from another computer over a TCP/IP network. Also the client program the user executes to transfer files. It is defined in STD 9 , RFC 959 .
General-purpose Server	A server designed to perform any type(s) of function(s). General-purpose servers typically require skilled IT professionals and system administrators to maintain them.
Gigabit Ethernet	An Ethernet standard that enables data transfer rates of up to 1 Gbps running over optical fiber cable.
GUI	Stands for Graphical User Interface. A GUI uses graphical elements to present information to a computer user rather than the traditional text-only command line interface still found in telnet and similar implementations.

HBA	Host bus adapter.
Host ID	The unique identifier assigned to the host computer.
Hot-spare	A drive used by the RAID controller to replace a failed drive. 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 feature that allows an administrator to remove and/or replace a device without affecting software integrity. This means that, while the system does not need to be rebooted, the new component is not automatically recognized by the system.
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 automatically recognizes the component change and configures itself as necessary.
HTTP	Stands for Hyper-text Transmission Protocol. A protocol for exchanging HTML pages and forms.
I/O	Input/output. Transferring data between the CPU and any peripherals.
IP Address	A unique 32-bit value that identifies network hosts using TCP/IP. An IP address, or a block of addresses, is assigned upon application to organizations responsible for that function. No two network hosts can be assigned the same IP address. Each address consists of a network number, optional subnetwork number, and host number, written as four numbers separated by periods. Each number can be 0 to 255. See also <i>Address</i> and <i>URL</i> .
ISV	Independent software vendor.
Java	Java is a programming language developed by Sun Microsystems to be portable to any type of computing device. In practice, Java allows web browsers to do much more than display information. Java scripts allow much more flexibility and functionality in web access and they run on virtually any type of computer.
Journaling File System	A fault-resilient file system in which data integrity is ensured because updates to directories and bitmaps are constantly written to a serial log on disk before the original disk log is updated. In the event of a system failure, a full journaling file system ensures that the data on the disk has been restored to its pre-crash configuration.
Kerberos Realm	A Kerberos realm is a secured network requiring access through a key. (See also <i>KDC</i> .) Each system or user with a key can access any services or systems that the key opens. The user does not have to enter a user name and password each time he requests a controlled service.
L2 cache	See Ecache.
LAN	Stands for Local Area Network. A communications network that provides high-speed (over 1 Mbps) data transmission and is limited to a specific physical area (up to about six miles). The basic components of a LAN are: adapter boards installed in each computer to provide a cable connector, cabling, server hardware, and network management software.
LCD	Stands for Liquid Crystal Display. An LCD is a display device used primarily for displaying small amounts of textual information. On the StorEdge NAS, the LCD is a two line display that shows basic information about system functions and, in conjunction with the control panel, allows you to perform certain system functions, like setting the IP address, directly on the unit, without access through the internet or intranet.
LED	Light emitting diode.
Login	Logging in is a security process designed to prevent access to system settings or other resources by those who should not have access. A login process usually requires a user name and password to verify, or authenticate, a user.
Master Domain Model	One of several types of domain models. In the Master Domain Model, an account domain is trusted by a resource domain.

Mirroring	Mirroring, which happens at the file system or volume level, allows you to duplicate any or all of the file volumes of an active server onto a mirror server. In the event that the active server fails, the mirrored file volumes on the mirror server can be made available to network users within minutes.
MTBF	Mean Time Between Failures. The average time a component works without failure.
MTTR	Mean Time To Repair. The average time it takes to repair a component.
NetBIOS	NetBIOS is a BIOS used for networking. NetBIOS was designed to support communications between symbolically named stations and the transfer of arbitrary data. NetBIOS manages the use of node names and transport layer connections for higher layer protocols such as SMB.
Network	A series of nodes such as terminals, computer systems, or other peripheral devices connected by a communications channel. See also LAN.
NIC	Stands for Network Interface Card. A NIC is an expansion card that provides access to a network.
NIS	Short for Network Information Service. Along with NFS, NIS provides a distributed database system to centralize (i.e., store one copy, on a single computer) common configuration files, such as the password file (/etc/passwd) and the hosts file (/etc/hosts).
NIS+	Short for Network Information Service Plus (NIS+). NIS+ was designed to replace NIS, and is the new default naming service for Solaris. NIS+ can provide limited support to NIS clients, but was mainly designed to address problems that NIS cannot address.
NTP	Stands for Network Time Protocol. NTP provides a mechanism for synchronizing the time among a number of computers connected to a network.
Packet	A piece of a message transmitted over a network. Contains the destination address in addition to the data. Once all packets arrive at the destination, they are recompiled into the original message.
Partition	Sections on a LUN. Each partition can either have some space allocated to it, or can be empty. When a LUN is first created, all of the available space is located in the first partition, while the other partitions are empty. Each partition can have only one volume.
Port Bonding	Otherwise known as “channel bonding.” Port bonding allows you to scale network I/O by joining ports. This forms a single network channel of high bandwidth from two or more channels of lower bandwidth.
Protocol	A set of standards or rules that enable computers to connect to one another and exchange data. Using a protocol helps reduce the possibility of errors during data transmission.
Quota	A restriction on disk space or the number of files written to file volumes in the StorEdge NAS. This limit can be determined for a user or group (user or group quota) or for a directory (directory tree quota).
RAID	Redundant array of independent disks. A set of disk drives which appears as a single logical disk drive to the 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 10	<p>Also known in the industry as RAID 0+1. Implements block interleave data striping and mirroring. RAID 10 is not formally recognized by the RAID Advisory Board (RAB), but, it is an industry standard term. In RAID 10, data is striped across multiple disk drives, and then those drives are mirrored to another set of drives.</p> <p>The performance of RAID 10 is approximately the same as RAID 0 for sequential I/Os. RAID 10 provides an enhanced feature for disk mirroring that stripes data and copies the data across all the drives of the array. The first stripe is the data stripe; the second stripe is the mirror (copy) of the first data stripe, but it is shifted over one drive. Because the data is mirrored, the capacity of the logical drive is 50 percent of the physical capacity of the hard disk drives in the array.</p>
RAID 5	RAID level 5, or striping with distributed parity. 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.
RAM	Random Access Memory.
RDATE	RDATE is a time synchronization method that simply asks another computer on the network what the correct time is and resets itself accordingly. RDATE is not particularly accurate, but is adequate for most networks.
Read-ahead	Sequential data read from disk into cache without having actually been requested by the application host, in anticipation that it will be requested by the host. When the request occurs, it can be serviced as a low latency cache hit, thus improving host application performance.
SCSI	Small Computer Systems Interface. Pronounced “scuzzy.” An ANSI standard for controlling peripheral devices by one or more host computers.
Segment	Segments are available space that can be “attached” to a volume when the volume reaches its assigned capacity. This increases the volume’s total capacity. The segment, after being attached, becomes part of the volume and cannot be removed. Otherwise known as volume extensions.
Server	A network host that makes network resources, such as software applications and databases on hard disk or CD-ROM, available to network users. The server provides the centralized, multi-user functionality of the network application, such as data management, information sharing, network administration, or security.
Server Name	Identifies a network server. Server names are used in addition to IP addresses. This allows a server to be advertised on a network with a recognizable name. For example, the first StorEdge NAS server on a network could be identified as cdts0, the second as cdts1, and the third as cdts2 or they could be identified as Fred, Barney, and Wilma.
Shutdown	The multi-user operating system resident on the StorEdge NAS server must be shut down in an orderly sequence prior to turning the power off. The shutdown sequence closes files and terminates running programs to prevent loss or corruption of data.
SMB	Stands for Server Message Block. A Microsoft-compatible network protocol for exchanging files. SMB is typically used by Windows for Workgroups, OS/2 Warp Connect, and DEC Pathworks. See also CIFS.
SMTP	SMTP (Simple Mail Transfer Protocol) is a TCP/IP protocol used in sending and receiving e-mail.
SNMP	Stands for Simple Network Management Protocol. SNMP is primarily used for network monitoring and notification of network errors and other events. In the StorEdge NAS, SNMP also provides notification services through e-mail messages.
TCP/IP	Stands for Transmission Control Protocol/Internet Protocol. A commonly used networking protocol that allows interconnection of different network operating systems.

Telnet	A terminal emulation program for TCP/IP networks. The Telnet program runs on your computer and connects your PC to the StorEdge NAS server on the network. You can then enter commands through the Telnet program and they run as if you were entering them directly on the server console.
Transfer Rate	The rate at which data is transferred, usually measured in megabytes per second (MB/sec.).
Ultra320 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 320 Mbytes/sec over a 16-bit SCSI bus.
Unicode	Unicode is a standard for representing letters that allows the language of computer messages and commands to be displayed in a variety of languages without rewriting the underlying programs.
URL	Stands for Uniform Resource Locator. An address system used by servers and clients to request documents. See also IP Address.
User Credentials	The information containing the user, account data, and the user's group membership.
Volume	A volume is a virtual disk into which a file system, a DBMS, or an application can place data. A volume can be a single physical disk or a virtual disk mapped from one or more underlying extents. 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.
Web Browser	A web browser is a software application designed to search for and retrieve information from the Internet and the world-wide web. See also <i>Internet</i> , <i>Intranet</i> , and <i>WWW</i> .
WINS	Stands for Windows Internet Naming Service. A WINS server resolves NetBIOS names to IP addresses, allowing computers on a network to locate other NetBIOS devices more quickly and efficiently. WINS performs a similar function for Windows environments as DNS does for Unix environments.

Materials Abstract

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
References				
<ul style="list-style-type: none"> <i>Sun StorEdge™ 5210 NAS, Just The Facts</i> 	Reference Guide (this document)	Training Sales Tool	SunWIN, Reseller Web	413907
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance NDA Presentation</i> 	NDA Presentation	Training Sales Tool	SunWIN, Reseller Web	412442
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Intro</i> 	Introductory E-mail	Training Sales Tool	SunWIN, Reseller Web	414766
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Customer Presentation</i> 	Customer Presentation	Training Sales Tool	SunWIN, Reseller Web	413906
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance “What Works With What”</i> 	Compatibility/Support Guide	Training Sales Tool	SunWIN, Reseller Web	414203
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance “Training Presentation”</i> 	Training Presentation	Training Sales Tool	SunWIN, Reseller Web	421665
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance “Technical Presentation”</i> 	Technical Presentation	Training Sales Tool	SunWIN, Reseller Web	421662
Product Literature				
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Data Sheet</i> 	Data Sheet	Training Sales Tool	SunWIN, Reseller Web	413904
External Web Site				
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Web Site</i> 	http://www.sun.com/storage/5000/5200/5210/			
<ul style="list-style-type: none"> <i>Warranty terms, SunSpectrum, Installation, Software Support and Implementation information</i> 	http://www.sun.com/service/warrantiescontracts			
Internal Web Site				
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Internal Site</i> 	http://webhome.ebay/networkstorage/products/5210/ http://onestop/5210/index.shtml?menu			
<ul style="list-style-type: none"> <i>Sun Storage Services Marketing</i> 	http://mymarketing.central.sun.com3A81/NASApp/myMarketing/Portal/NonLeaf?FunctionalCatId=1656&CategoryId=2038			
iForce Partner Web Site				

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
<ul style="list-style-type: none"> <i>Sun StorEdge 5210 NAS Appliance Partner Site</i> 	http://partner.sun.com/products/storage/5210.html			



Competitive Information

The Sun StorEdge 5210 NAS Appliance targets the “workgroup” (\$25,000-\$99,000) NAS market space. Also in this space are Network Appliance, EMC, Dell, and HP:

	Sun StorEdge 5210 NAS	NetApp FAS250	NetApp FAS270	Dell 775N	EMC NetWin 200	HP 2000s
System Hardware						
Filer Height	2U	3U	3U	2U	2U	2U
Capacity (raw)	6.1TB	2TB	6TB	Up to 16.7TB	Up to 35.8TB	Up to 27TB
Internal (Filer)	876GB (6X146GB)	2TB (14X144GB)	2TB (14X144GB)	438GB (3X146GB)	2X36GB (for OS only)	587.2GB (4x146.8GB) + 2x36.4GB mirrored HDD's for OS
External	5.256TB (36x146GB)	Not scalable	4.08TB (28x146GB)	16.3TB	35.8TB	26.7TB
HDD type	SCSI	FC-AL	FC-AL	SCSI w/FC option	FC & ATA	SCSI
# CPUs	1	1	1	Up to 2	2	Up to 2
Frequency	3.06GHz	650MHz	650MHz	2.4GHz or 2.8GHz	3.06GHz	3.06GHz
Processor	Intel Xeon	Broadcom SB1250	Broadcom SB1250	Intel Xeon	Intel Xeon	Intel Xeon
L2 Cache	512KB	512KB	512KB	512KB	512KB	512KB
Front Side Bus Speed	533MHz	?	?	533MHz	533MHz	533MHz
RAM (Max)	4GB	512MB	2GB	Up to 4GB	2GB	Up to 6GB
RAID type (HW/SW)	Hardware	Software	Software	Hardware (ROMB)	Hardware	Hardware (ROMB)
RAID Level	5	4	4	0,1,5,10,50	5	0, 1, 1+ 0, 5
RAID Cache	128MB	0	0	?	4GB (external)	64MB
Total PCI slots	6	0	0	3	?	3
Available PCI slots for expansion	4	0	0	3	?	2
Network ports, embedded	Dual 10/100/1000	Dual 10/100/1000	Dual 10/100/1000	Dual 10/100/1000	Quad 10/100/1000 (in HBA)	Dual 10/100/1000
System Software						
Operating System	Sun StorEdge NAS	ONTAP	ONTAP	WSS 2003	WSS 2003	WSS 2003
File Access Protocols	NFS, CIFS, FTP	NFS, CIFS, FTP, HTTP	NFS, CIFS, FTP, HTTP	NFS, CIFS, FTP, HTTP, NCP, AFP	NFS, CIFS, FTP, HTTP, NCP, AFP	NFS, CIFS, FTP, HTTP, NCP, AppleTalk
Filer Failover	No	No	Yes (FAS270c)	Yes (thru MSCS)	Yes (thru MSCS)	No
File Sharing	UNIX, NT	UNIX, NT	UNIX, NT	UNIX, NT	UNIX, NT	UNIX, NT

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



	Sun StorEdge 5210 NAS	NetApp FAS250	NetApp FAS270	Dell 775N	EMC NetWin 200	HP 2000s
Lock Type	CIFS & NFS	CIFS & NFS	CIFS & NFS	CIFS & NFS	CIFS & NFS	CIFS & NFS
Authentication	ACL's user & group IDs, AD	ACL's user & group IDs, AD	ACL's user & group IDs, AD	ACL's user & group IDs	ACL's user & group IDs	?
Snapshots	16 per volume	255 per volume	255 per volume	64 per volume	64 per volume	64 per volume
Remote Copy	Yes	Yes	Yes	Yes	Yes	Yes (host based)
NDMP Support	Yes	Yes	Yes	Yes	Yes	?
Integrated Antivirus Detection	No	Yes	Yes	Yes (not supplied)	Yes (not supplied)	Yes (not supplied)
Quota management	Yes	Yes	Yes	Yes	Yes	Yes
Automatic File System Extension	Yes	Yes	Yes	?	?	?
Admin interface	Web GUI, CLI, Telnet, SSH	Web GUI, CLI, Telnet, SSH	Web GUI, CLI, Telnet, SSH	Web GUI, CLI, Telnet, SSH	Web GUI, CLI, Telnet, SSH	Web GUI, "Desktop", Telnet
SNMP reporting	Yes	Yes	Yes	Yes	Yes	Yes
Support and Warranty	2 yr. Limited warranty - Year 1 - NBD parts delivery Bus. Hrs/8 hr response phone - Year 2 - Return to Sun	3 yr. limited warranty: - Next Bus. Day parts delivery - 24x7 Phone - AutoSupport (phone home) - 90 day software (media)	3 yr. limited warranty: - Next Bus. Day parts delivery - 24x7 Phone - AutoSupport (phone home) - 90 day software (media)	3yr limited warranty: -3yr NBD parts replacement -1yr NBD on-site labor - Lifetime HW supp - SW ??	2yr limited warranty: - includes installation - 24x7 phone support - 4hr onsite response - SW ??	3yr limited warranty: -3yr parts -1yr labor -1yr on-site -Next business day response -SW?

Network Appliance

When comparing to NetApp it is important to know that NetApp's pricing model is a la carte. Drive enclosures, disk drives, NFS and CIFS licenses are all sold separately. In order to make an "apples to apples" comparison with NetApp filers, be sure to:

- Include the costs for the NFS and CIFS licenses as they are included with the OS of the Sun StorEdge NAS family. It is believed that NetApp typically includes either a NFS or CIFS license with the Data ONTAP operating system.
- Capacities are similar. NetApp uses drive enclosures that house up to 14 drives. The head also, typically, houses up to 14 drives.

There are some questions that should be asked of customers either using or considering NetApp's NAS products:

- How does the NetApp system handle old "snapshots" vs. Sun StorEdge 5210 NAS Appliance when the volume becomes full? The StorEdge 5210 NAS Appliance automatically deletes the oldest "checkpoint"; avoiding system shutdown.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- Would you rather recover whole volumes or individual files? Do they really want millions of objects on a volume restored to a prior state? The StorEdge 5210 NAS Appliance enables the customer to recover individual files from a “snapshotted” state.
- How many “snapshots” do you need? NetApps supports up to 255 “snapshots” per volume. The Sun StorEdge 5210 NAS Appliance supports 16 snapshots per volume. How many “snapshots” would you like to manage? Do you understand the the overhead imposed on the system with so many “snapshots”?
- With respect to mirroring, would you rather have call changes in your data replicated or only the the most recent changes in a specified period? The purpose of mirroring is largely to ensure data availability with all changes to files being communicated. The Sun StorEdge File Replicator will send **all** changes to the customer's data that occur within a scheduled period.
- Journaling helps to ensure file system consistency and fast recovery in the unlikely event of a system crash. Would you prefer to have the journal on RAID protected disk or on unprotected NVRAM (single point of failure)?

Q&A

Q. Where have NAS devices deployed most effectively -- in terms of best applications and size of IT environment or company?

NAS has been predominantly deployed in departmental or workgroup environments. Probably greater than 90% of NAS devices are in these environments. The size of company isn't the issue - it's the application or work environment that dictates what is deployed. Development (engineering CAD or programming) was one of the first big users of NAS. Now we're seeing departments in companies using NAS even if they have a central IT organization. Remote offices such as insurance agents have also been a success story for NAS.

Q. What are NAS "heads" or "gateways"?

Gateways are the NAS controller function (head) without the storage. All NAS resolves down to block storage and most use direct-attached storage (DAS). A NAS Gateway uses the storage in a SAN rather than direct-attached for the block I/O to be done.

Q. Does the StorEdge 5210 NAS Appliance support DFS?

DFS (distributed file system) is a hierarchical file system that allows files to be stored across multiple servers and managed as a single group. The StorEdge 5210 NAS Appliance can serve as a DFS target. This means that DFS referrals can redirect clients to the StorEdge 5210 NAS Appliance, but the StorEdge 5210 NAS Appliance does not provide referrals and cannot be configured as a root replica.

Q. What is "port aggregation"?

Port aggregation gives you the flexibility to scale your network I/O in port aggregation or to provide NIC port redundancy in high availability.

Port Aggregation is also known as "channel bonding" or "trunking." This type of bonding lets you scale network I/O by joining adjacent NIC ports. It forms a single network channel of high bandwidth from two or more channels of lower bandwidth. You must have a minimum of two available NIC ports for port bonding, and they must be of the same interface type (e.g., Fast Ethernet with Fast Ethernet).

High Availability port bonding provides NIC port redundancy or failover. More than one NIC port is bonded to a primary port as backup ports. If the primary port fails, the StorEdge switches over to the backup port that is first on the list of "high availability" bonded ports. If that port also fails, the port next on the list is used and so on.

Q. Can more than one default gateway be set?

No. The default gateway is the gateway used when a TCP/IP client needs to send data to a network which it does not have a specific route to. After checking the destination network against the routing table and finding no match, the data is sent to the default gateway. There is no provision within TCP/IP to choose between default gateways.

Some operating systems allow the administrator to configure a second default gateway to be used in the case of failure of the primary default gateway. StorEdge does not currently support this feature.

Q. How many StorEdge 5210 Expansion Units (EU) may be attached to the StorEdge 5210 NAS Appliance?

Up to 3 StorEdge 5210 EU's are supported for attachment to the StorEdge 5210 NAS Appliance (with two RAID controllers).

Q. Are other arrays supported with the StorEdge 5210 NAS Appliance?

Only the StorEdge 5210 EU is supported for attachment & capacity expansion on the StorEdge 5210 NAS Appliance.

Q. Are rackmount kits included with the StorEdge 5210 NAS Appliance and StorEdge 5210 EU?

Rackmount kits must be ordered separately for the StorEdge 5210 NAS Appliance (XTA-5200-2URK-19U) and StorEdge 5210 EU (XTA-3000-2URK-19U).

Q. The system is based on a 32-bit processor architecture. How have you managed to get a 64 bit File System ?

"64 bit" refers to the storage allocation address space (i.e. inode pointer length) in the file metadata structure. This impacts the allowable overall size of the file system (16TB). You are correct that arithmetic manipulation of 64 bit values using a 32 bit processor requires double precision arithmetic.

Q. Can a customer use/install an existing antivirus application on the StorEdge 5210 NAS Appliance?

The Sun StorEdge NAS Appliance does not use an operating system supported by antivirus application vendors, so their virus scanning application can not be installed and will not run on the file server itself. Because the StorEdge NAS Appliance does not run Windows or services commonly used by viruses to propagate themselves such as Outlook or Internet Explorer, the StorEdge NAS Appliance itself is virtually immune from the effects of viruses and should not participate in their propagation.

As the StorEdge 5210 NAS Appliance exports storage volumes that may be mounted by clients as if they were native file systems, it is possible for the customer to configure one of their existing systems running an antivirus application to scan mounted NAS volumes periodically to detect and isolate viruses that were stored by a vulnerable client system.

Q. What is the usable capacity of the StorEdge 5210 NAS Appliance?

The StorEdge 5210 NAS head has six 146GB SCSI disks in a "4+1" RAID group with 1 hot spare. The StorEdge 5210 EU's have 12 146GB SCSI disks in a "10+1" RAID group with 1 hot spare. The 146GB SCSI drives have 133GB usable capacity after formatting.

StorEdge 5210 NAS Appliance: (6 drives - 2 for overhead) x 133GB = 0.532TB usable

StorEdge 5210 EU: (12 drives - 2 for overhead) x 133GB = 1.33TB usable

Maximum usable capacity: $.532\text{TB} + 3 \times 1.33\text{TB} = 4.522\text{TB}$

Q. Does the StorEdge 5210 NAS Appliance support HTTP?

The StorEdge 5210 NAS Appliance provides CIFS, NFS, and optionally FTP services to users.

The StorEdge 5210 NAS Appliance does include an embedded HTTP server, which is used only for administrative access and can not be configured as a generic web server for user access.

Q. What is StorEdge File Replicator?

StorEdge File Replicator is an available software option that allows a StorEdge NAS Appliance volume to be replicated on another remote StorEdge NAS Appliance.

Q. Why do I need StorEdge File Replicator?

Anyone that needs to have an online copy of data available at all times can benefit from StorEdge File Replicator. It can be used to simplify the following data administration tasks:

- *Disaster Recovery

- *Backup

Q. How does StorEdge File Replicator work?

Any update (disk write) made on the source volume is automatically duplicated on the target volume on another StorEdge NAS Appliance using an interconnecting network that is responsible for propagating the data between the nodes. The target StorEdge NAS Appliance can be in the same room as the source, or on the other side of the world, as long as the interconnecting network has sufficient bandwidth to carry the data across.

Q. How does the data move from the source StorEdge NAS Appliance to the target StorEdge NAS Appliance?

All communications between the data source and target utilize the TCP/IP protocol, so the target may be located on any reachable subnet. There has to be a reliable and persistent interconnection to ensure that data is always moving.

Q. How would one use StorEdge File Replicator?

StorEdge File Replicator can be used to help address many data management challenges facing IT professionals today:

- *Disaster Recovery

Without a reliance on slow tape media, StorEdge File Replicator helps to relieve the need for lengthy tape restores. StorEdge File Replicator enhances recovery time in case of a complete loss of data, as businesses can now access mission-critical data from an online backup on a mirror filer. With StorEdge File Replicator properly configured, the target, or mirror, is assured to be an accurate, near real-time representation of the offline source filer. The StorEdge NAS

Appliance target file volume can be brought online quickly to help enable uninterrupted operations.

***Backup**

A StorEdge File Replicator target volume may be dedicated for backing up source volumes. Without affecting production operations, replicated data can be backed up on the target: StorEdge File Replicator enhances operations by moving backup I/O to the remote volume. This shadow processing capability reduces CPU load on the production filer, streamlining operations.

Q. Does StorEdge File Replicator mirror entire files?

No. With StorEdge File Replicator, data replication is performed at the block level of files. This means that individual blocks that compose a file are sent over the network.

This block-level implementation dramatically reduces the required bandwidth on the interconnecting network by transmitting only the data blocks that have changed. For example, if only a single 4 KB block of a multi-megabyte (MB) file is updated, only that 4 KB block is transferred, not the entire file. As a result, StorEdge File Replicator efficiently utilizes StorEdge NAS Appliance resources and available network bandwidth.

Q. Can StorEdge File Replicator software be used to replicate between StorEdge 5210 and 5310 NAS Appliances?

Yes. StorEdge File Replicator may be used to replicate data from a StorEdge 5210 NAS Appliance to a StorEdge 5310 NAS Appliance (or vice versa). Both StorEdge NAS Appliances must be using the same level of operating system.

Q. When does the eval period begin with the StorEdge File Replicator evaluation licenses?

The 90-day evaluation period begins on the day the customer faxes their license card information to Sun's Licensing Center for their enablement key.

Q. What information is in the email generated for remote monitoring?

The information transmitted is the machine serial number, the customer contact information and a summary of the detected error. There is no customer data or information about the customer data included in the email transmission.

Q. Where do the emails generated from the remote monitoring feature go within Sun?

The email is routed internally in Sun to a special server inside the locked NAS Engineering laboratory. Access to the error messages is only available to authorized engineers and that access is read-only. Customer privacy is tightly protected.

Appendix A

Application Examples

Application: GIS Imaging

COMPANY

Profile: In the acquisition and processing of digital aerial imagery space industry, companies require storage-intensive services such as color, black and white, and infrared aerial photography, along with photo scanning, image rectification, digital mapping (2D & 3D), geodetic and airborne Global Positioning System (GPS) and Inertial Measuring surveys, LIDAR, Digital Elevation Models and Geographic Information Systems (GIS).

Environment: In producing digital imagery and maps, personnel work 24 hours a day, five days a week on 30 workstations digitizing and scanning aerial photography, editing maps and images, and quality-checking all deliveries. As workloads increased, projects demanded more storage. File sizes vary from several megabytes to over three gigabytes, and individual projects may have thousands of aerial photos. Files were stored on different computers around the network, including Silicon Graphics servers and workstations, Compaq Proliant NT Servers, Intergraph and Compaq workstations and DEC VAXs. This architecture, however, proved inadequate and difficult to manage.

CHALLENGE

- Consolidate data storage
- Simplify storage administration
- Scalable capacity for future workload increase
- Data protection
- Unix and Windows clients accessibility

SOLUTION

Implementation: Deploy a StorEdge5210 NAS to consolidate storage from all the servers and workstations. The StorEdge 5210 NAS Appliance would be used to store image files that are scanned from aerial photography using a Zeiss/Intergraph Autoscan 2000 scanner. To perform daily, weekly, and monthly backups, the company might use a Compaq Proliant Win2K server running ARCserve 2000 with an external Quantum/ATL Powerstore L500 fourteen tape DLT 7000 library. Applications such as Adobe Photoshop, ERDAS Imagine, and Z/I Imagination could be used to process these images for specific client uses. Dual-processor Compaq SP750 workstations process the data. Gigabit Ethernet connects the Sun StorEdge 5210 NAS Appliance to a switched full-duplex fast Ethernet VLAN.

Benefits:

- Storage consolidation eliminates expensive storage islands on multiple servers
- Simplified storage administration is performed through the web-based GUI interface

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- With support for up to 2.6TB, scalability is ensured to accommodate future growth
- Checkpoints increase availability by enabling rapid recovery of lost and/or accidentally deleted files and reducing backup windows
- Heterogeneous access facilitate access to UNIX and Windows clients

Business Results: Higher productivity levels could be achieved with the implementation of Sun StorEdge 5210 NAS Appliance, and total cost of ownership could be reduced by eliminating expensive and isolated storage islands on multiple servers and simplifying the storage management by consolidating storage to the Sun StorEdge 5210 NAS Appliance. In addition, companies could benefit from other integral features of the filer, such as high performance file serving and fault tolerant components.

Application: File Sharing/Database

COMPANY

Profile: This federal organization mandates that all aircraft in flight over the United States must file a flight plan. The flight plans are managed by individual “flight” information centers (IC). An information center belongs to one of many ARTCC, Air Route Traffic Control Center. There are currently 250 information centers currently deployed in the US. The responsibility of the ARTCC is to provide air flight safety and separation data to all of the aircraft in flight. After a pilot files a flight plan and receives clearance to proceed, this data is placed online and in turn the aircraft is tracked real-time using the existing air traffic control system.

Environment: The flight-tracking application runs on a Sun server with Solaris OS. Local and remote NFS and CIFS clients connect to the Sun server and run the application which graphically displays all airways superimposed onto a map of the continental United States. An individual flight number, airline, or all aircraft in flight can be called upon to be placed graphically onto each of their respective airways while representing where the aircraft is at the time of the query. The integration and organization of the real-time flight data is performed through an Oracle database. There is a second Sun server setup as a backup to the main server to provide access to clients should the main server fail.

CHALLENGE

- Storage consolidation for multiple servers
- Cross-platform file-sharing
- Multi-location access
- Oracle Database support
- Ensure data availability

SOLUTION

Implementation: The Information Centers could implement a Sun StorEdge 5210 NAS Appliance on each site to share storage between the primary and secondary (backup) Sun servers. The application data would then be stored in an Oracle database that resides on the Sun StorEdge 5210 NAS Appliance. The filer then provides access to both servers through a Gigabit Ethernet connection.

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



Benefits:

- The NAS filer enables both Sun servers to access the same database file through a Gigabit Ethernet connection
- Heterogeneous access provides air traffic analysts access through either UNIX or Windows clients
- Although Sun StorEdge File Checkpoints would increase data availability by enabling rapid recovery of lost and/or accidentally deleted files, in this application Checkpointing would be used to provide a replay mechanism for aircraft in flight in the event that historical flight path need to be reviewed

Business Results: Data of this critical nature is required to be available real-time and shared between several information centers at any given moment in time. By providing file and data sharing as rendered from an Oracle database to a Sun Microsystems graphics server, an air traffic analyst can monitor flights effectively. Storage management costs are reduced by consolidating storage on the Sun StorEdge 5210 NAS Appliance that both Sun servers can share.

Application: VoIP/Unified Messaging

COMPANY

- **Profile:** An industry leader in enhanced services platform enabling carriers, service providers, and broadband cable providers to quickly and cost-effectively develop, deploy and manage new voice and telephony services over existing and next generation networks.
- **Environment:** The product solution includes a carrier grade media server platform, Sun blade servers running Sun Solaris and market proven applications – auto attendant, voice mail, unified messaging service, audio/web conferencing and prepaid/debit-limit services.

CHALLENGE

- Consolidation of server storage
- Centralization of administrative duties
- Cost effective storage integration
- Multi-protocol accessible for manageability

SOLUTION

Implementation: Sun blade servers with Sun Solaris OS are to be installed in a TELCO rack running service applications for unified messaging clients. The Sun StorEdge 5210 NAS Appliance would provide dedicated storage for voice and data messages for tens of thousands of customers per install. Checkpoints are integrated providing online recovery mechanisms as well as the source for backing up the stored data for archival requirements.

Benefits:

- Centralized / consolidated storage

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- GUI / Telnet access to systems administrators for local and remote manageability
- Price effective storage integration
- Easy scalability as customer's needs increase

Business Results: Pre-configured implementations help to achieve a high rate of success. The Sun StorEdge 5210 NAS Appliance provides the unified messaging solution the consolidation of storage. This reduces performance overhead and data access bottlenecks typically associated with general purpose servers. The filer is tuned to provide faster storage and retrieval of voice and test messages. Administration headaches associated with diverse servers is reduced. As the number of clients grows so grows the NAS easily and without disruption to service.

Application: Data Warehouse/Data Mining

COMPANY

Profile: An OEM partner specializes in internet filtering and reporting. Small to medium size as well as large corporations are customers needing to track and block internet activity of its employees.

Environment: A MySQL database is the main repository of information that is gathered, stored, manipulated and tracked. Tracking and reporting applications are installed and run on Sun blade servers with Sun Solaris 9 OS. Clients that are monitored access the network Windows and UNIX workstations.

CHALLENGE

- Server storage consolidation
- Accessible from multiple protocols
- MySQL database compatible
- Data protection
- Provide rapid recovery of deleted / corrupted files

SOLUTION

Implementation: Companies integrating the tracking/reporting solution install the server(s) on their existing network. Employees accessing the web from behind the company firewall are then monitored. The solution integrates NAS as the storage component for data base applications. The data is then stored in one of three distinct volumes on the Sun StorEdge 5210 NAS Appliance. This data would be recalled by the tracking or reporting applications. Checkpoints are taken on the stored logs periodically providing an online recovery mechanism as well as a source for backup and archival processes.

Benefits:

- Storage consolidation through the Sun StorEdge 5210 NAS Appliance contribute to an overall **lower cost** to the end user
- **Heterogeneous access** facilitate access to UNIX and Windows clients

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- With tight integration to the enterprise reporting solution, administrator intervention is at a minimum to the end user – **ease of use**
- **Backup/Data protection** of data is faster using **Checkpoints** as the source
- **Checkpoints** provide online recovery in the event of lost data in the unified messaging forum

Business Results: Report generation in this environment would range between 3 – 4 hours vs. the primary competition at which takes 3 – 4 days. Tight integration between the report/filtering server and the S5210 NAS allows for future product expansion opening up greater industry infiltration especially in price sensitive environments.

Application: Medical Imaging

COMPANY

Profile: A medical imaging application provider owns approximately 60 percent of the PACS imaging market among hospitals in Korea. They believe that PACS is beneficial for diagnosis and treatment in hospitals. Based off of its unique imaging systems and services providing systems integration, standardization of diagnostic images, and resource management in the integration and installation of its systems is achieved.

Environment: Diverse PACS servers are installed within the DICOM infrastructure, each maintaining its own versions of data, applications, backup facilities and processes. This slows the diagnosis and subsequent treatment of patients by having to “share” files through FTP, hand carrying, etc. between medical facilities.

CHALLENGE

- Centralized, consolidated storage
- DICOM / PACS compatible
- HIPPA compliant
- High data availability and integrity
- Scalability of the storage medium due to size and quantity of files
- Flexible architecture to ease administration efforts

SOLUTION

Implementation: The Sun StorEdge 5210 NAS Appliance would be installed on an existing DICOM network. The filer would then become the primary source of backups as required by HIPPA as well as the consolidation point of preexisting servers. Via the DICOM protocol, clients would then be able to share files across the network and access them locally or remotely.

Benefits:

- Consolidating storage eliminates unused and expensive storage pools on different servers

Sun StorEdge 5210 NAS Appliance

Just the Facts

06/16/05



- Sun StorEdge 5210 NAS Appliance would provide the needed **scalability** for future growth
- Rapid and easy install
- Doctors and technicians would be able to access images simultaneously and from multiple locations
- Sun StorEdge 5210 NAS Appliance features provide high data availability and integrity

Business Results: Installs that traditionally took months would now takes minutes.