

Sun StorEdge™ 9985 Storage System

Just the Facts

Sun Internal / Partner Version

July 12, 2005



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Positioning

Figure 1: Sun StorEdge9985 System



Introduction

The StorEdge 9985 is a scaled-down, modular version of Sun's flagship data center class StorEdge 9990 system. It shares the same crossbar architecture, microcode, software, and connectivity protocols. The StorEdge 9985 joins Sun's storage portfolio at the entry of the StorEdge 9900 series and will replace the StorEdge 9970, surpassing it in performance, capacity, and scalability while adding the benefits of storage virtualization and logical partitioning. As with the other members of the StorEdge 9900 series, the StorEdge 9985 will have the highest levels of availability and will be supported with an optional 100% Data Availability Guarantee

The StorEdge 9985 brings enterprises all the benefits of the Sun StorEdge 9990 system in a flexible, modular package. The Sun StorEdge 9985:

- Provides common management and replication for mixed storage systems
- Protects existing storage investments through consolidation
- Creates a foundation for ILM and tiered storage infrastructures
- Enables complex disaster recovery plans
- Helps meet service level agreements with logical partitioning of storage resources
- Helps lower storage costs for enterprises with mainframe applications

The StorEdge 9985 will be brought to marketing in two phases. Phase 1 features will deliver all the essential characteristics required to compete in the data center storage market. Phase 2 will deliver significant improvements in capacity and performance as well as mainframe connectivity.

Phase 1 highlights:

- Single rack
- 120 HDD
- 32 GB Cache
- 12 GB/sec system bandwidth
- Runs the same software as SE 9990

Phase 2 highlights

- Add second rack
- 240 HDD
- 64 GB Cache
- Mainframe Support (e.g. ESCON/FICON and others)

Key Product Attributes are summarized below:

- Virtualization capabilities which supports a customer Data Lifecycle Management initiatives
- Partitioning which supports a customers “Service Business Model” initiative.
- Modular design to offer higher level of flexibility than 9970
- Advanced disk-journalized Distance Replication software to support rigorous Business Continuance requirements
- Copy software to broaden data migration options and facilitate file distribution
- Data movement software to facilitate the movement of data in support of Data Lifecycle management initiatives
- High Capacity Disk Drives which reduce cost per megabyte and costs per square foot of expensive data center floor space.
- Standards-based management platform that integrates heterogeneous SAN management, resource, operations, application management, and provisioning
- Integration of NAS capability with the data center grade management tools of the SE 9985.
- Disk to Disk backup for Microsoft Exchange Server, Microsoft SQL Server
- Server-less Backup Enabler simplifies server configurations as well as offloads server compute cycles.
- Replication monitoring tools for software such as TrueCopy, Shadow Image, and Universal Replicator.

Main Hardware Features

- Uses the same Universal Star Network Crossbar Switch architecture as SE9990
- Aggregate System Bandwidth is 12 GB/sec
- Maximum System Data Bandwidth 8.5 GB/sec
- Maximum System Control Bandwidth 3.5 GB/sec
- Maximum drive count 120 drives or 35TB raw with 300GB FC disk (240 drives or 72TB raw planned for future)

- Up to 16PB of internal and virtualized external storage
- Up to 32 GB Data Cache (64 GB planned for future)
- Up to 6 GB Control Cache
- 16 to 48 2Gb FC host ports
- Up to (8) 1Gb NAS ports
- Up to 8 FICON and 16 ESCON host ports (future)
- Supports up to 6144 hosts (theoretical)
- 73 GB 10K, 73 GB 15 K, 146 GB 10K, 300 GB 10K
- SE 9990 NAS Blade Feature
- Up to 255 World Wide Names (WWN)
- 1024 Logical Units (LU)
- 16,384 Logical Devices (LDEV)

Main Software Features

- Similar microcode as SE9990 – all software leverageable
- StorEdge 9900 Universal Volume Manager – Supports the connection and virtualization of “External Storage” . The StorEdge 9985 provides a common point for the virtualization of a multi-tiered, heterogeneous storage. environment managed by a common set of tools.
- StorEdge 9900 Virtual Partition Manager – supports the logical partitioning of ports, cache, and disk capacity (parity groups) on the StorEdge 9985 to create independently managed Virtual Private Storage Machines. Up to 8 Virtual Private Storage Machines can be created and managed.
- StorEdge 9900 FlashCopy2 (future) - Compatible Mirroring for IBM® FlashCopy® is unique to the Sun StorEdge 9990 storage systems and provides a superior hardware-based solution for data duplication, data migration, remote copy, and disaster recovery tasks. Compatible Mirroring for IBM FlashCopy is the only 100% functionally compatible solution with the IBM S/390 FlashCopy product.
- StorEdge 9900 Copy on Write Snapshot (future) - provides non-disruptive, high-speed snapshot data replication within Sun StorEdge 9990 Series storage systems. Copy-on-Write snapshots store only the changed data blocks in the Copy-on-Write Snapshot storage pool, resulting in a significant savings over full cloning methods. Copy-on-Write Snapshot copies are fully read/write compatible by other hosts and can be used for rapid data restores, application testing and development, data mining/data warehousing, or non-disruptive backup or maintenance procedures.
- StorEdge 9900 Universal Replicator – StorEdge 9900 Universal Replicator – Provides data replication for all storage volumes managed by a StorEdge 9985s, both internal and external . The Universal Replicator's significant advantage over competitive products derives from advanced technology including disk-based journaling, and “pull technology” which off-loads processing from the central site. Initially available in “2 Data Center” configurations, it will in the future be enhanced to include “3 Data Center” configurations. Universal Replicator is based on True Copy Asynchronous product with additional code to provide its advanced features. Universal Replicator may be combined

with TrueCopy Synchronous to provide a no-data loss solution for shorter disaster recovery distances. Less data cache is required and link capacity is often less with disk journalling bandwidth need not be sized for for peak values. Both of these aspects reduce costs.

- Cross System Copy - Cross System Copy is primarily for data migration between different platforms as well as file distribution.
- *SE9985 Sun StorEdge 9900 HiCommand Storage Services Manager(HSSM) 4.2 Software - HSSM 4.2 delivers the comprehensive, standards-based management platform for SE9985 that integrates heterogeneous SAN management, storage resource, operations, and application management, and provisioning.
- StorEdge 9900 Business Continuity Manager (future) - Business Continuity Manager for IBM® z/OS software dramatically reduces recovery times from outages through the automation of complex disaster recovery and planned outage routines. It offers centralized, simplified management of TrueCopy and ShadowImage software running in mainframe environments across an enterprise. One can generate system performance metrics and threshold alerts to avoid problems and meet or exceed service-level objectives. The auto discovery capability eliminates time-consuming and error-prone manual configuration of protection for complex applications and data layouts. Support for three data center disaster recovery solutions provides long distance replication with minimal data loss.
- StorEdge 9900 Tiered Storage Manager - The primary objective of this software package is to support a customer's Data Lifecycle Management initiatives with transparent, nondisruptive data volume movement to the appropriate tier of storage. Different tiers of storage may have different attributes such as cost, performance, level of data protection and types of storage management tools. Underlying data movement engine is SE 9900 Volume Migrator, formerly known as Cruise Control.
- Hi Command Protection Manager 4.1 - Protection Manager 4.1 enables “disk-to-disk”-based rapid backup and recovery operation for Microsoft Exchange Server, Microsoft SQL Server, and Microsoft NT File System (NTFS), taking advantage of StorEdge 9985 storage system replication technologies. Protection Manager 4.1 major enhancements include the support of TrueCopy Remote Replication software and Universal Replicator software that enables remote disaster recovery backup against risks including storage system failure and local disaster. Through support of Microsoft Volume Shadow Copy Service (VSS), integration is now provided for NTFS backup and recovery for file servers as well as the capability to take multiple generation backups. And support of dynamic disks through Logical Disk Manager (LDM), found in Microsoft Windows, VERITAS Volume Manager (VxVM) and VERITAS Volume Cluster Server (VCS) expands Protection Manager supporting system configuration.
- StorEdge 9900 Serverless Backup Enabler (e-Copy)for the Sun StorEdge 9900 Systems. e-Copy provides advanced backup protection via the SCSI standards embedded in the storage array in conjunction with existing backup software, such as VERITAS NetBackup(TM). e-Copy manages the actual backup data movement directly from disk-to- tape without impacting server or LAN resources. Professional services is require when deploying this feature.
- StorEdge 9900 Replication Monitor - is a monitoring/reporting application that interfaces to replication management functions provided by an Element Manager (Storage Navigator, CCI or HiCommand Device Manager) for Sun StorEdge 9900 systems and replication software. HRpM allows the customer to get a visual reference for data under replication management along with a point in time status indicator of pairs. For troubleshooting, the HRpMsoftware also provides for user notification of pairs suspended due to errors. For usability, different

views of the replication relationship of pairs, including hosts, arrays, consistency groups and configuration files, are available.

New major features and functions of Sun StorEdge 9900 Replication Monitor are listed as follows:

- Replication Reporting: Reporting by displaying replication configuration and status
- Pair Status Management: Monitoring and changing pair status
- Pair Configuration: Adding and deleting copy pairs (by launching HdvM)

In summary, the StorEdge 9985 provides significant improvements over 9970 in the areas of

- Storage asset consolidation
- Performance
- Scalability
- Hardware acquisition cost
- Configurability
- Management

Key Messages

1. An enterprise's information is one of its most critical assets, and an intelligent and holistic approach must be applied to manage information from creation to deletion. Sun provides the Information Ecosystem for end-to-end data management, including a portfolio of storage arrays and systems to help customers ensure the right data is in the right place at the right time.
2. The StorEdge 9985 is a scaled-down, modular version of the StorEdge 9990 system. It shares the same crossbar architecture, microcode, software, and connectivity protocols. The StorEdge 9985 is the right choice for customers who have an existing investment in StorEdge 9900 systems and software, and want a compatible system for new deployments where the full scalability of the StorEdge 9990 is not required.
3. The StorEdge 9985 is the follow on product for Sun StorEdge 9970.
4. The StorEdge 9985 can help lower the cost of storage for enterprises with investments in mainframe applications (available post launch).

Detailed Messages

1. An enterprise's information is one of its most critical assets, and an intelligent and holistic approach must be applied to manage information from creation to deletion. Sun provides the Information Ecosystem for end-to-end data management, including a portfolio of storage arrays and systems to help customers ensure the right data is in the right place at the right time.
 - Arrays and systems from entry-level to data center, providing the performance/availability/scalability/cost balance to meet customers' needs. (SE3000, SE6000, SE9000)
 - We offer everything needed for the Information Ecosystem -- for data at work, at motion and at rest -- from the flexibility of Java Card computing to the peace of mind of industry leading identity management and security solutions available across a range of integrated servers, software, storage and services.

2. The StorEdge 9985 is a scaled-down, modular version of the StorEdge 9990 system. It shares the same crossbar architecture, microcode, software, and connectivity protocols. The StorEdge 9985 is the right choice for customers who have an existing investment in StorEdge 9900 systems and software, and want a compatible system for new deployments where the full scalability of the StorEdge 9990 is not required.
 - The Sun StorEdge 9985 system provides all the enterprise class features and the market proven availability of the StorEdge 9900 family with the flexibility of a modular, rack mounted package.
 - The Sun StorEdge 9985 system leverages customers existing StorEdge 9900 investments by utilizing the same microcode, the same storage management tools and the same replication software as the Sun StorEdge 9990 system.
 - The Sun StorEdge 9985 provides storage virtualization. Customers can attach their existing storage systems from various vendors to the StorEdge 9985 which then appear as if they were part of the same system. This capability helps customer more effectively utilize and actually add value to their existing storage investments. (implemented by StorEdge 9900 Universal Volume Manager software)
 - The Sun StorEdge 9985 can help customers lower the cost of storage and meet data lifecycle management (DLM) objectives by implementing a tiered storage infrastructure. Data can be moved from tier 1 high performance fibre channel disks to lower performance tier 2 serial ATA disks based on the value of the data over its lifecycle. (implemented by StorEdge 9900 Universal Volume Manager and StorEdge 9900 Tiered Storage Manager software)
 - The Sun StorEdge 9985 helps customers meet service level agreements by logically partitioning system resources – disk, ports and cache. Up to 8 Virtual Private Storage Machines (VPSMs) can be created on a StorEdge 9985, allowing customers to dedicate storage resources to applications according to service level agreements. VPSMs are a natural compliment to Solaris Containers, which logically partition resources on Sun Fire servers. Effectively managing service level agreements is essential to creating a utility storage model where enterprises can charge departments or customers according to their actual usage of IT resources. (implemented by StorEdge 9900 Virtual Partitioning Manager)
 - The Sun StorEdge 9985 system utilizes an advanced replication software that leverages disk based journaling, and “pulls” the copy from the primary, enabling “no-data-loss” replication and the ability to survive a downed link. (implemented by StorEdge 9900 Universal Replicator software)
 - The Sun StorEdge 9985 system can also be a lower cost replication target for 3 data center disaster recovery plans based on StorEdge 9990 systems. The Sun StorEdge 9985 system provides a “Universal Replication Layer” with any-to-any replication. (implemented by StorEdge 9900 Universal Replicator and StorEdge 9900 ShadowImage software)

3. The Sun StorEdge 9985 system replaces the StorEdge 9970 and brings advances in performance and functionality
 - 12GB/s aggregate bandwidth - 150% increase vs. the StorEdge 9970
 - 72TB maximum raw capacity (phase II) - 380% increase vs. the StorEdge 9970
 - Up to 240 hard disk drives supported (phase II) - 180% increase vs. the StorEdge 9970

4. The StorEdge 9985 can help lower the cost of storage for enterprises with investments in mainframe applications (available post launch).
 - Native mainframe connectivity (FICON and ESCON)
 - Universal Replicator allows the attachment and virtualization of SATA devices

- Virtual Private Storage Machines are a natural complement to mainframe LPARs

Key Messaging Statements with Respect to Current Product Line

- The Sun StorEdge 9985 is positioned at the entry of Sun's high end, data center class StorEdge 9900 family.
- As a members of the Sun StorEdge 9900 family, the StorEdge 9985 targets mission-critical enterprise applications where market validated reliability and data availability are an absolute requirement. The StorEdge 9985 also delivers the multi-protocol connectivity (FC, FICON, ESCON) required in large, complex data centers.

The StorEdge 9985 is the right choice for existing StorEdge 9900 family customers which require market proven availability and mainframe attach, but don't need the full scalability of a 9990 system. For example, customer can deploy the StorEdge 9985 as a target system in disaster recovery plans that involve 2 or more datacenters. Because the StorEdge 9985 shares the same architecture, microcode and software as the StorEdge 9990, customers can leverage their existing StorEdge 9900 family investments in storage management and software.

The Sun StorEdge 6000 family, with it's flagship StorEdge 6920 system, delivers consolidation and business continuity capabilities to the mid-market as well as storage virtualization. With the addition of the StorEdge 9985 to the StorEdge 9000 family, Sun continues to broaden its high-end, data center product portfolio, offering customers no-compromise, market validated availability and mainframe connectivity.

Key Messaging Statements with Respect to Competition

- **Market Proven Availability:** All components with a StorEdge 9990 are fully redundant. customers A 100% data availability guarantee available with the appropriate customer engagement.
- **Extreme Configurability:** Comprehensive heterogeneous server support for both storage area networks (SANS), and network attached storage (NAS) environments. Added to this is the StorEdge 9990's ability to seamlessly aggregate heterogeneous storage systems for cohesive management from a single system.
- **Robust Scalability** – In phase 2, the StorEdge 9985 will support up to 240 disks for a total internal capacity of 72TB, placing it above the EMC DMX800, the EMC DMX1000 and the IBM DS6800.
- **Excellent Performance:** The performance of the StorEdge 9985 is expected to be roughly half of the StorEdge 9990.
- **Extreme Manageability:** Utilizes the same comprehensive suite of management tools as the rest of the StorEdge 9900 family to help customers install, manage, and optimize storage assets.
- **End-to-End Solutions:** Procurement, implementation, services and support – As a systems company, Sun exceeds storage only vendors providing outstanding end-to-end support for our enterprise data center customers
- **One hand to hold:** Seamless joint global support and service centers through Sun professional and support services. Extensive services offerings dedicated to data migration, consolidation and optimization -- with premier 24X7 same day/ (2) hour on-site response.

	Sun StorEdge 9985 System	EMC DMX800	EMC DMX1000	IBM DS6800	Sun StorEdge 9990 System
Arch	Switched	Direct matrix	Direct matrix	Dual controller	Switched
Packaging	Rack mounted	Rack mounted	Floor standing	Rack mounted	Floor standing
Max drives	120 (240*)	120	144	224	1152
Max capacity	35TB (72TB*)	35TB	42TB	67TB	330TB
HDDs	73GB/15K 146GB/10K 300GB/10K	73GB/10K 73GB/15K 146GB/10K 300GB/10K	73GB/10K 73GB/15K 146GB/10K 300GB/10K	73GB/15K 146GB /10K 300GB/10K	73GB/15K 146GB/10K 300GB/10K
Bandwidth	12GB/sec	3.2GB/sec	8GB/sec	4GB/sec	81GB/sec
Max cache	32GB (64GB*)	64GB	128GB	8GB	256GB
FC ports	48	16	48	36	192
Host interfaces	ESCON* FICON* NAS FC-AL	FICON FC-AL iSCSI	FICON FC-AL iSCSI	FICON FC-AL	ESCON FICON NAS FC-AL

General Availability

This chart indicates, at a high level, what is available at Phase I (July 12, 2005) and Phase II (2QFY06).

Hardware

Hardware	Phase 1	Phase 2 Enhancements
Connectivity	Fibre Channel, NAS	FICON, ESCON
Min/Max ports	16/48 Fibre Channel, 8 NAS	8 FICON, 16 ESCON
Minimum HDD	(3 Data + 1 Parity)+ 1 spare	
Maximum HDD	120 HDD	240 HDD
Drive Types	73GB, 146GB, 300GB	
Maximum External Capacity	16PB	
Minimum Cache	4GB	
Maximum Cache	32GB	64GB
Min/Max Control Memory	2GB/6GB	
Rack	One 19" Rack with logic box and capacity to hold 120 HDD	Add secondary rack with 120 HDD capacity

Software

	Phase 1	Phase 2 Enhancements
Software	RR/GA	Enhancements
ShadowImage	Open Systems only	Adds Mainframe Support
TrueCopy Sync/Async	Open Systems only	Adds Mainframe Support
Universal Replicator	No	Yes
Copy on Write Snapshot	No	Yes
Data Retention Utility	Yes	Yes
Business Continuity Manager	No	Yes
HiCommand Device Manager	Yes	Yes
Volume Migration	Yes	Yes
Virtual Partition Manager	Yes	Yes
Server Priority Manager	Yes	Yes
Universal Volume Manager	Yes	Yes
FlashCopy V2	No	Yes
HW Warranty		
Warranty Period	3yrs	
Service Level	1 st Year - 4hr 24x7, 2nd- 3 rd Year – Parts Exchange	
Install Service	Yes	
Third party install	Yes	

Features and Benefits

Features	Benefits
<ul style="list-style-type: none"> Proven third-generation enterprise-class storage system 	<ul style="list-style-type: none"> Provides investment protection Maintains compatibility with Sun StorEdge 9900 Series systems
<ul style="list-style-type: none"> Internally supports up to 35 TBs of internal storage 	<ul style="list-style-type: none"> Permits maximum scalability within one storage system Ideal for storage consolidation
<ul style="list-style-type: none"> StorEdge 9985 will support an additional 16PBs of heterogeneous storage 	<ul style="list-style-type: none"> Simplifies configuration and management Solves pressing business continuity data problems. Simplifies virtualization of storage resources Protects investment of existing storage resources

Features	Benefits
<ul style="list-style-type: none"> Next generation non-blocking switch architecture 	<ul style="list-style-type: none"> Over two times performance improvement over previous generation switch Gives even performance as system is scaled Provides performance to high transactional applications
<ul style="list-style-type: none"> Separate data and control memory caches 	<ul style="list-style-type: none"> Increases reliability Increases serviceability
<ul style="list-style-type: none"> 2Gbps disk interfaces 	<ul style="list-style-type: none"> Improves back-end performance Improves back-end scalability
<ul style="list-style-type: none"> New back-end director design 	<ul style="list-style-type: none"> Improves reliability Removes performance bottlenecks Supports application consolidation Supports quality of service (QoS) objectives
<ul style="list-style-type: none"> Enhanced RAID support 	<ul style="list-style-type: none"> Increases reliability Increases recovery Increases security
<ul style="list-style-type: none"> New RAID 6 required with 300 GB HDD 	<ul style="list-style-type: none"> Increases availability (two sets of parity information) Increases recovery Minor performance degradation Relevant to larger capacity installations
<ul style="list-style-type: none"> 32 switched data paths, yielding a cache bandwidth of 8.5GB/s (Aggregate Bandwidth is 12 GB/sec) 	<ul style="list-style-type: none"> Superior throughput for demanding applications
<ul style="list-style-type: none"> 16 control paths to control memory, yielding a control memory bandwidth of 3.5GB/s. (Aggregate Bandwidth is 12 GB/sec) 	<ul style="list-style-type: none"> Superior throughput for demanding applications
<ul style="list-style-type: none"> 32 concurrent cache memory operations 	<ul style="list-style-type: none"> Results in outstanding overall system performance Supports simultaneous I/O requests from multiple critical applications
<ul style="list-style-type: none"> Up to 32GBs of data cache memory and up to 6GBs of separate control memory (increased to 64GBs of data cache in the future) 	<ul style="list-style-type: none"> Allows system to scale with no performance impacts Delivers performance to applications
<ul style="list-style-type: none"> New flexible front-end director design 	<ul style="list-style-type: none"> Improves configurability Improves reliability – reduces outages, increases productivity
<ul style="list-style-type: none"> Expanded front-end director connectivity 	<ul style="list-style-type: none"> Increases choice of connectivity – Fibre Channel and NAS at initial release ESCON, FICON and iSCSI in future releases
<ul style="list-style-type: none"> Up to 48 front-end Fibre Channel connections 	<ul style="list-style-type: none"> Improves configurability – three times that of the competition Facilitates storage consolidation

Features	Benefits
<ul style="list-style-type: none"> Up to 8 back-end 2Gbps Fibre Channel Arbitrated Loops 	<ul style="list-style-type: none"> Increases performance – all active-active and twice as many as the competition Improves reliability
<ul style="list-style-type: none"> Up to 8 separate Virtual Private Storage Machines (VPSM) 	<ul style="list-style-type: none"> Allows consolidation, behind one system, of heterogeneous environments requiring different storage characteristics Provides better quality of service control Eases consolidation and asset management Maintains separation and security between partitions Reassigns resources between partitions if not required or used Complements Dynamic System Domains (DSD) provided by Sun Servers. DSD is a form of server partitioning. Together, VSPM and DSD support customers who intend to implement “Service Provider Business Models”
<ul style="list-style-type: none"> Retains all StorEdge 9900 software functions 	<ul style="list-style-type: none"> Provides compatibility between StorEdge systems Eases migration Requires no additional user training
<ul style="list-style-type: none"> New StorEdge 9900 Universal Volume Manager software 	<ul style="list-style-type: none"> Provides support of externally connected storage systems Transparent use of different technologies beyond a single point of control Matches applications with specific storage characteristics Supports both open and mainframe environments Manages up to 16 PBs of internal and external storage
<ul style="list-style-type: none"> New StorEdge 9900 Universal Replicator 	<ul style="list-style-type: none"> Provides new replication technology (disk based journaling schema) Offload cycles to destination site Mitigates link failure Multi-target Simplifies management Lowers operational costs
<ul style="list-style-type: none"> New StorEdge 9900 Copy-on-Write Snapshot software available post GA. 	<ul style="list-style-type: none"> Cost effective alternative to ShadowImage In-System Replication for business continuity Minimizes performance impact via snapshot of changed information versus full volume replication

Product Family Placement

The Sun StorEdge 9985 system is positioned above the Sun StorEdge 9970 system and the StorEdge 9980 storage systems due to advances such as storage virtualization (note that the StorEdge 9985 does not exceed the 9980 in terms of performance, capacity and scalability) Like the rest of the StorEdge 9900 family, the StorEdge 9985 is an excellent choice for enterprises requiring extreme levels of performance, availability, and heterogeneity, including mainframe attachment. With roughly half the performance of a 9990 system with more limited scalability and capacity, the StorEdge 9985 system is an “entry level”

StorEdge 9900 for organizations who need a data center class system for deployments where the full scalability of a StorEdge 9990 is not required.

Positioning Statements with Respect to the Sun's Disk Array Families

- The Sun StorEdge 9000 product family is the right choice for customers who demand the absolute highest levels of data availability and mainframe connectivity. With the introduction of the StorEdge 9985, Sun's StorEdge 9900 family customers now have a smaller-scale alternative to the StorEdge 9900 that is compatible in hardware, firmware, and software. The StorEdge 9985 is ideal for existing StorEdge 9900 environments where space is a consideration and the scalability of a StorEdge 9990 is not required.
- The Sun StorEdge 6000 product family delivers the most cost-effective combination of data availability, performance, scalability, and features. The Sun StorEdge 6920 is the right choice for delivering high-end application/storage consolidation and business continuity capabilities to enterprise customers deploying business critical applications.
- The Sun StorEdge 3000 product family offers complete, ruggedized storage systems for workgroup environments. These systems deliver high performance, reliability, and scalability, as well as a small footprint. StorEdge 3000 products maximize performance and availability for workgroup applications and offer a flexible, cost-effective approach for growing storage demands.

Selling Highlights

Market Value Proposition

The Sun StorEdge 9985 provides Sun's data center customers all of the benefits of the Sun StorEdge 9990, in a smaller scale, modular package. Customers with StorEdge 9900-based disaster recovery plans, business continuity plans, data lifecycle management strategies and mainframe investments now have a lower point of entry system for divisions or locations that require the market proven availability and reliability of a StorEdge 9990, but not the full scalability. The StorEdge 9985 runs the same software and microcode as the StorEdge 9990, so the existing skill sets of IT staff are easily leveraged. The StorEdge 9985 system can help lower the cost of storage for mainframe applications with native mainframe connectivity and support for externally attached SATA devices. In addition, current StorEdge 9970 customers who are ready for a technology refresh will find the StorEdge 9985 a compelling choice.

Selling Highlights

For enterprises facing rapid data growth and multiple, disparate applications, the Sun StorEdge 9985 system can help reduce costs and improve service levels through better management of new and existing storage resources.

Simplified Management — The Sun StorEdge 9985 system's application oriented storage-management utility abstracts storage complexity, enabling users to simplify management by pooling storage resources. Sun refers to this as Multi-Vendor Storage Pooling. With conventional provisioning, it is difficult to know how storage inventory is configured or how much is utilized at any given time, which can prove costly and time-consuming. With the Sun StorEdge 9985 system, however, the boundaries of physical storage devices are abstracted to a *virtual pool* of enterprise-class storage classes and resources that are easily managed, enabling quick and precise provisioning based on application workloads. This can greatly reduce complexity and improve operational efficiencies that translate into cost savings.

Market Proven Availability — The Sun StorEdge 9985 systems has been designed to ensure that the entire system has no single point of failure. Further, should a component in a StorEdge 9985 experience an outage, a redundant component takes over the tasks of a failing component until repaired. All of this is transparent from an application's perspective to the operation of the storage system. The result is Sun is one of the few companies in the industry to offer a 100% data availability guarantee to customers selecting a StorEdge 9900 storage solution for complete protection of their digital assets.

Extreme Performance — The StorEdge 9990 is the industry leading storage platform in terms of performance. This system easily has twice the performance over competitive storage system. The performance of the StorEdge 9985 is expected to be roughly ½ of the StorEdge 9990 and utilizes a the same basic non-blocking crossbar switch at the heart of all StorEdge 9990 system. The resulting throughput of the entire system provides outstanding performance to even the highest I/O intensive transactional applications. Additionally, the StorEdge 9985 offers the ability to partition resources into 8 Virtual Private Storage Machines (VPSMs) to further ensure application quality of service objectives are maintained.

Highly Flexible Configuration Options — The StorEdge 9985 system can be tailored to fit the most complex customer environment. The front-end connectivity to servers is supported through Fibre Channel, and Ethernet, as well as ESCON and FICON (available in phase II), permitting concurrent attachment to open system servers and mainframe systems.

Lower Cost Business Continuity — Complimenting the StorEdge 9985 system is a suite of business continuity software, ensuring that all essential data managed by a 9985 is fully protected. Organizations who have build business continuity and disaster recovery plans based on Sun StorEdge 9990 systems may be able to lower costs by deploying a StorEdge 9985 at the replication site if the full scalability of a StorEdge 9990 is not required. The StorEdge 9985 can be used with two point-in-time local copy protection packages – StorEdge 9900 ShadowImage In-System Replication and StorEdge 9900 Copy-on-Write Snapshot. To support remote replication of data, the StorEdge 9990 offers the StorEdge 9900 True Copy Remote Replication software that permits both synchronous and asynchronous data replication across StorEdge 9985/9990 systems. Universal Replicator is the next generation beyond TrueCopy and offers disk-based journaling, off-loading of cycles from the production site via pull technology, and well as improved mitigation of link failures.

Controller-based Data Services — The Sun StorEdge 9985 system boosts application performance and creates operational efficiencies by delivering data services without diverting compute or storage resources from their intended purpose, which can help lower the total cost of ownership (TCO). Traditionally, data services delivery is either array-based or host-based. In the first case, data services are delivered via the data path, which can negatively affect application performance. In the second case, CPU cycles are consumed that could be dedicated to processing transactions. With the Sun StorEdge 9985 system, data services are system-wide and have dedicated compute resources existing outside of the data path and independent of the host, improving application performance.

- **Supports Implementation of “Service Provider” Business Models**

By Complementing Dynamic System Domains (DSD) provided by Sun Servers as well as Solaris Containers, the StorEdge 9985 systems's Virtual Private Storage Machines (VPSM) support customer's initiative's to implement “Service Provider” Business Models. (note, DSDs are a form of server partitioning).

Partner Business Proposition

The Sun StorEdge 9985 system provides System Integrators (SI's) and Value Added Resellers (VAR's) building complex business continuity and disaster recovery solutions based on the Sun StorEdge 9990 system a lower cost replication target for secondary and tertiary sites. The Sun StorEdge 9985 system also protects SI's and VAR's StorEdge 9900 installed base since it has full compatability with the entire StorEdge 9900 software suite. In addition, the StorEdge 9985 system can help lower the total cost of solutions which include mainframe-based applications since it has native mainframe connectivity (FICON and ESCON).

Target Applications

The highly flexible architecture of the Sun StorEdge 9985 system provides a mix of optimal performance and availability for business-critical applications such as database, technical computing, and messaging.

Databases — Online Transaction Processing (OLTP) and Decision Support Services (DSS)

Databases for online transaction processing (OLTP) are performance-hungry business applications characterized by very high amounts of small, random, non-sequential read and write transactions within concentrated periods.

The Sun StorEdge 9985 system provides high application performance through 2-gigabit per second, full-fabric Fibre Channel ports and 32 GB of data cache. With more than 35 TBs of internal capacity, the Sun StorEdge 9985 system is an unsurpassed enterprise storage solution for multiple high-performance applications.

Messaging — Electronic Mail

Email applications combine the workload characteristic of OLTP and DSS databases. I/O is highly random and therefore unpredictable, and record sizes range from small text-only messages to large messages with file attachments. These environments require a storage system capable of performing both transaction-heavy and throughput-heavy I/O.

The Sun StorEdge 9985 system can be scaled to optimize I/O request operations, data movement, or a combination of both. I/O optimization does not sacrifice data protection, making this system an ideal storage solution for messaging applications.

Mission-Critical Environments

As more and more data becomes mission critical and an increasing number of businesses need data access 24 hours per day, data availability is more important than ever.

In order to meet the high availability (HA) characteristics required in mission-critical environments, the Sun StorEdge 9985 system storage trays are designed to be fully redundant and available. Hot-swap, redundant RAID controllers, disk drives, cache, interconnect cards, data paths, mid-planes, power supplies, and cooling fans work in tandem to provide high levels of stability and data protection. In addition, the storage tray's RAID controller is equipped with enough embedded battery power to completely de-stage cache to disk in case of power failure for maximum data integrity. In event of power failure, the batteries of the system will maintain full operation for 20 milliseconds (e.g. read/write operations proceed and disk drives continue spinning). After 20 milliseconds, data in data cache and shared memory will be sustained by battery power for 36 hours. A manual de-stage operation from cache to disk can be initiated during this timeframe.

The Sun StorEdge 9985 system's *no single point of failure* architecture (through embedded dual fabrics and total redundancy), combined with Sun StorEdge Traffic Manager Software (SSTM) software on the host, also offers ease of deployment while maintaining a high level of data protection.

In addition, the Sun StorEdge 9985 system is even more suitable for mission-critical environments with its ease of management and multi-platform connectivity features.

Storage Consolidation

The problem faced by many business executives in today's IT environment is their ability to manage exponential storage growth at reduced IT budgets. By consolidating storage needs onto a Sun StorEdge 9985 solution, customers can achieve higher levels of storage utilization, improve availability and scalability of storage environments, enhance management of storage infrastructures, and simplification of business continuity needs to protect critical data assets, all at effectively lower costs.

With the StorEdge 9985's unique ability to manage other heterogeneous storage systems through aggregation of these resources under one “umbrella” (external storage), the StorEdge 9985 takes storage consolidation to the next level.

Data Warehousing / Business Intelligence

Over the past decade, data warehousing and business intelligence has emerged as a “must-have” solution for myriad of business challenges – from addressing the need for consistent information across the enterprise to enabling rapid response to business change. Today, companies considering data warehouse / business intelligence deployments face an evolving array of architectures, solutions and tools from which to choose.

The Sun StorEdge 9985 system is the ideal storage platform for implementing data warehousing and business intelligence solutions. A StorEdge 9985 provides heterogeneous connectivity and offers extreme levels of availability, performance and security for the largest data warehouse / business intelligence environments. The Sun StorEdge 9985 system incorporates the highest levels of scalability, along with virtualization and blade architecture to add easily capacity as data demands of a warehouse increase. The Sun StorEdge 9985 series systems are ideal for data warehouse SAN solutions and as storage companions to Sun Fire 25K and Sun Fire 20K servers, underscoring the value of Sun's complete systems approach to meeting customer needs.

Data / Information Lifecycle Management

One of the next big things in the storage industry is data lifecycle management (DLM) and information lifecycle management (ILM). Simply stated, data lifecycle management allows for the correct storage of data based on the data's information value. Information lifecycle management extends this concept through the grouping of data and storage into classes and migrating data based on established policies from one storage device to another. Data and information lifecycle management has become critical to companies for compliance and regulatory reasons.

A Sun StorEdge 9985 is an ideal storage system from a data / information lifecycle management perspective. With the StorEdge 9985's ability to support other heterogeneous systems through aggregation or pooling storage resources under a single 9985 system, critical digital assets can be maintained on the StorEdge 9985 and less critical digital assets can be migrated to lower-cost storage systems managed by the StorEdge 9985. Adding to this software support for hierarchical storage management, such as Sun's StorEdge SAM-FS and StorEdge QFS products, the Sun StorEdge 9985 becomes the answer to an enterprise's information lifecycle management needs.

Business Continuity

With outstanding reliability and availability characteristics, the StorEdge 9985 is an enterprise's answer to providing complete data protection for their critical data assets. The StorEdge 9985 system compliments its data availability through a suite of business continuity software, ensuring that all essential data managed by a StorEdge 9985 is fully protected. The StorEdge 9985 provides two point-in-time local copy protection packages – StorEdge 9900 ShadowImage In-System Replication and StorEdge 9900 Copy-on-Write Snapshot. To support remote replication of data, the StorEdge 9985 offers StorEdge 9900 True Copy Remote Replication that permits both synchronous and asynchronous data

replication across StorEdge 9985 systems. Finally, new to the StorEdge 9985 is the StorEdge 9985 Cross-System Copy that supports data replication across heterogeneous storage systems.

Product Specifications

Product Overview

The StorEdge 9985 intelligent storage systems are the most powerful enterprise systems in the industry today and are two generations ahead of the competition. The architecture used in the StorEdge 9985 Series has over 1.5 the bandwidth of our earlier enterprise entry system 9970. From an introductory overview perspective, key features of the StorEdge 9985 are:

- Next generation non-blocking switch architecture
- Up to 32GBs of internal data cache and up to 6GBs of internal control memory. Data cache will be doubled to 64 GB in the future.
- Increase of aggregated bandwidth from 7.9GBs in the StorEdge 9970 to 12GB/s in the StorEdge 9985 – approximately 1.5 X or 150% improvement.
- New in the SE 9985 is a "Mixed Adapter" board which combines both FED and BED on a single printed circuit board. The overall result is 16 FC FED ports and 8 BED FCAL loops.
- Data cache, Shared memory, and cache switches are now integrated on a single printed circuit board
- Up to 8 back-end Fibre Channel Arbitrated Loop (FC-AL) connections
- Support for up to 120 (240- future) internal disk drives consisting of 73GB, 2Gbps FC-AL, 15Krpm disk drives; 146GB, 2Gbps FC-AL, 10Krpm disk drives; and/or 300GB, 2Gbps FC-AL, 10Krpm disk drives. 145 GB 15K are in the future.
- Configurable for Fibre Channel and iSCSI storage area network (SAN), network attached storage (NAS), and IBM zSeries mainframe environments; iSCSI is a future.
- Support for Fibre Channel, Gigabit Ethernet.
- Up to 48 Fibre Channel ports, 16 ESCON ports (future), 8 FICON ports (future), or 8 NAS ports are supported
- A integrated NAS Blade Feature is available.

StorEdge 9985 Architecture Block Diagram

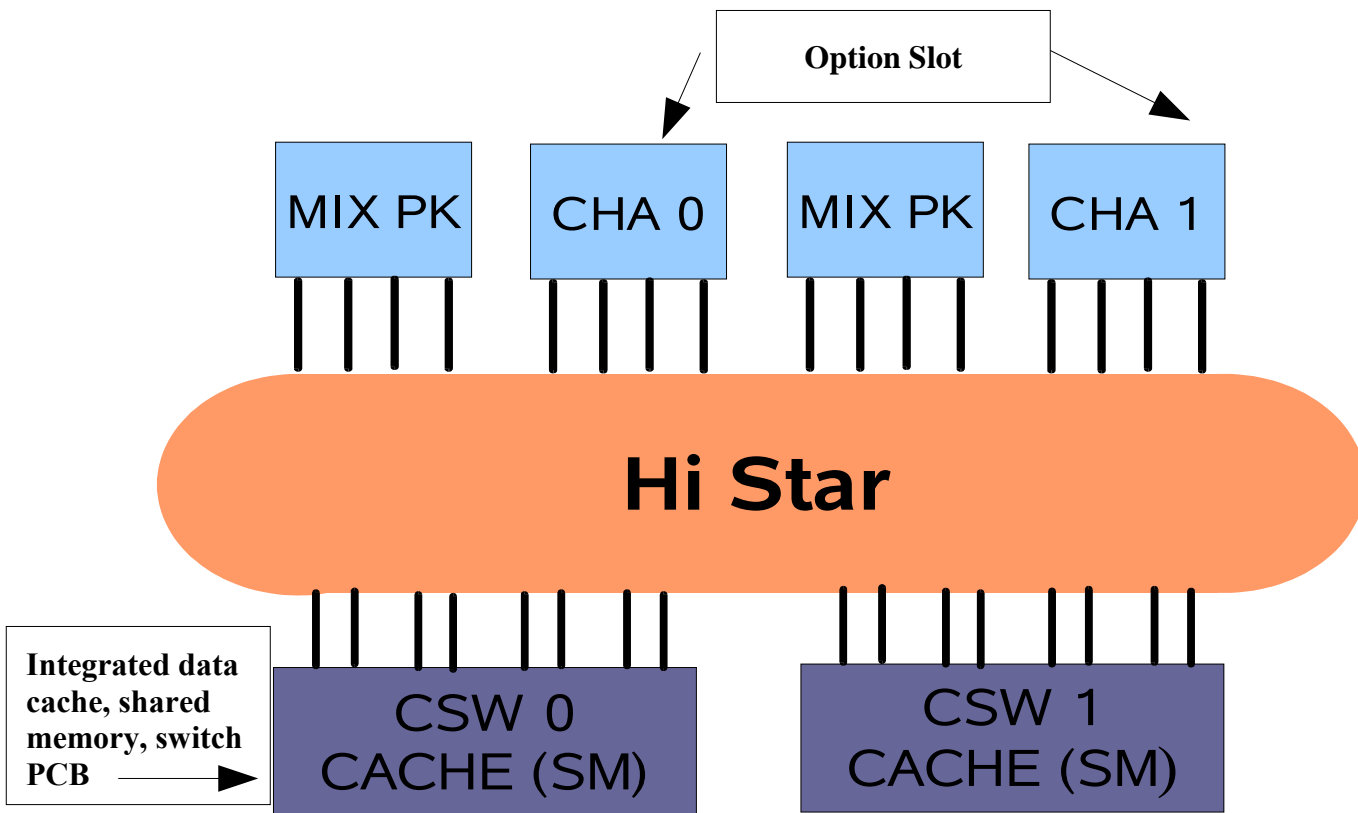


Figure 2: Sun StorEdge 9985 Architecture Block Diagram

Sun StorEdge 9985 Packaging

The StorEdge 9985 system consists of a single modular rack in Phase I release of this product. In phase II, an additional rack will be available. The rack itself is a standard 19' rack. The first rack contains 120 disk drives, and the second rack will contain another 120 disk drives. Therefore at the completion of phase II release of this product, the SE 9985 will be able to hold 240 disk drives. The rack is an integrated and tested part of the entire SE 9985 product. The subsystems may not be sold separately outside of the integrated rack. To do so would constitute breach of contract with our supplier. Therefore, do not sell the internal subsystems separately from the rack.

A StorEdge 9985 system can be seamlessly and non-disruptively upgraded through the addition of:

- An additional rack
- Front-end directors (previously referred to as channel host adapters or CHAs)
- "Mixed Adapters" which are combination of FED and BED
- Integrated data cache, shared memory, and switch boards.
- Disk Drives.

Integrated Modular Rack

The StorEdge 9985 modular rack is the heart of each StorEdge 9985 system. Inside each rack are the following:

- Six adapter slots.
- Integrated data cache, shared memory, and switch boards, mirrored. Contained on this board is up to 32 GB of data cache, up to 6 GB of shared memory. The cache switch is also located on this board.
- "Mixed Adapters" which are combination of FED and BED. This board provides 16 FC FED ports and 8 BED FCAL ports.
- FC Front-end directors (previously referred to as channel host adapters or CHAs). These come in either 16 or 32 port versions. This particular component is the same as used on the SE 9990.
- The SE 9900 NAS Blade may also fit in the NAS "Options Slot"
- In the future, ESCON and FICON and possibly iSCSI adapters will become available and fit in the "Options Slot"
- The primary rack can contain up to 120 disk drives.
- The SE 9985 contains one service processor (SVP). The number of SVPs cannot be increased beyond one.
- Redundant power supply modules. The SE 9985 power supply modules are different than those used by the SE 9990.
- Redundant battery backup modules. The SE 9985 battery backup modules are different than those used by the SE 9990.
- Cooling fans.
- The physical dimensions of the StorEdge 9985 control/array frame are:
 - Height: 1, 920 mm
 - Width: 610 mm high
 - Depth: 925 mm

SE9985 – Phase 1 Hardware Structure

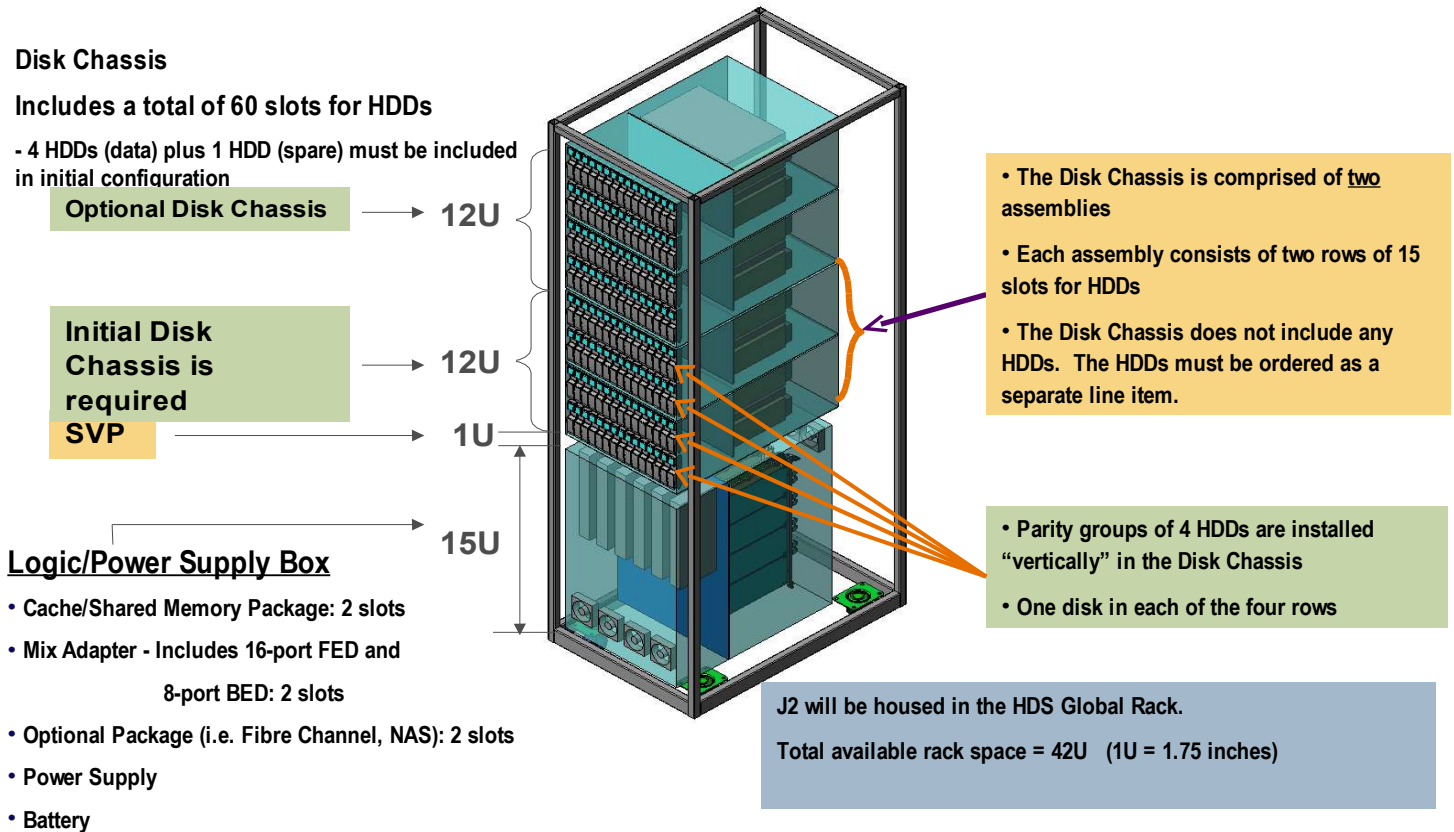


Figure 3 – Primary Modular Rack

Second modular rack (Future)

The primary modular rack of the StorEdge 9985 system can contain up to 120 disk drives. The disk drives are arranged in 8 drive trays each containing 15 disk drives. Additionally, each array frame contains cooling fans, redundant power supply modules, and redundant battery backup modules. The total capacity of both the first rack and second rack together are 240 disk drives.

The physical dimensions of each StorEdge 9985 array frame are 1920 mm high, 610 mm wide, and 925mm deep.

SE9985 – Phase 2 Hardware Structure - Additional 120 HDDs in Secondary Rack

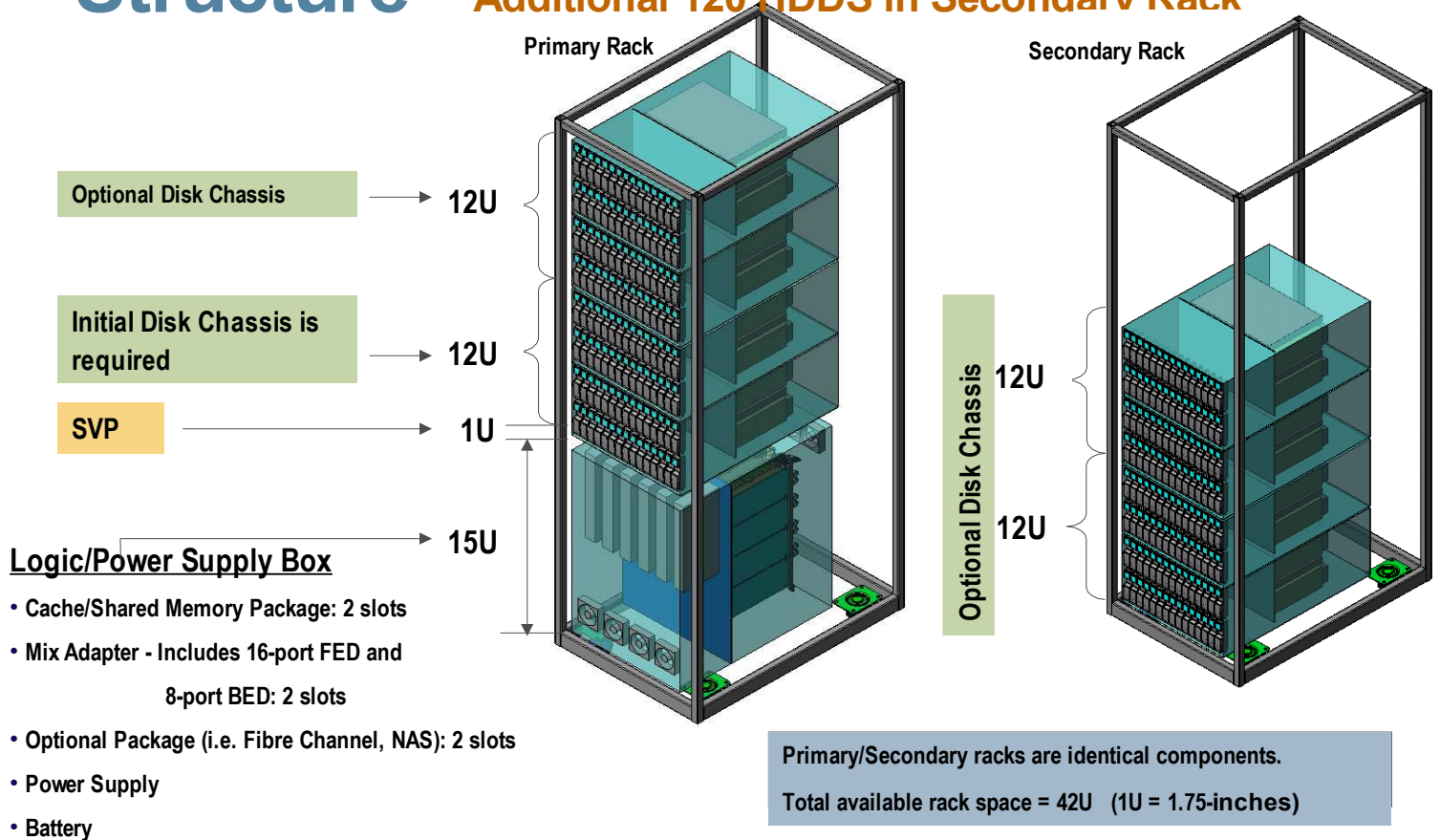


Figure 4 – Second Modular Rack

SE 9985 Cache Switch

Generally speaking, a higher level integration is manifested at the printed circuit board (PCB) in the SE 9985. Specifically the cache switch, data cache, and shared memory are integrated into a single PCB which is then mirrored. The net result is two redundant PCBs, each containing a cache switch, data cache, and shared memory.

The internal StorEdge 9985 switch architecture consists of two separate networks: the cache hierarchical star network and the control memory hierarchical star network. The cache hierarchical star network is the network which transfers data to and from the main global data cache at a rate of 8.5GB/s. The second network is the control memory hierarchical star network. This is a point-to-point network that handles the exchange of control information between the processors and control memory and transfers data at a rate of 3.5GB/s. The total aggregate data rate supported by this next switch is 12GB/s. Control memory contains information about the status, location, and configuration of the cache, the data in the cache, and the configuration of the StorEdge 9985 Series system (as well as other information related to the operational state of the system). Two shared memory areas are mirrored images of each other. Essentially, control information is handled “out of band” from the data paths, both through a separate memory area and network.

The StorEdge 9985 next generation switch can support up to 32GBs of data cache (64GB in the future), all directly addressable. Separate Shared Memory modules, up to 6GBs, are used to contain meta (also known as control data). Competitive systems use their cache for both data and control information, limiting the amount of usable data cache and creating performance limitations for certain workloads.

On top of this next generation switch, the StorEdge 9985 system has advanced cache algorithms and software solutions to provide exceptional performance.

Data Cache on the integrated Switch/Cache/Shared memory PCB

This memory is used to cache read and write requests from the attached storage arrays. In the initial release, this memory is packaged on the Integrated Switch/Cache/Shared memory PCB. A physical location on the Integrated Switch/Cache/Shared memory PCB contains from 4GBs to 16GBs of ECC data cache memory. Two of these Integrated Switch/Cache/Shared memory PCBs comes standard with the system for full redundancy, and provides a total of 32 GB of data cache at Phase I release. There are no additional slots for data cache. Future increases in amounts of data cache will be due to increases of memory density. Data cache memory is available in 4GB increments. Thus, a fully populated data cache in the StorEdge 9985 contains 32GBs of ECC memory (64 GB in the future). The board labeled "CSW0 Cache (SM)" is the "Integrated Switch/Cache/Shared memory PCB".

These pair of PCBs must be placed in dedicated slots 1C and 2D. This adapter can be used only in the SE 9985.

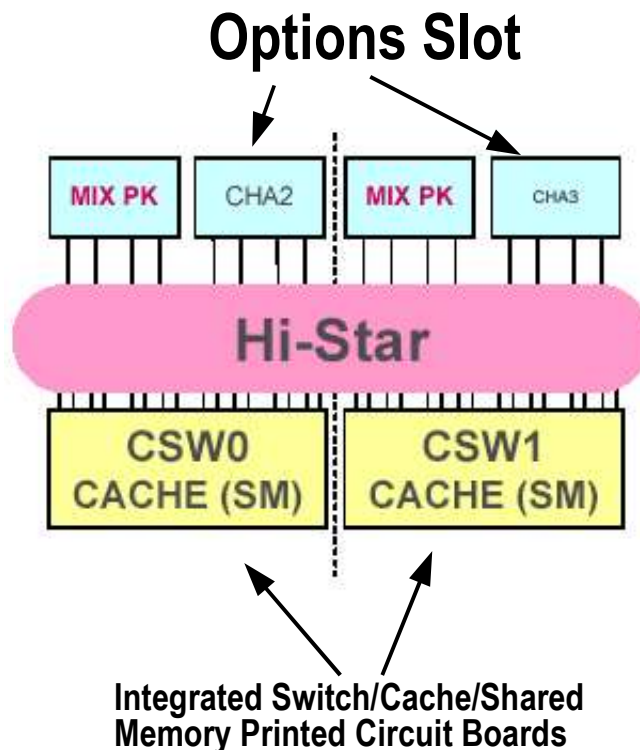


Figure 5 Block Diagram

Shared Memory

As stated above, the Shared memory contains status information regarding the operation of a StorEdge 9985 system. Shared memory is now integrated on the same PCB as the cache switch and data cache. Again, there are two integrated switch/data/shared memory PCBs (for redundancy) and each PCB can contain 1GBs of ECC memory. Thus, in a minimum system configuration there is 2 GBs of ECC control memory and on a fully populated system there is 6GBs of ECC shared memory.

Input/Output : Front End Directors (FED) and Back End Directors (BED)

There are six adapter slots. Of these six slots, two are reserved for the Mixed Adapter, two are reserved for the integrated data cache/shared memory/switch board, and two are referred to as the "Options" slot into which a FED, NAS Blade, FICON, ESCON Adapters can be placed. Note, each feature, such as a Mixed Adapter, NAS Blade, or FED, actually consists of two printed circuit boards which reside in two different slots in two different hardware clusters.

In the future, the ESCON and FICON and possibly iSCSI adapters will become available and fit in the "Options Slot"

In summary, there are (or will be in the future) five types of front-end directors for the StorEdge 9985 for customizing the system to support customer requirements.

- Mixed Adapter (combination FED and BED)
- Fibre Channel (FC FED)
- NAS Blade Feature
- FICON Feature (Future)
- ESCON Feature (Future)
- iSCSI Blade Feature (Future)

StorEdge 9985 Mixed Adapter Features

"Mixed Adapters" which are combination of FED and BED. The "Mixed Adapter" provide 16 FC FED ports and 8 BED FCAL ports. These fit in dedicated slots 1A and 2F. This adapter can be used only in the SE 9985.

StorEdge 9985 Fibre Channel Feature

The StorEdge 9985 Fibre Channel Feature consists of a channel host adapter pair and occupies two slots in a StorEdge 9985 modular rack. This feature is also referred to as a FC Front End Director, or FED. This adapter is offered in two configurations – 16 Fibre Channel ports or 32 Fibre Channel ports. Both configurations utilize Gigabit Interface Converters (GBICs) to connect to Fibre Channel cabling. Both configurations support short-wave GBICs and long-wave GBICs can be intermixed. Both come fully populated with GBICs.

The 16 port version contains 4 CPUs at 400 MHz each. The 32 port version has 8 CPUs running at 400 MHz. There are no plans for 800 MHz versions.

Please note that Front-end directors have in the past been referred to as channel host adapters or CHAs. This adapter fits in the "Options Slot, slots 1B and 2E. These Front End Directors can be used interchangeably with the SE 9990.

SE 9990 NAS Blade Feature

The SE 9990 NAS Blade Feature also fits in the The StorEdge 9985. The NAS Blade Feature consists of an adapter pair and occupies two slots in a StorEdge 9985 modular rack. There are a total of eight 1Gbps Ethernet ports per NAS blade. CIFS and NFS NAS protocols are supported A maximum of 8 Ethernet ports are supported on a single StorEdge 9985 system.

The NAS blade feature was released May 3, 2005. This Feature consists of two boards with active-active failure-over which are placed the SE 9985 "Options Slot". Each SE9900 NAS Blade contains a Pentium 4 microprocessor with 4GB of memory and is equipped with 4 Gigabit Ethernet (GbE) ports with a rated throughput of 100 MB/sec. This means that a "feature(two boards) " provides eight GbE ports.

Performance will vary according to actual workload. Each SE9900 NAS Blade leverages the data cache which comes with the associated SE99xx Storage Array. The cache for processing of NAS files is not on-board the SE9900 Blades itself. Both NFS and CIFS files systems are supported. Enterprise Class Data

Protection - Point-In-Time Copy (or Snapshot) capability is provided through integrated SyncImage (integrated snapshot software with copy on write capability) technology. Integration of Sync Image, ShadowImage and TrueCopy enables the implementation of a data protection architecture that is unattainable on currently available standalone file servers. For virus protection, the SE 9990 NAS Blade Feature interfaces with Symantec Anti-Virus Search Engine (SAV SE) to guard against infection by viruses. (Note, customers purchase SAV SE from Symantec or an authorized Symantec reseller)

Please refer to SE 9990 NAS Blade Sun Intro Token # 439960 for more information.

StorEdge 9985 FICON Feature (future)

The StorEdge 9985 FICON Feature consists of a channel host adapter pair and occupies two slots in a StorEdge 9985 modular rack. This is also referred to as a FICON Front End Director or FED. This adapter provides 8 FICON ports operating at full duplex data rates of 200MBps or 400MBps (1Gbps or 2Gbps) for connection to IBM zSeries mainframe environments. The FICON adapter supports both short-wave and long-wave, they cannot be intermixed.

The FICON front-end director feature will be enhanced to support up to 16 FICON ports operating at 4Gbps. There are 8 microprocessors operating at 400 MHz.

StorEdge 9985 ESCON Feature (future)

The StorEdge 9985 ESCON Feature consists of a channel host adapter pair and occupies two slots in a StorEdge 9985 modular rack. This is also referred to as a ESCON Front End Director or FED. This adapter provides 16 ESCON ports operating at full duplex data rates of 400Mbps for connection to IBM zSeries mainframe environments. The FICON FED contains 8 microprocessors running at 400 MHz.

StorEdge iSCSI Blade Feature

The iSCSI blade feature is a future. Details of this feature will be made available upon release.

Back-End Directors (BED)

The only BEDs available with the SE 9985 are the 8 FCAL ports provided on the mixed adapter. This board has 4 microprocessors operating at 400 MHz. The BED adapters used in the SE 9990 may not be used in the SE 9990.

Service Processor (SVP)

The SE 9985 contains up to 1 SVP. A second SVP may *not* be added. The SVP in the SE 9985 and the SE 9990 are different in terms of form factor, power connectivity, and component. The SE 9985 contains an internal LAN switch built into the SVP along with a PCMCIA LAN card which is cabled into the internal LAN switch built into the SVP. The SVP for the SE 9985 contains a 2.0 GHz Intel microprocessor, 512 MB memory, 20 GB disk, a RS-232C serial port, and two USB ports with a Microsoft Windows Professional XP operating system. A keyboard and display are not provided with the System. Sun Service has already addressed the issue of interfacing with the SVP.

Just like in the StorEdge 9990 system, the base service processor (SVP) is integrated with the modular rack instead of relying on a laptop PC, as was the case with the the StorEdge 9970 and StorEdge 9980 systems. This ensures a consistent platform for all systems and simplifies the support process. Only 1 SVP can be configured with 9985, and this SVP is different from the SVP contained in the SE 9990.

Security Issues

It is generally recommended that the SVP be administered on a private management network. By doing this, the SVP is protected from the public internet or open corporate networks, which have a high risk of transmitting viruses.

However, customers have raised several security issues. Most of these issues are general in nature.

Installation of Anti-virus software

The first security issue is associated with viruses infecting the SVP. This usually occurs when the SVP is placed on an open corporate network which has either a known or "unknown" connection to the internet. With respect to the term "unknown", this means that the customer may not know that a system on the a supposedly private network is actually on the public internet, and may actually be infected and spreading viruses across a supposedly secure private network. In this scenario, installation of anti-virus software is a recommended, pro-active measure which can mitigate the risk associated with this situation.

Please refer to the following Sun Service Bulletin to secure the SVP with anti-virus software.

<http://sejsc.ebay/almain.html#SECURITY>

Trade Offs Between Placement of the SVP on a Private Network in Context of Remote Administration.

It is generally recommended that the SVP be administered on a private management network. By doing this, the SVP is protected from the public internet which has a high risk of transmitting infection.

However, many customers have chosen to administer their systems remotely. If this occurs, then the security problem should be reframed as a general network security, administration, and integration issue. The issue may also be framed as a trade off between being secure on a private network versus opening up to an open corporate or even the public internet, which increases security risks.

Therefore utilizing remote administration across open corporate networks or the public internet surfaces a new set of challenges in context of general network security, administration, and integration issues instead of a narrowly focused SVP issue.

Please ensure that encryption is turned on with respect to avoidance of having password being transmitted in the clear. To address that issue, the Apache Server residing on the SVP should be -installed with SSL enabled.

Please refer to the following manual for guidelines

- OpenSA Manual, see chapter 5
- <http://subdude.central.sun.com/toi/hds/9990manual/21web.pdf>
- Encrypted Communications User Guide MK94RD168-01
- The ISO image of "Open SA CD" and also zip file is posted at <http://se9990/eng/ssl/>
- These two files can also be found on sunsolve.sun.com under /coresdirectory.

There can be some challenges re-installing the Apache Web server with SSL enabled. Pls. contact ken.ow-wing@sun.com to direction to the appropriate resources which can assist you.

For those customer who strongly prefer to engage in remote administration, please check with Ken.Ow-Wing@Sun.com for the latest in terms improvement to security on this system.

Additional Monitoring Capability:

Introduced with the Sun StorEdge 9990 system is the ability to monitor new StorEdge 9990 performance data through the SVP. The same capability is provided for the SE 9985. The statistics about the performance of a StorEdge 9985 include:

- Cache Usage Information
 - Cache use Rate (%)
 - Cache Write Pending Rate (%)

- Case Read Rate (%)
- Cache Side File Rate (%)
- Cache Side Asynchronous File Rate (%)
- Cache Side Universal Replicator Rate (%)
- Processor Usage Information
 - Processor Work Rate (%)
- Logical Device Usage Information
 - Transaction Rate (IOPS)
 - Transfer Rate (GB/s or MB/s)
- FICON Usage Information (future)
 - Read Data Transfer Rate (MB/s)
 - Write Data Transfer Rate (MB/s)
 - HTP Processing Rate (%)
- Fibre Channel Usage Information
 - Loss of Signal Count
 - Bad Received Character Count
 - Loss of Synchronization Count
 - Link Failure Count
 - Received EOFs Count
 - Discarded Frame Count
 - Bad CRC Count
 - Protocol Error Count
 - Expired Frame count

Additionally, each service processor contains an industry standard 18-pin monitor connector, USB mouse port, and keyboard port. These interfaces provide connections to an external monitor, mouse, and keyboard, respectively. Use of external monitor, mouse, and keyboard is a secondary is not recommended except in a recovery situation. To install, the monitor, mouse, and keyboard a re-boot of the SVP is required, and this operations is not recommend. A separate PC type of device is recommended as the preferred access method. Sun Enterprise Services has the recommended specifications for the PC type of device.

Disk Drives

- The primary rack can contain up to 120 disk drives. These disk drives fit into two "disk chassis ",each of which can contain up to 60 disk drives; these two disk chassis occupy the upper portion of the rack. Within each of these disk chassis are assemblies which contain two rows (15 disk drives each). Therefore each "disk chassis" contains up to 60 disk drives. Since there are up to two chassis in the primary rack, maximum disk drive capacity is 120 disk drives. A different method is used to arrange disk drives in parity groups. Parity groups of 4 disk drives are installed vertically in the disk drive chassis.

All disk drives contained in a StorEdge 9985 system are dual-ported bi-directional 2Gbps FC-AL drives and are configured as active-active. At initial product release, three disk drives are available:

- 73GB / 15Krpm disk drive
- 146GB / 10Krpm disk drives
- 300 GB/ 10K disk drives

RAID Support

- RAID1 (2D + 2D)
- RAID5 (3D + 1P)
- and RAID6 (6D +2P)

At Revenue Release July 12, 2005, the SE 9985 will not support the following:

- RAID1 (4D + 4D) and
- RAID5 (7D +1P).

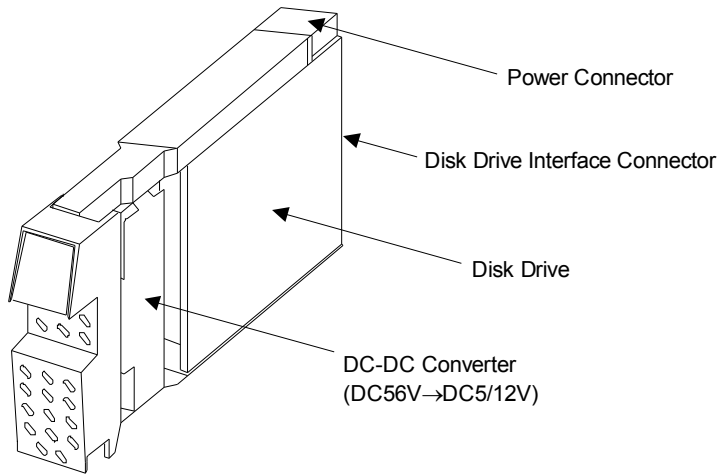
There is a maximum of 16 Global Spares.

Specific disk drive specifications are as follows:

Item		72GB/15k	146GB/10k		
Disk Drive Model Name	Seagate	DKS2C-K72FC	-	-	
	HGST	-	DKR2E-J146FC	DKR2F-J146FC	-
Capacity/HDD		71.50GB	143.76GB		
Diameter of disk (inch)		2.5	3	3	
Number of heads		8	10	5	
Number of disks		4	5	3	
Seek Time (ms) (Read/Write)	Minimum	0.4/0.6	0.5/0.7	0.4/0.45	
	Average	3.8/4.2	4.9/5.4	4.7/5.1	
	Maximum	6.7/7.1	10.0/11.0	10.0/11.0	
Average latency time (ms)		2.01	2.99		
Revolution speed (min ⁻¹)		14,904	10,025		
Interface data transfer rate (MB/S)		200	200		
Internal data transfer rate (MB/S)		74.5 to 111.4	57.3 to 99.9	72.73 to 134.44	

Item		300GB/10k	
Disk Drive Model Name	Seagate	-	DKS2D-J300FC
	HGST	DKR2F-J300FC	-
Capacity/HDD		288.20GB	
Diameter of disk (inch)		3	3.3
Number of heads		10	8
Number of disks		5	4
Seek Time (ms) (Read/Write)	Minimum	0.4/0.45	0.65/0.85
	Average	4.7/5.1	4.9/5.5
	Maximum	10.0/11.0	9.8/10.4
Average latency time (ms)		2.99	
Revolution speed (min ⁻¹)		10,025	

Interface data transfer rate (MB/S)	200	
Internal data transfer rate (MB/S)	72.73 to 134.4 *2	58.75 to 114.13



In the canister that is mounted with the HDD above, the DC-DC converter, which converts 56V DC to 5V and 12V DC used by the HDD, is installed.

All disk drives are over-engineered for extended life and the drive's firmware can be updated non-disruptively. All disk drives can be replaced with no disruption to the system.

With a maximum of 120 disk drives total, the total internal system raw capacity of a single StorEdge 9985 system is 35 TBs in Phase I, and 240 disk drives with capacity of 72 TB in phase II.

300 GB Disk Drives and RAID 6

The introduction of 300 GB 10K disk drives has attracted a considerable amount of interest from the Sun field. Additional complexities are associated with the 300 GB disk drives include the following:

- RAID 6 (6+2) is required
- Performance considerations associated with RAID 6
- The amount of shared memory required will vary according to the capacity associated with the installed 300 GB disk drives. Please refer to the SE 9985 maintenance manual, which is available only to authorized support personnel.

The reason why RAID 6 is required with 300 GB drives is to protect against double disk drive failures.

As larger disk drive capacities are achieved (such as with 300 GB), the total amounts of data which would need to be recovered increases. The recovery time increases commensurately with the amount of data being recovered. As the recovery time lengthens, some customers are concerned that if a second disk drive fails, their ability to recover their data would be lost.

RAID 6 is similar to RAID 5 as blocks of data and parity information are striped across an array of drives, except that in a RAID 6 implementation there are two sets of parity information striped across an array of drives. This duplication is solely to improve fault tolerance – RAID 6 can handle the failure of any two drives in the array while other single parity RAID levels can handle at most one fault.

Performance-wise, RAID 6 is generally slightly worse than RAID 5 in terms of write operations due to the added overhead of more parity calculations, but may be slightly faster in random read operations due to the spreading of data over one more disk. The StorEdge 9900 will support RAID 6 sets as 8-drive stripe depth (6 data drives + 2 parity drives).

For these reasons additional information and focus is provided below.

The 300GB 10K RPM HDD (288.20GB unformatted, raw) achieved general availability May 3, 2005 for the SE 9990. This drive is also used in the SE 9985. The new disk drives extend the maximum internal storage capacity of the SE 9985 to 35TB (un-formatted, raw) in phase I, and 72 TB in phase II.

At Revenue Release, July 12, 2005, RAID-6 (6D+2P) is required with 300 GB disk drives. The new disk drive, part number DKU-F505I-300JSR, is the next generation of high speed, large capacity disk drive. The disk drives are manufactured by Hitachi Global Storage Technologies, the worldwide leader in the 10K RPM disk drive market and they are fully compatible with all models of the SE 9985. The new optional disk drives dramatically increase the total internal storage capacity when compared to the current 73GB and 146GB drive options. The new maximum capacity is increased to 35 Tbs. This new RAID level provides the ability to recover 100% of the data even when any two of the eight disk drives in the parity group have failed. Due to their larger capacity and their proportionally longer rebuild time, the RAID-6 configuration provides an additional protection against possible data loss in the event of a second drive failure during the longer rebuild time.

300GB HDDs and RAID-6 are supported with microcode level 50-03-68 or higher.

Additional RAID levels and striping sizes are under consideration and further information will be provided when available.

3. Comparing RAID levels

The following are guidelines for comparing the characteristics of several RAID levels.

3.1 Space efficiency

RAID level	Space efficiency (User area/Physical capacity)	Note
RAID1 (2D+2D)	50.0%	Due to mirroring
RAID5 (3D+1P)	75.0%	Ratio between Data HDD and Parity HDD 6D+2P is the same as 3D+1P
RAID5 (7D+1P)	87.5%	
RAID6 (6D+2P)	75.0%	

3.2 Maximum performance

The following table shows the maximum performance (in the case of HDD bottleneck) for each RAID group (RAID1(2D+2D) is 100%). Note that we normally configure systems in customer environments so that HDD bottleneck would not occur. Therefore, the ratio is not always as shown in the table below.

RAID level	Random Read, Sequential Read	Sequential Write	Random Write
RAID1 (2D+2D)	100%	100%	100%
RAID5 (3D+1P)	100%	150%	50%
RAID5 (7D+1P)	200%	350%	100%
RAID6 (6D+2P)	200%	300%	66.7%
Note	Proportional to the number of HDDs	Proportional to that of data HDDs	(※)

※ Difference between performance in RAID6(6D+2P) and that in RAID5(7D+1P)
RAID6(6D+2P) needs to process 1.5 times^(*) more HDD I/Os than RAID5(7D+1P).

In other words, the Random Write performance in RAID6 (6D+2P) is lower than that in RAID5 (7D+1P) by 33%.

- *: - The number of HDD I/Os in RAID5 Random Write: 4
(Old data/old parity reads, new data/new parity writes)
- The number of HDD I/Os in RAID6 Random Write: 6
(Old data/old parity (P)/old parity (Q) reads, new data/new parity (P)/new parity (Q) writes)

Power Specifications

The SE 9985 supports the following power specifications:

Single Phase 30 AMP and 50 AMP available Worldwide

60 Hz: 200V, 208V, 230 V at 30 Amps

50 Hz: 200V, 220V, 240 V at 50 Amps

The SE 9985 does not support 3 phase power.

All power supplies are dual power supplies and are hot-swappable

Specific plug and receptacle configurations and part numbers are specified in the StorEdge 9985 installation guide.

For environmentals, please go to the following URL:

<http://pts-storage.west/products/T99x0/documentation.html>

For power plug description, please refer to the following URL.

<http://pts-storage.west/products/T99x0/docs/user/9985/user/rd2310.pdf>

Page 110 (doc) Page 126 (Acrobat viewer)

Battery Backup

To provide complete protection to all data, the StorEdge 9985 provides for standard battery backup. With the standard battery backup an I/O operation can be continued and disk drives continue spinning a power failure of 20 milliseconds duration. In the case of a power failure with a duration of longer than 20 milliseconds, it is possible to retain data in both data cache and shared memory with battery backup. A manual de-stage from data cache and shared memory is required at this point. This is a different operation than used in the SE 9990.

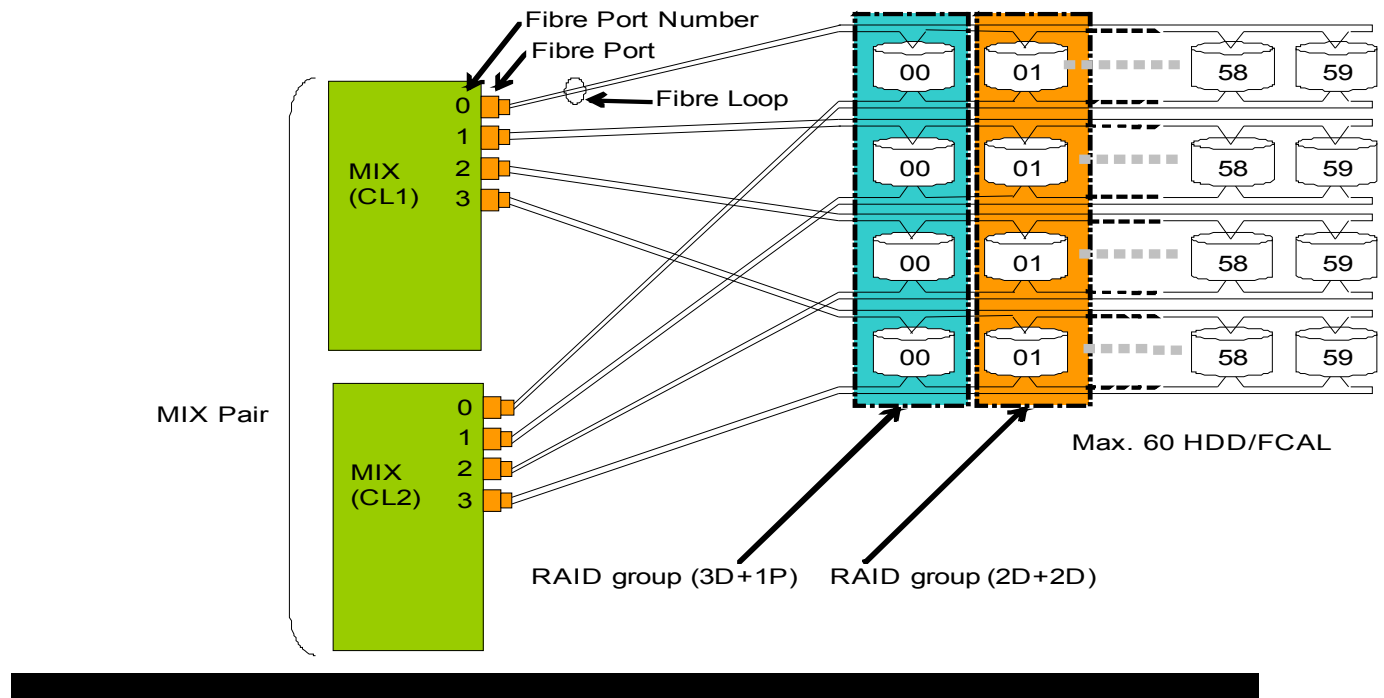
When an external UPS is connected, the destaging can be done for the time specified according to the capacity of the external UPS and the data in the data cache can be with battery backup.

Intermix Configurations

RAID-Level Intermix

RAID technology provides full fault-tolerance capability for the disk drives of the SE 9985. The cache management algorithms (see section) enable the SE 9985 to stage up to one full RAID stripe of data into cache ahead of the current access to allow subsequent access to be satisfied from cache at host channel transfer speeds.

The SE 9985 supports RAID-1, RAID-5, RAID-6, and intermixed RAID-level configurations, including intermixed array groups Figure below illustrates an intermix of RAID levels. All types of array groups (RAID-5 3D+1P; RAID-1 2D+2D; RAID-6 6D+2P) can be intermixed within the SE 9985.



Hard Disk Drive Intermix

The SE 9985 supports an intermix of all HDD types within the same subsystem with the following condition: All hard disk drives (HDDs) in an array group (parity group) must be of the same capacity and type.

Device Emulation Intermix

The SE 9985 supports an intermix of all device emulations within the same subsystem.

The Virtual LVI/LUN function (also called CVS) enables different logical volume types to coexist. When Virtual LVI/LUN is not being used, an array group can only be configured with one device type (e.g., OPEN-V or OPEN-3, not OPEN-V and OPEN-3). When Virtual LVI/LUN is being used, you can intermix OPEN-*x* device types within an array group.

Software Solutions

All current Sun StorEdge 9900 software products are supported on the new StorEdge 9985 providing a complete suite of storage management, data/information lifecycle management, and business continuity solutions.

Complimenting the Sun StorEdge 9985 system is a set of specific software offerings providing storage resource management, performance tuning, and business continuity solutions. At the heart of Sun StorEdge 9900 Software Solutions are the Sun StorEdge 9900 Resource Management Suite, Sun StorEdge 9900 Performance Enhancement Suite, and Sun StorEdge 9985 Business Continuity Suite.

StorEdge 9900 Resource Management Suite

The Sun StorEdge software and hardware solutions are managed through the powerful StorEdge 9900 HiCommand Storage Area Management Suite. This management tool substantially lowers total cost of ownership by enabling storage hyper-consolidation and the intelligent remote management of critical information. The business value of centralized, global storage management is to increase business agility through heightened operational excellence and greatly reduced total cost of ownership.

StorEdge 9900 HiCommand Device Manager

The StorEdge 9900 HiCommand Device Manager software provides a single platform for centrally managing, configuring, and monitoring Sun StorEdge 9900 series and any storage product that complies with the Storage Management Initiative Specification (SMI-S) standard set by the Storage Networking Industry Association. By significantly boosting the volume of storage that each administrator can manage, the single point-of-control design of Device Manager software can help raise storage management efficiency in these environments as well as reduce costs.

Easy-to-use Device Manager software views storage resources logically, while maintaining independent physical-management capabilities. By offering a continuously available view of actual storage usage and configuration, Device Manager software allows administrators to precisely control all managed storage systems. The result? Highly efficient use of administrative time and storage assets. When combined with StorEdge 9900 HiCommand Tuning Manager and StorEdge 9900 HiCommand Storage Services Manager modules, Device Manager software helps automate entire storage environments.

StorEdge 9900 HiCommand Tuning Manager

The StorEdge 9900 HiCommand Tuning Manager software enables tuning of large storage infrastructures and helps manage storage growth. Beyond monitoring and reporting on capacity and performance, it employs predictive trending to forecast future storage requirements to help you satisfy service-level agreements. Besides deep integration with Sun storage systems, it accesses basic application-based utilization information from heterogeneous storage systems to:

- Predict and respond to capacity crises
- Consolidate existing storage resources and plan for new ones
- Identify performance bottlenecks.

StorEdge 9900 HiCommand Data Link Manager

The capabilities of the StorEdge 9900 HiCommand Data Link Manager software (formerly known as StorEdge 9900 Dynamic Link Manager™ software)—including path fail-over and fail-back and

automatic load balancing—can provide higher availability and accessibility to data than other solutions. If one path fails, the Data Link Manager path fail-over feature automatically switches the I/O to an alternate path, helping to ensure that an active route to your data is always available. Data Link Manager software also helps maintain outstanding system performance by balancing workloads across available paths. By removing the threat of I/O bottlenecks and protecting key data paths, Data Link Manager software can boost not only performance and reliability, but information-retrieval rates as well.

StorEdge 9900 HiCommand Storage Services Manager

The StorEdge 9900 HiCommand Storage Services Manager is the main console for Sun's heterogeneous storage infrastructure management software. Storage Services Manager provides:

- auto-discovery of hosts, HBAs, SAN switches, and disk subsystems
- graphical topology mapping
- dependency and path management
- capacity and performance reports
- event management
- trending information
- policy-based automation
- role-based security.

Built-in Advisors and Automators simplify complex tasks such as

- replacing HBAs
- upgrading firmware
- understanding what users and data are impacted by planned or unplanned downtime
- identifying new capacity that can be utilized by individual application.

StorEdge 9900 Universal Volume Manager

The StorEdge 9985 Universal Volume Manager provides the virtualization of a multi-tiered storage area network, comprising heterogeneous storage systems. It enables the operation of multiple storage systems connected to the 9985 system as if they were all in one system and provides common management tools and software. The shared storage pool, composed of external storage volumes, can be used with storage system-based software for data migration and replication, as well as any host-based application. Combined with the StorEdge 9900 Volume Migrator (formerly CruiseControl), Universal Volume Manager provides an automated data lifecycle management solution across multiple tiers of storage.

StorEdge 9900 SAnTinel

Sun StorEdge 9900 SAnTinel software delivers simplified and centralised volume access control within a Sun StorEdge 9900 series SAN environment by establishing access control around allocated information for complete data protection. From a central management console, administrators can intuitively designate particular logical units (LUNs) to communicate with specified servers through industry-standard Fibre Channel naming conventions. This prevents unauthorised users from viewing the secured LUN and restricts access to its information.

StorEdge 9900 Graph-Track

Sun StorEdge 9900 Graph-Track software tool monitors hardware activities and provides complete storage system information through a graphical user interface (GUI). Graph-Track displays real-time or historical information that identifies spikes in system utilization and processing trends. It then pinpoints specific high-load activities that pose a threat to system operations and allows you to fine-tune your configuration for premier performance.

StorEdge 9900 Virtual Partition Manager

The StorEdge 9985 Virtual Partition Manager enables the logical partitioning of ports, cache, and disk capacity (parity groups) on Sun StorEdge 9985 systems to create independently managed Virtual Private Storage Machines. These logical partitions allocate separate, independently managed, dedicated storage resources for specific users (servers, applications, etc.), and available only to those users.

Storage resources can be allocated based on business requirements and priorities and be re-assigned as needed. To the host, the partition appears as if it is its own storage system and can be managed as such. Administrators will have access to configure and manage resources within their assigned partitions. Overall system priorities, disk space and tiers of storage can be managed and used most efficiently based on business applications and requirements by allocating and adjusting resources to each partition.

Virtual Partition Manager is scheduled for release post GA.

StorEdge 9900 Remote Console – Storage Navigator

The Remote Console for StorEdge 9900 Series systems – Storage Navigator is provided as a Java applet program, which can execute on any machine that supports a Java Virtual Machine (JVM). The Remote Console – Storage Navigator PC hosts the Storage Navigator Java applet program and is attached to the StorEdge 9900 Series system(s) via a TCP/IP LAN. When a Storage Navigator accesses and logs into the desired service processors (SVPs), the Remote Console applet is downloaded from the SVP to the Remote Console and runs on the Web browser of the Remote Console PC. In this way, the Remote Console communicates with the attached StorEdge 9900 Series systems via a TCP/IP network.

StorEdge 9900 Performance Enhancement Suite

The StorEdge Performance Enhancement Suite increases performance service levels for business-critical on-line transaction processing and decision support system applications, thereby enabling more rapid deployment of new applications by managing data more intelligently.

StorEdge 9900 Cache Residency

The StorEdge 9900 Cache Residency software (previously known as StorEdge 9900 FlashAccess) helps achieve consistent performance levels of application-critical files by dynamically "locking and unlocking" information into cache in real time. Cache Residency ensures that all read and write functions occur at cache speeds with no disk access delays, customers control and configure the allocations as required. For example, a specific portion of cache can be allocated to designated volumes. Adding, deleting, or changing allocations can be managed at any time-quickly and easily.

StorEdge 9900 Performance Monitor

The StorEdge 9900 Performance Monitor software is a powerful utility that provides a variety of performance measurements for system administrators to optimize performance of their Sun StorEdge 9900 Series systems. Sun StorEdge 9900 Performance Monitor software is required with the purchase of

either Sun StorEdge 9900 Volume Migrator software or Sun StorEdge 9900 Server Priority Manager software.

The StorEdge Performance Monitor software monitors systems and allows users to obtain statistics about workloads on the disks and ports. If the system encounters a problem (for example, server hosts suffer delayed response time), the software may help detect the cause of the problem.

StorEdge 9900 Server Priority Manager

The StorEdge 9900 Server Priority Manager (formerly known as Priority Access) software allows users of open systems to designate prioritized ports (for example, for production servers) and non-prioritized ports (for example, for development servers), and set thresholds and upper limits for the I/O activity of these ports. Users can tune the performance of the development server without affecting the production server's performance. With Sun StorEdge 9900 Server Priority Manager software, users can define and optimize data access performance, helping to ensure that production servers have prioritized access to data over development servers.

StorEdge 9900 Volume Migrator

The StorEdge 9900 Volume Migrator software helps simplify the way users manage performance levels in the Sun StorEdge 9900 series. Sun StorEdge 9900 Volume Migrator software automatically monitors, analyzes, tunes, and balances high volumes of information, then forecasts performance levels to system administrators. Performance level thresholds can be set and approved in either manual or automatic mode. Users can define and control the guidelines; StorEdge 9900 Volume Migrator software does the work. This eliminates the requirement of physically managing performance levels, and liberates staff to work on other more productive, revenue-generating projects within the organization.

StorEdge 9900 Resource Manager

The StorEdge 9900 Resource Manager software delivers simplified storage management capabilities—right to your fingertips. With Resource Manager, customers control the Sun StorEdge 9900 series system's configuration and adjust performance to best suit your applications.

Sun StorEdge 9900 Resource Manager software combines Sun StorEdge 9900 Graph-Track, LUN Manager, LUN Size Expansion, Virtual Logical Volume Image Manager, and Cache Residency into one package.

StorEdge 9900 Traffic Manager Software (SSTM)

The StorEdge Traffic Manager software provides server-based dynamic path SAN-wide I/O fail-over, fail-back, and load balancing. The software, which can help improve the performance and availability of business and mission-critical SAN-enabled applications, supports multiple I/O paths concurrently to help eliminate single points of failure within the SAN, thereby maintaining continuous access to both data and Fibre Channel storage devices. Sun StorEdge Traffic Manager software helps ease administrative overhead, allowing bandwidth on demand and new LUN creation without rebooting to be easily managed across multiple disparate host servers.

StorEdge 9900 Business Continuity Suite

Sun Microsystems has an industry-unique commitment to the paradigm of continuous business. Continuous business refers to an enterprise's ability to minimize system downtime, whether it is planned or unplanned. This is distinct from business continuity, which refers to the ability to recover from unplanned downtime. Building on the Sun Microsystems reputation for bulletproof reliability, StorEdge 9900 Series storage systems offer complete redundancy and hot-replaceable components, delivering

maximum uptime. To these already-robust platforms, Sun Microsystems adds business continuity solutions to ensure quick recovery from unplanned downtime resulting from acts of nature, human errors, application errors, and malicious attacks.

StorEdge 9900 Cross-System Copy (future mainframe support)

The StorEdge 9900 Cross-System Copy (formally StorEdge 9900 HiCopy) provides business continuity answers with its high-speed, bidirectional data movement capabilities between Sun StorEdge 9900 storage systems. Since Cross-System Copy software can use StorEdge 9900 ShadowImage In-System Replication in-system replication software copies as the source for the data movement process, it can ensure that these tasks are performed non-disruptively. Production applications can remain online during the entire process.

Cross-System Copy software quickly and easily replicates, distributes, and stores data between Sun StorEdge 9900 series enterprise storage systems, wherever they reside. With Cross-System Copy software, customers benefit from consolidated backup capabilities and the ability to move data between storage tiers, either within a data center or across remote locations.

StorEdge 9900 ShadowImage In-System Replication

The StorEdge 9900 ShadowImage In-System Replication along with the Sun StorEdge 9900 series, allows information to be protected and accessible 24x7. StorEdge 9900 ShadowImage In-System Replication software helps ensure continuous access to information. ShadowImage In-System Replication software replicates large volumes of information within the Sun StorEdge 9900 series without impacting service levels, timing out, or affecting performance levels. The information volumes can then be split away from the host application and used for system backups, testing, and data mining applications while your business continues to run at full capacity.

StorEdge 9900 Copy-on-Write Snapshot (Future)

The high-speed, non-disruptive, copy-on-write technology of Sun's StorEdge 9900 Copy-on-Write Snapshot software rapidly creates up to 14 point-in-time copies of any data volume within a StorEdge 9900 series systems, without impacting host service or performance levels. Since Copy-on-Write Snapshot copies only store the changed data blocks in the Copy-on-Write Snapshot storage pool, the volume of storage capacity required for each Copy-on-Write Snapshot copy is substantially smaller than the source volume. As a result, a significant savings is realized when compared with full cloning methods. The Copy-on-Write Snapshot copies are fully read/write compatible with other hosts and can be used for rapid data restores, application testing and development, data mining/data warehousing, or non-disruptive backup or maintenance procedures.

The StorEdge 9900 Copy-on-Write Snapshot software will be available post GA.

StorEdge 9900 True Copy Remote Replication

The StorEdge 9900 True Copy Remote Replication remote replication software automates the recovery process, enabling normal business operations to resume in a matter of minutes rather than hours or days. True Copy Remote Replication software provides a host independent data replication solution over any distance and rapidly copies data between the Sun StorEdge 9900 Series enterprise storage systems without affecting application performance. These copies can be used for production, rapid recovery following an outage, disaster recovery, data warehousing/data mining, or migration applications. Both synchronous and asynchronous versions of True Copy Remote Replication software are available for open systems and mainframe environments. True Copy Remote Replication software can also be integrated with StorEdge 9900 ShadowImage™ in-system replication software to enable robust business continuity solutions.

StorEdge 9900 Universal Replicator

The StorEdge 9985 Universal Replicator is intended for organizations that have enterprise-class heterogeneous data replication needs for business continuity or operational improvement requirements. All current copy products will work within a StorEdge 9900 series environment. When used in conjunction with the StorEdge 9985 system, the Universal Replicator becomes the first storage-based replication software component that provides server-free and application-transparent journal-based multi-target replication features for data from heterogeneous storage environments. And it does this in a way that accommodates both open and mainframe systems users and maximises the performance of the replication process.

Customers using Universal Replicator technology can optimise their ability to control recovery time objectives and recovery point objectives, while maximizing their investment in StorEdge 9900 True Copy Remote Replication software by leveraging their existing investment in the StorEdge 9900 Series storage systems. It provides an unmatched business continuity framework that enables local, remote, and multi-site data replication among 9985 systems including between and among hosted storage systems.

The Universal Replicator will be generally available post GA.

Field Issues

Cross System Copy Positioning In Context of Shadow Image and TrueCopy

Use Cross System Copy for cross platform data migration, file distribution, or backup consolidation. Cross Platform migration in this context is defined to mean copying between different vendor's equipment.

Use ShadowImage for creating full duplicate copies on both internal and external storage. These copies may be used by other other software such as TrueCopy for disaster recovery.

Use TrueCopy for disaster recovery, both short and long distances.

There are three sets of customer requirements which should be considered.

- Requirements #1

Data migration is based on short term data movement between products built by different vendors.

- Requirement #2

Copy data from internal to external storage. Context is that external storage makes storage outside the SE 9985 or SE 9990 look like it is internal storage.

- Requirement #3

Disaster Recovery is used to safely store data so it may be invoked in a reasonable amount of time in order to restart business operations in the event of a catastrophic event.

Cross System Copy does not have flow control for managing data movement through cache as data is sent over the communications links to disaster recovery locations. TrueCopy does have extensive facilities to manage data in/data out of data cache with respect to metering data over communications links. While Cross System Copy does have the ability to monitor "Copy Pair" status, the level of monitoring is not as extensive as used in TrueCopy "Pair Status" monitoring. ShadowImage maintains extensive "Pair Status Monitoring" as well as recovery facilities.

Shadow Image is the primary recommendation for copying from internal storage to external storage.

For more Cross System Copy information, please refer to User Guide MK- 94RD2522.

For more information on TrueCopy, please refer to User Guide MK-94RD210

For more information on ShadowImage please refer to User Guide MK-94RD240

Cluster Support

Please refer to the following URL for Cluster Support of the SE 9900 Family of Storage Systems.

<http://suncluster.eng/products/SC3.1/config/sc3ConfigurationGuide-6.htm#pgfId-780547>

Open V

The SE 9985 and SE 9990 are sold with Open V emulation as the predominate emulation.

In the maintenance manuals, Open 3 and Open 9 emulations are documented as available, even though their installation is actively discouraged. This can be confusing. Hitachi Data Systems (the sales and marketing arm of Hitachi Limited Japan) is seeking to reduce their overhead by reducing the complexity and permutations of the systems they set up, test, and ship.

Therefore, please proceed with the notion that only Open V is supported with the SE 9985.

Note that a FAQ regarding Open V is now available at Token #428905. Originally published for the SE 9990, this FAQ also applies to the SE 9985.

WWWW (What Works With What)

There are several WWWW documents associated with the SE 9900 family of products.

Here is an explanation of the WWWW documents.

- Token #344150 (WWWW)

This is the most important WWWW and it contains the following information:

- Supported combination of the following systems:
Storage + Server + HBA + OS + Switch + Switch firmware.
- SE 9990, SE 9985, SE SE 9980, SE 9970, SE 9960, SE 9910
- Support for all of these hardware platforms are contained in token 344150
- Solaris 10
- AMD 64
- SAN X.X versions

Token # 385413(FAR or Feature Availability Report)

This is the second most used WWWW for the SE 9900 Family.

- The most important items contained in this document include support statements for multipathing, clustering, booting, and volume management.
- A separate document under this token number is the TrueCopy Link Matrix. This is the document which states support for channel extenders in support of TrueCopy distance replication.

Hi Command Device Manger 4.2

Only High Command Device Manager 4.2 and higher versions may be used on the SE 9985.

Please note that Hi Command Device manager is recommended where multiple configurations are to be managed. If there is only one SE 9985, it is not essential to order Hi Command Device Manager 4.2.

High Command Device Manager 4.2 is scheduled for Sun GA on August 23, 2005. For those who need Hi Command Device Manager 4.2 sooner, 120 day trial licenses will be made available.

Microcode

The microcode used by the SE 9985 and SE 9990 are very similar, but not their same. By end of calendar year 2005, the microcode versions should converge.

V03:

SE 9990 = 50-03-93 00/00

SE 9985 = 50-03-94 00/00

V04:

SE 9985 and SE 9990 microcode different

V05:

Convergence of SE 9985/SE 9990 microcode 4QCY05

RAID 10

Hitachi Data Systems promotes "RAID 1+". In reality, striping is included with this, and therefore SE 9985 and SE 9990 RAID 1 is equivalent to RAID 10.

Major Features

Feature Overview

The Sun StorEdge 9985 system extends the feature and functionality of the StorEdge 9970 and 9980 systems and has many features unique to any storage system in the industry today. The same advance features introduced on the SE 9990 over the last 10 months are also available on the SE 9985.

These are:

- Virtualization– the ability to aggregate up to 16 petabytes of heterogeneous storage systems connected to a StorEdge 9985 for improved management and business continuity data replication. The term "external" and "Multi-Vendor Storage Pooling" are other terms commonly used to represent the tiers of storage with varying price, availability, performance characteristics. (See Figure 6 below)
- Virtual Private Storage Machines: Virtual Partitioning – allows users to create up to 8 different Virtual Private Storage Machines with assigned storage resources
- SE 9900 Universal Replicator Software – any-to-any data replication at any distance for total disaster recovery.
- StorEdge 9900 Tiered Storage Manager - The primary objective of this software package is to support a customer's Data Lifecycle Management initiatives with transparent, nondisruptive data volume movement to the appropriate tier of storage.
- Hi Command Protection Manager 4.1 - Protection Manager 4.1 enables “disk-to-disk”-based rapid backup and recovery operation for Microsoft Exchange Server, Microsoft SQL Server, and Microsoft NT File System (NTFS), taking advantage of StorEdge 9985 storage system replication technologies.
- StorEdge 9900 Replication Monitor - is a monitoring/reporting application that interfaces to replication management functions provided by an Element Manager (Storage Navigator, CCI or HiCommand Device Manager) for Sun StorEdge 9900 systems and replication software.

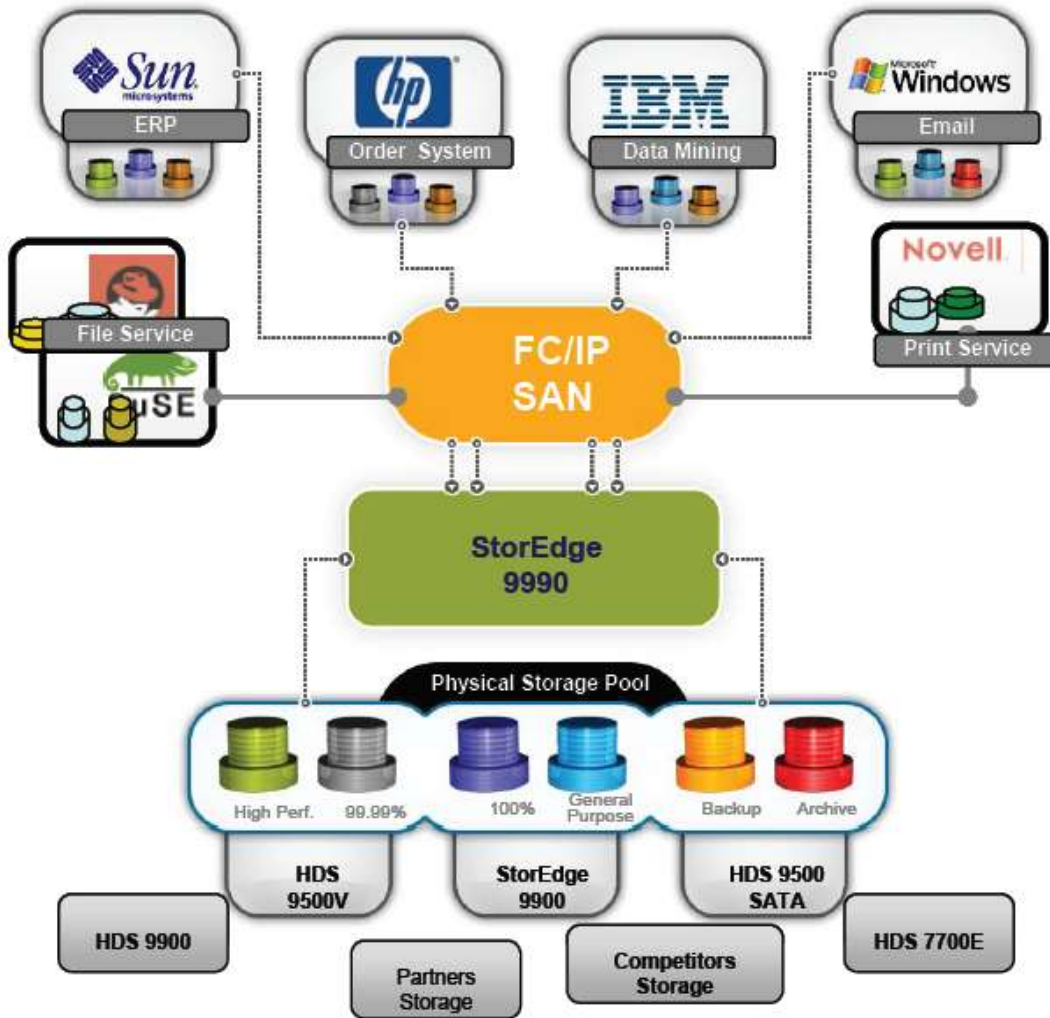


Figure 6: Sun StorEdge 9985 Multi-Vendor Host Platform Storage Pooling

The method by which the StorEdge 9985 implements multi-vendor host platform storage pooling is through mapping an external LUN (ELUN) to a LUN within the StorEdge 9985 system. An external LUN (ELUN) requires no physical disk storage on the StorEdge 9985. This LUN mapping is illustrated in Figure 5.

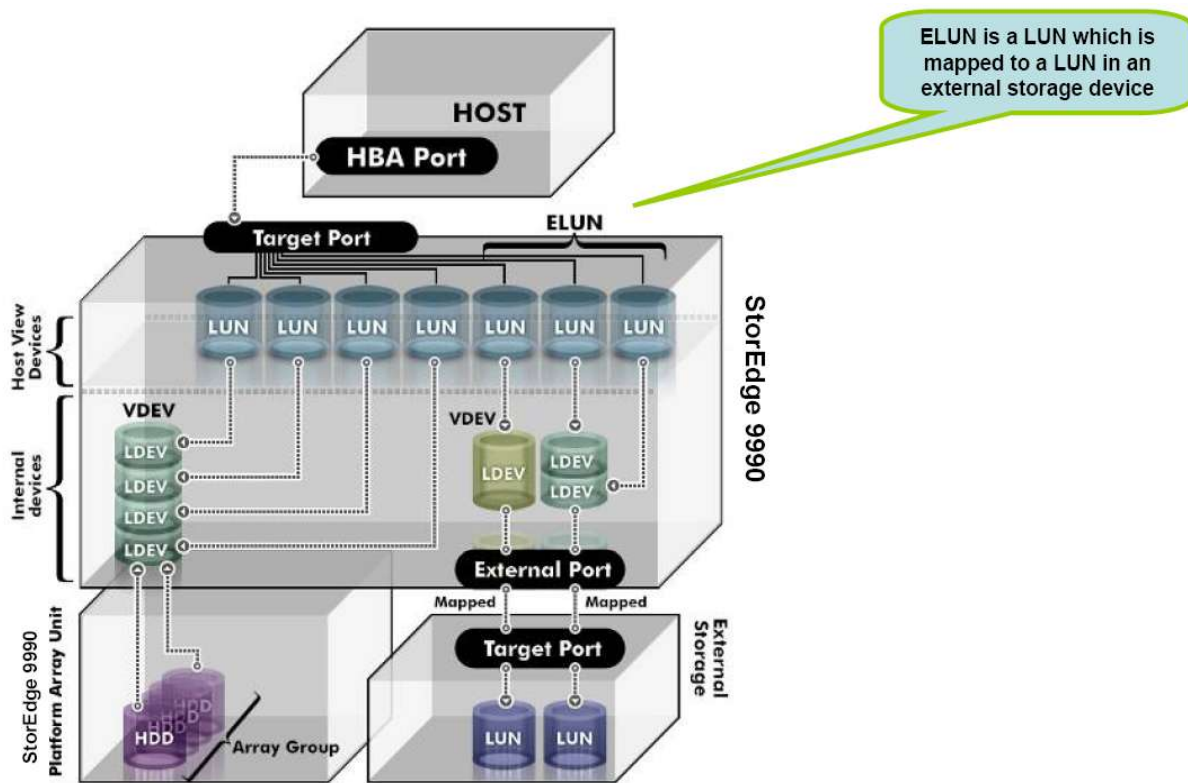


Figure 5: Multi-Vendor Host Platform Storage Pooling External LUN Mapping

As illustrated in Figure 6, an external heterogeneous storage system can be connected to a StorEdge 9985 system (1) through a direct connection, (2) through a switch, or, remotely, through extenders.

Currently, the following heterogeneous storage systems are supported by the StorEdge 9985 multi-vendor host platform storage pooling:

- Sun StorEdge 9900 series storage systems
- HDS Lightning 9985V series storage systems
- HDS Thunder 9500V series storage systems
- HP XP series storage system
- Sun StoreEdge T3B, and SE 6120.

Additional Sun and other vendor's storage systems will be added to this support matrix as they are qualified and support agreements reached.

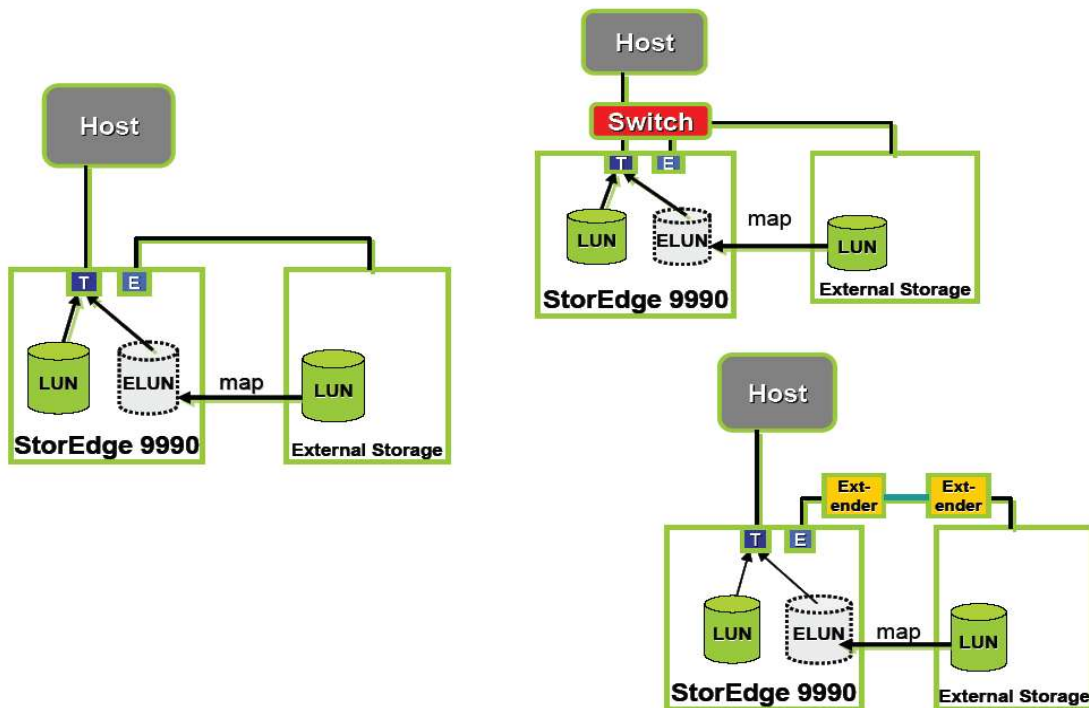


Figure 6: Multi-Vendor Storage Pooling Connection Examples

Virtual Private Storage Machines (VPSM)

Another unique feature of the StorEdge 9985 system is the ability to create Virtual Private Storage Machines within the system. Through the StorEdge 9985 Virtual Partition Manager, up to 8 separate Virtual Private Storage Machines can be defined, each with unique cache, channel, back-end resource aggregation specifications. This virtual partitioning feature of the StorEdge 9985 allows users to consolidate heterogeneous storage environments to provide known quality of service (QoS) metrics to applications and users.

VPSMs complement Dynamic System Domains (DSD) provided in Sun Servers. DSDs are a form of server partitioning. Together, VPSMs and DSD supports a customer's "Service Provider" business model initiatives.

Each Virtual Private Storage Machine within a StorEdge 9985 is dynamically allocated and statically used. This capability allows the assignment of resources between partitions if not required or used. Additionally, full separation and security is maintained between configured partitions.

The benefits of the StorEdge 9985 Virtual Private Storage Machines are:

- Better resource usage
- User and application aggregation with predictable QoS metrics
- Lower operational costs.

The virtual partitioning feature of a StorEdge 9985 is ideal for dedicating storage resources to critical applications, or in a storage provider model, allocating storage resources to specific clients with varying service level agreements. One example of the use of virtual partitioning would be the creation of separate storage partitions, each with different characteristics, supporting individual SunFire server domains. Figure 7 conceptually portrays the StorEdge 9985 virtual partitioning functionality.

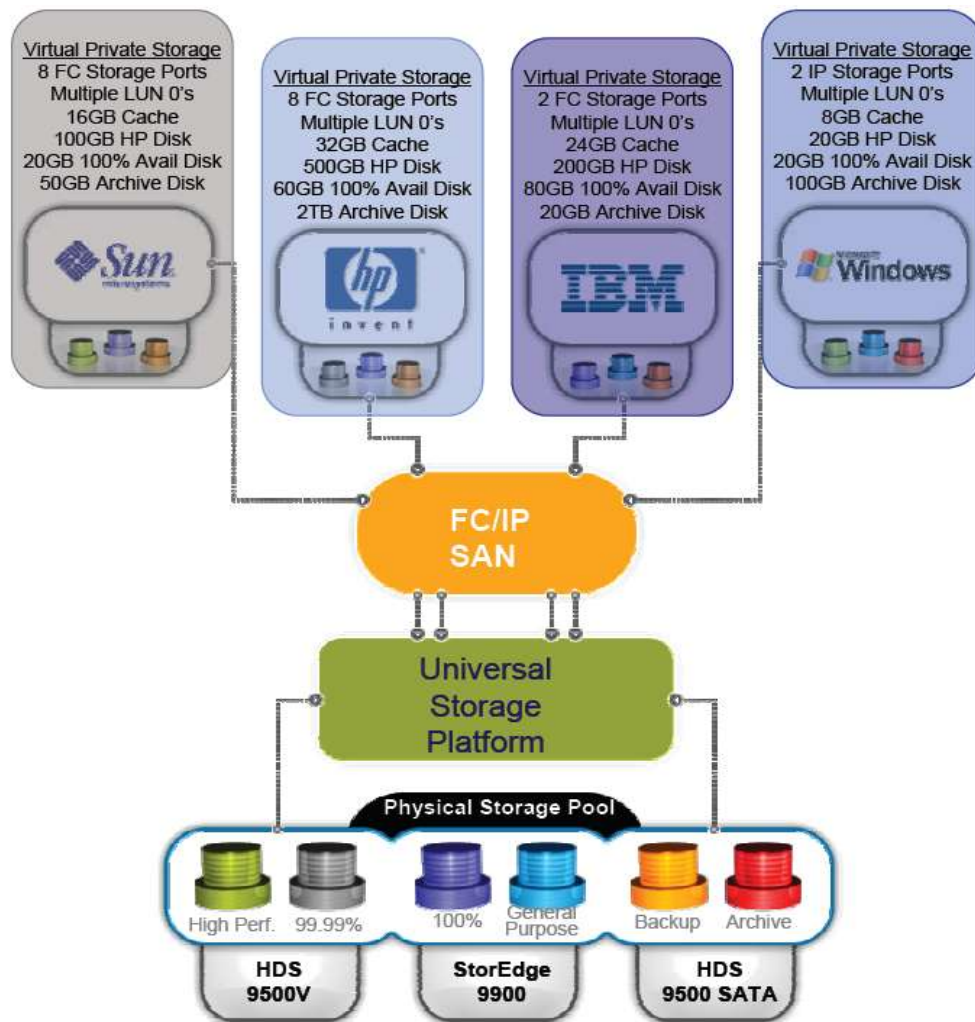


Figure 7: StorEdge 9985 Virtual Partitioning

Virtual partitions are configured via SE 9900 Virtual Partition Manager, which is the software tool used to set up Storage Logical Partitions (SLPR) and Cache Logical Partitions (CLPR). The Storage Logical Partition (SLPR) defines the assignment of one or more Cache Logical Partitions (CLPRs) and the assignment of one or more target physical ports for the Cache Logical Partitions (CLPRs) to use. Each Cache Logical Partition (CLPR) defines the assignment of a specific data cache allocation and the assignment of one or more parity groups assigned to that cache allocation. This mapping of resources through a Storage Logical Partition (SLPR) and a Cache Logical Partition (CLPR) is depicted in Figure 8.

The StorEdge 9900 Storage Navigator is used to maintain user access control for each Virtual Private Storage Machine. Storage Navigator provides administrator and user level authorities and maintains an access control directory to keep manage user authorities. This ensures that each defined Virtual Private Storage Machine within a StorEdge 9985 system is fully secure.

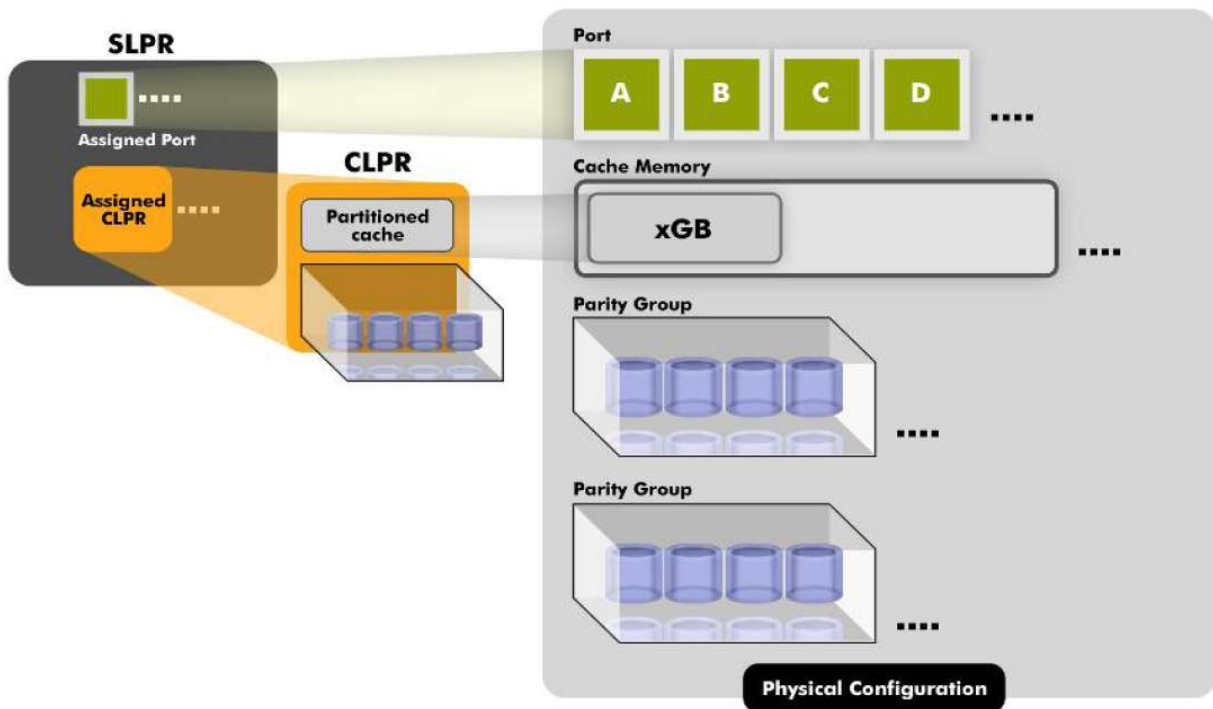
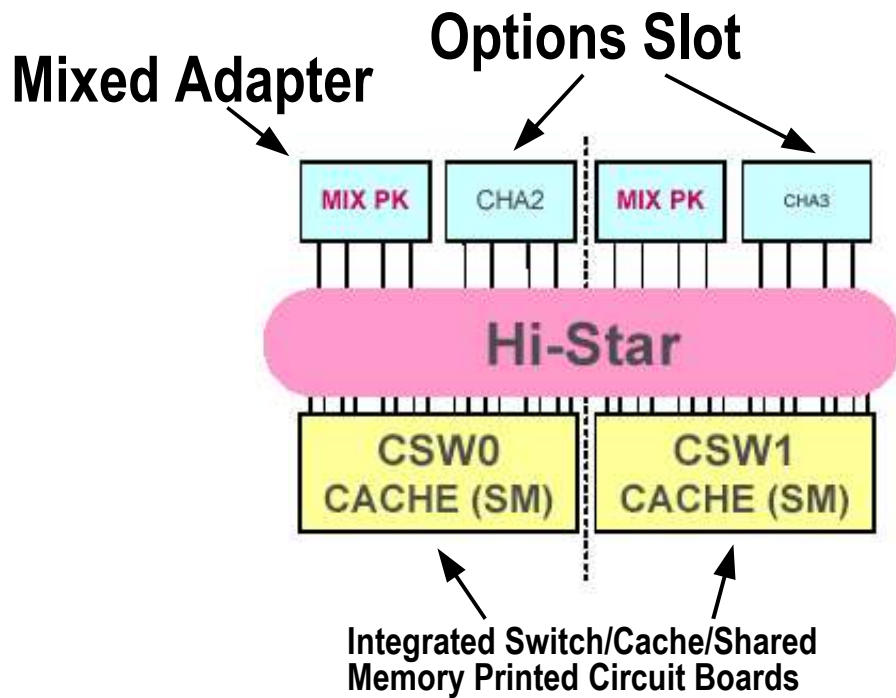


Figure 8: StorEdge 9985 Virtual Private Storage Machine Basic Concepts

Fibre-Channel Ports: New Implementation

New and unique to the SE 9985 is the "Mixed Adapter" which is combination of FED and BED. "Mixed Adapters" provide 16 FC FED ports and 8 BED FCAL ports. These fit in dedicated slots 1A and 2F. This adapter can be used only in the SE 9985.



To summarize the slot arrangements in the SE 9985:

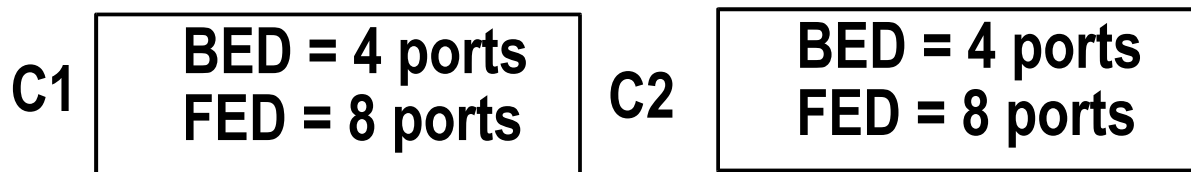
Six slots in two HW clusters

- Slots 1A & 2F = Mixed adapter
- Slots 1C & 2D – Integrated Cache/Shared/Switch Printed Circuit Board
- Slot 1B & 2E “Options Slot” for FED, NAS, FICON, ESCON

Additional Description of the Mixed Adapter

A pair of boards deployed into two HW clusters

- Total of 16 FED and 8 BED ports
- C1 = Cluster 1 and C2 = Cluster 2



Data Cache on the integrated Switch/Cache/Shared memory PCB

This memory is used to cache read and write requests from the attached storage arrays. In the initial release this memory is packaged on the Integrated Switch/Cache/Shared memory PCB. A physical location on the Integrated Switch/Cache/Shared memory PCB contains from 4GBs to 16GBs of ECC data cache memory. Two of these integrated Switch/Cache/Shared memory PCBs comes standard with the system for full redundancy. No additional card can be added. Data cache memory is available in 4GB increments. Thus, a fully populated data cache section in the StorEdge 9985 contains 32GBs of ECC memory (64 GB in the future). The board labeled "CSWO Cache (SM) is the "integrated Switch/Cache/Shared memory PCB".

This pair of printed circuit boards fit in dedicated slots 1C and 2D. These adapters can be used only in the SE 9985.

Service Processor (SVP)

The SE 9985 contains up to 1 SVP. A second SVP may *not* be added. The SVP in the SE 9985 and the SE 9990 are different in terms of form factor, power connectivity, and component. An internal LAN switch built into the SVP along with a PCMCIA LAN card which is cabled into the internal LAN switch internal LAN switch built into the SVP along with a PCMCIA. The SVP for the SE 9985 contains a 2.0 GHz Intel microprocessor, 512 MB memory, 20 GB disk, a RS-232C serial port, and two USB ports with a Microsoft Windows Professional XP operating system. A keyboard and display are not provided with the Systems. Sun Service has already the addressed the issue of interfacing with the SVP.

Just like in the StorEdge 9990 system, the base service processor (SVP) is integrated with the modular rack instead of relying on a laptop PC, as was the case with the the StorEdge 9970 and StorEdge 9980

systems. This ensures a consistent platform for all systems and simplifies the support process. Only 1 SVP can be configured with 9985 which is different from 9990.

Universal Replicator Software

The new StorEdge 9900 Universal Replicator represents an evolution of remote copy protection (it is the next generation beyond StorEdge 9900 True Copy Remote Replication) for critical digital assets. The process used by the Universal Replicator software in providing remote replication is achieved through disk based journaling. When data is written to a volume of the primary system, the Universal Replicator “captures” these write data requests in a disk-based journal file along with meta data. The Universal Replicator facilitates the remote disaster recovery site's ability to pull the data and meta data off the disk journal to the disaster recovery site. This off-loads compute cycles from the production site and onto the disaster recovery site.

Disk journalling also allow copies to be accumulated to disk in the event of down communications links. When communications are restored, the copy operations are resumed to disaster recovery site with no interruptions or suspensions of copy operations.

Using these journaling techniques, the Universal Replicator improves levels of reliability and robustness in remote copying operations, thereby also achieving better data recovery capabilities. Further, the Universal Replicator provides customers with greater levels of flexibility, including support for “cascading” and “multi-target” configurations. The expanded functionality achieved by the Universal Replicator journaling technique can also be used in point-in-time data backup and data recovery scenarios.

Operating System Support

The following operating systems are supported at the initial release of the Sun StorEdge 9985:

- Open Systems
 - HP HP-UX
 - HP Tru64
 - HP OpenVMS
 - IBM AIX
 - Microsoft Windows Server 2003
 - Microsoft Windows 2002 Server
 - Novell Netware
 - RedHat Linux
 - SGI IRIX
 - Sun Solaris
- Mainframe Systems
 - IBM OS/390
 - IBM MVS/ESA
 - IBM VMS/SA
 - IBM VM/ESA
 - IBM VSE/EDA
 - IBM z/OS
 - IBM z/OS.e
 - IBM z/VM
 - IBM RedHat for S/390 zSeries

Post GA, the StorEdge 9985 support will be added for Fujitsu's mainframe operating systems.

Security

Monitoring and Diagnostics Software (StorEdge Hi-Track)

The main security features of this software are:

- 128-bit secure socket layer (SSL) encryption support for the user interface between the customer's management LAN and the Storage Service Processor
- Password protection in the user interface.

LUN Mapping

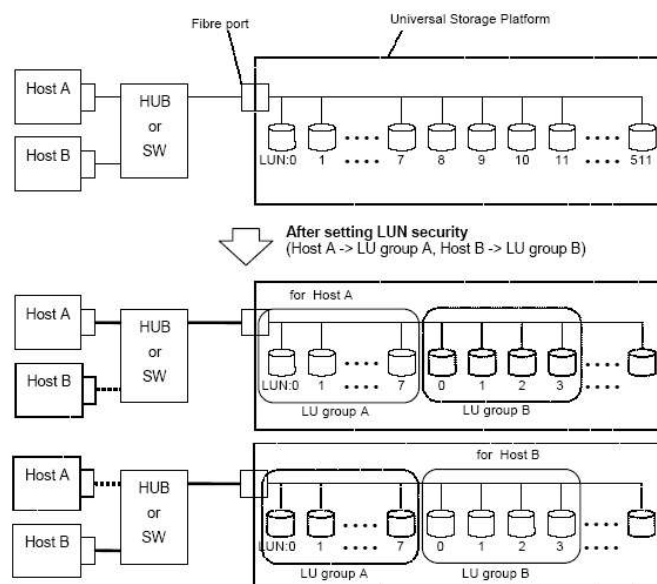
LUN mapping is the task of assigning a LUN number to a volume. This helps ensure that the storage administrator can tightly control access to particular volumes.

Storage Domains

This feature lets the user carve the Sun StorEdge 9985 system into several storage domains (see Figure 2 below). Storage domains can be used to create multiple logical *arrays* and to assign volumes to these arrays. The domains serve as logical *buckets*, into which new servers and storage can be easily added via the Configuration Service software of the Sun StorEdge 9985 system.

This allows:

- More efficient storage management — storage domains allow collapsing multiple departments or applications into a single storage management infrastructure.
- More efficient utilization of storage capacity — all attached servers and departments receive storage from a unified storage pool, reducing the amount of capacity overhead required and eliminating the unused storage that typically sits wasted in a distributed environment.



LUN Masking

LUN masking is the term used for assigning access permissions — read-only, read/write, or none — to a volume. LUN masking eases storage administration while allowing for a more secure environment. When a volume is masked from a host, that volume is not available to be configured from that host and thus cannot be assigned to multiple hosts accidentally.

WWNs (world-wide number) can either be assigned to a specific volume or a specific set of volumes, or multiple WWNs can be grouped and assigned to a specific volume or a specific set of volumes.

Virtual Private Storage Machines

Each Virtual Private Storage Machine defined within a StorEdge 9985 is protected through an access control directory to maintain and manage administrator and user level authorities. This ensures that each defined Virtual Private Storage Machine within a StorEdge 9985 system is fully secure from outside access.

Command Line Interface (CLI)

The CLI uses encryption and authentication.

Encryption

Only encrypted services are provided on the Sun StorEdge 9985 system — that is, the monitoring and diagnostic software as well as the management software support only through https encrypted communications.

Reliability, Availability, and Serviceability (RAS)

Reliability

The Sun StorEdge 9985 system includes the following reliability features:

- Monitoring and diagnostic software aids early detection and notification of faults on a 24-hour basis
- Non-disruptive firmware upgrades through a combination of monitoring and diagnostic software that tracks version levels of Sun StorEdge 9985 system components
- Error checking and correction on all disk drives
- Skip sectors and spare cylinders on all disk drives
- Automatic sector reallocation on RAID controllers
- Redundant data and control caches
- ECC on all data and control caches
- ECC on all data paths
- Redundant next generation non-blocking switch
- Temperature sensors in the Sun StorEdge 9985 system located near heat spots to provide accurate temperature measurements
- Power on self test of all FRU's
- Protection on all data paths within the SVP
- DSP error logging to NVRAM
- Hardware support for parity for RISC RAM
- RAID set/disk scrubbing
- Global hot-spares
- Loop card loop back diagnostic
- Back-end director down detection
- Front-end director down detection

Availability

The Sun StorEdge 9985 system has the following availability features:

- Multi-pathing capability
- Symmetric access to volumes
- Simultaneous use of both dedicated and array hot-spare drives
- Redundant power distribution units (PDUs)
- Optional second storage service processor
- Because of redundant architecture, replacing non hot-swap FRUs does not impact data availability
- Hot-swap components in the Sun StorEdge 9985 system include disk drives, power supplies, cooling fans, integrated UPS batteries, interconnect cards, loops, loop switching cards, administration channels, and controllers
- Dual hot-swappable redundant load-sharing/load-balancing auto-sensing power supplies (with individual power cord) in the Sun StorEdge 9985 system
- Integrated hot-swappable redundant UPS batteries in the Sun StorEdge 9985 array for cache backup
- Four redundant electrically independent cooling fans (with temperature sensors) in the Sun StorEdge 9985 system
- Hot-swappable redundant unit interconnect cards (UIC) in the Sun StorEdge 9985 array
- Hot-swappable redundant dual-ported FC-AL drives and dual backend drive loops per controller in the Sun StorEdge 9985 system
- Hot-swappable redundant back-end directors for automatic fail-over and cache mirroring in the Sun StorEdge 9985 system
- Redundant processors, data cache, and control memory accessible via next generation switch
- Redundant data interfaces on the Sun StorEdge 9985 system
- Temperature sensors in the Sun StorEdge 9985 system for continuous threshold-based temperature monitoring
- Automatic hardware-based bypass of a faulty drive in case a faulty drive causes loop disruptions
- Redundant, hot-swappable dual power supplies, fans, MIC's, and switch fabrics

Serviceability

The Sun StorEdge 9985 system has the following serviceability features:

- Phone home capability
- Enclosure chassis LED (locator/fault LED)
- Sun-standard FRU ID support
- Wiring harness allows cables to be individually replaced in the event of a failure
- Service access panel provides connection to the Storage Service Processor in order to perform routine maintenance or reconfigure the storage system
- Every Storage Service Processor is configured with the same hardware and software components to facilitate ease of replacement
- All FRUs of the Sun StorEdge 9985 system can be hot-swapped for non-disruptive service
- All firmware of the Sun StorEdge 9985 system can be replaced without disrupting operation
- Complete system interrogation through the service processor
- Upgradeable drive firmware (with only the associated volume off-line during the upgrade)
- Detection and reporting for incorrect drive position in the Sun StorEdge 9985 array
- Automatic drive-ID selection on the Sun StorEdge 9985 array
- Quick snap locking mechanisms on the Sun StorEdge 9985 array for easy insertion and extraction of disks and other FRUs
- Blind-mate connectors on the Sun StorEdge 9985 array to avoid bent pins on FRU insertion
- External and internal loopback test of Sun StorEdge 9985 back-end directors
- External and internal loopback test of Sun StorEdge 9985 front-end directors

System Administration

The following are the five key system administration User Guides:

- StorEdge 9985 User Guide MK-95RD279
- StorEdge 9900 LUN Manager User's Guide (MK-94RD203)
- StorEdge 9900 LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) User's Guide (MK-94RD205)
- StorEdge 9900 ShadowImage User Guide (MK-94RD204)
- StorEdge 9900 Storage Navigator User's Guide (MK-94RD206)

Excerpts from these User Guides below at the end of this section:

Here is a broader list of End User Guides:

StorEdge 9900 TrueCopy – z/OS® User and Reference Guide	MK-94RD214-P
StorEdge 9900 TrueCopy™ User and Reference Guide (Synchronous and Asynchronous for UNIX®/PC Servers)	MK-94RD215-P
StorEdge 9900 Command Control Interface (CCI) Users Guide (Factory Source: RAID300/400/450/500 RAID Manager Basic Specifications (CCI))	MK-90RD011-14
StorEdge 9900 Database Validator User's Guide	MK-94RD207-P
StorEdge 9900 Compatible PAV for z/OS® User's Guide (HPAV)	MK-94RD211-00
StorEdge 9900 9900/ 7700E Cache Manager User's Guide (Factory Source: RAID300 / 400 / 450/ 500 Cache Manager Users Guide)	MK-91RD045-04P
StorEdge 9900 Cache Residency Manager User's Guide (was FlashAccess)	MK-94RD208
StorEdge 9900 LUN Expansion and Virtual LVI/LUN User's Guide (LUSE)	MK-94RD205-P
StorEdge 9900 LUN Manager User's Guide	MK-94RD203-P
StorEdge 9900 Storage Navigator™ User's Guide (Incls. CFL @ HUR)	MK-94RD206-P
StorEdge 9900 Serverless Backup Enabler User's Guide (was e- copy)	MK-94RD217
StorEdge 9900 Performance Manager User's Guide (Performance Monitor, Volume Migration, and Server Priority Manager)	MK-94RD218
StorEdge 9985 Storage Navigator Error Codes	MK-94RD202-P
StorEdge 9900 Multiplatform Backup User's Guide (HMBR)	MK-94RD209-0

StorEdge 9900 Volume Retention Manager User's Guide (was LDEV Guard)	MK-94RD219-01 (07.19.04)
StorEdge 9900 Data Retention Utility User's Guide (was Open LDEV)	MK-94RD210-0 (07.01.04)
StorEdge 9900 Volume Security User's Guide (was SAnTinel - S/390)	MK-94RD216-01 (07.19.04)
StorEdge 9900 ShadowImage User Guide (Incls. FlashCopy Mirror)	MK-94RD204-P0 (06.17.04)
StorEdge 9900 ShadowImage for z/OS® User's Guide	MK-94RD212-P0 (06.17.04)
StorEdge 9900 RapidXchange Code Converter User's Guide	MK-93RD152
StorEdge 9900 SNMP API Reference Guide	MK-94RD213
StorEdge 9900 Universal Volume Manager User's Guide (aka External Storage Manager. Includes Hi-Copy)	MK-94RD220-P0
StorEdge 9900 Universal Replicator - z/OS® User and Reference Guide (HUM)	MK-94RD224
StorEdge 9900 Configuration File Loader	MK-94RD244-P (06.15.04)
StorEdge 9900 ShadowImage FlashCopy	MK-94RD245
StorEdge 9900 Hitachi Cross-OS File Exchange for TagmaStore™ (HRX)	MK-94RD246
StorEdge 9900 /Hitachi Freedom Storage Lightning 9900V Series Encrypted Communications User's Guide	MK-94RD248
StorEdge 9900 Cross-System Copy User's Guide	MK-94RD252
StorEdge 9900 (TM) User and Reference Guide	MK-94RD231
StorEdge 9900 Universal Storage Platform IBM AIX Configuration Guide	MK-94RD232
StorEdge 9900 Red Hat Linux Configuration Guide	MK-94RD233
StorEdge 9900 Universal Storage Platform SuSE Linux Configuration Guide	MK-94RD234
StorEdge 9900 Universal Storage Platform HP-UX Configuration Guide	MK-94RD235
StorEdge 9900 Universal Storage Platform SUN Solaris Configuration Guide	MK-94RD236
StorEdge 9900 Universal Storage Platform SGI IRIX Configuration Guide	MK-94RD237
StorEdge 9900 Universal Storage Platform Novell NetWare Configuration Guide	MK-94RD238
StorEdge 9900 Universal Storage Platform HP OpenVMS Configuration Guide	MK-94RD239
StorEdge 9900 Windows NT Configuration Guide	MK-94RD240

StorEdge 9900 Universal Storage Platform Windows 2000 Configuration Guide	MK-94RD241
StorEdge 9900 Windows 2003 Configuration Guide	MK-94RD242
StorEdge 9900 HP Tru64 UNIX Configuration Guide	MK-94RD243
StorEdge 9900 Business Continuity Manager User's Guide (CopyCentral)	MK-94RD247

LUN Manager User's Guide (mp-94rd203-00)

Overview of LUN Manager

The LUN Manager feature of the StorEdge 9900 subsystem enables the user to define the SCSI-to-LUN paths for the StorEdge 9900 logical units (LUs) and configure the StorEdge 9900 ports and LUN security. Each StorEdge 9900 LU can be mapped for access from multiple ports, providing alternate paths for path failover and nonstop data availability. LUN Manager allows the user to reconfigure the LUs at any time to accommodate system configuration changes and/or optimize subsystem performance.

LUN Manager is used to configure the command device for Command Control Interface (CCI) operations and apply command device security. LUN Manager also enables the user to set the port modes and fibre topology. The StorEdge 9900 fibre-channel ports support a high-speed mode that increases throughput. This is configured using LUN Manager.

This document describes and provides instructions for performing LUN Manager operations using the licensed StorEdge 9900 Storage Navigator software. The StorEdge 9900 Storage Navigator software communicates directly with the StorEdge 9900 subsystems via a local-area network (LAN). The Storage Navigator software displays detailed LUN Manager information and allows the user to perform LUN Manager operations on the StorEdge 9900 subsystem.

ShadowImage User's Guide (mp-94rd204-00)

The ShadowImage feature enables you to maintain subsystem-internal copies of all user data on the StorEdge 9900 storage subsystem for purposes such as data backup or duplication. The RAID-protected duplicate volumes are created within the same Lightning 9900™ V subsystem as the primary volume at hardware speeds. ShadowImage is used for UNIX®-based and PC server data. ShadowImage can provide up to nine duplicates of one primary volume. ShadowImage is a key component of Hitachi Data Systems' solutions and service offerings.

This document describes and provides instructions for performing ShadowImage operations using the Lightning 9900™ V Storage Navigator. The licensed ShadowImage software on the Lightning 9900™ V Storage Navigator displays the ShadowImage information and allows you to perform ShadowImage operations. The Lightning 9900™ V Storage Navigator can be attached to several Lightning 9900™ V subsystems via the Lightning 9900™ V-TCP/IP local-area network (LAN). The Storage Navigator communicates and exchanges data directly with the service processor (SVP) of each attached StorEdge 9900 subsystem. For further information on the *StorEdge 9900 Remote Console - Storage Navigator* and software, refer to the *StorEdge 9900 Remote Console - Storage Navigator User's Guide* (MK-94RD101).

ShadowImage operations are nondisruptive and allow the primary (main) volume of each volume pair to remain online to all hosts for both read and write I/O operations. Once established, ShadowImage

operations continue unattended to provide asynchronous internal data backup. Usability is further enhanced through a resynchronization capability that reduces data duplication requirements and backup time, thereby increasing user productivity. ShadowImage also supports reverse resynchronization for maximum flexibility.

The licensed StorEdge 9900 Remote Console – Storage Navigator software allows you to configure the ShadowImage option on the StorEdge 9900 subsystem. The StorEdge 9900 Storage Navigator software communicates directly with the StorEdge 9900 subsystem via a LAN. For further information on the StorEdge 9900 Storage Navigator software, please refer to the *StorEdge 9900 Remote Console – Storage Navigator User's Guide* (MK-94RD206).

ShadowImage operations can be performed in conjunction with TrueCopy operations (see section) to provide additional remote copies of ShadowImage volumes. ShadowImage also supports the Open Volume Management Virtual LVI/LUN and Cache Residency Manager features of the StorEdge 9900 subsystem, ensuring that all user data can be duplicated by ShadowImage operations. See section for further information on combining ShadowImage with these and other data management features.

ShadowImage operations can also be performed in conjunction with Universal Volume Manager operations to create pairs with the external volumes. For information about the external volumes, please refer to the *StorEdge 9900 Volume User's Guide*, MK-94RD220.

ShadowImage operations can also be performed from the UNIX® and/or PC-server host using the StorEdge 9900 Command Control Interface (CCI) software. For information and instructions on using CCI to perform ShadowImage (or TrueCopy) operations, please refer to the *StorEdge 9900 Command Control Interface (CCI) User and Reference Guide*.

Storage Navigator User's Guide (mp-94rd205-00)

StorEdge 9900 Web Server and Web Client

The StorEdge 9900 Storage Navigator consists of a group of Java™ applet programs that enable the user to manage the StorEdge 9900 subsystem. The Storage Navigator Java™ applet programs run on a web browser to provide a user-friendly interface for the StorEdge 9900 web client functions. The StorEdge 9900 service processor (SVP) is the computer inside the subsystem that uses Java Virtual Machine™ (JVM™) to function as a web server. The SVP is also used by Sun representatives to perform maintenance. The Storage Navigator computer functions as a web client. Each time you log onto the Storage Navigator computer and connect to the SVP, a Java™ applet program is downloaded from the SVP to the Storage Navigator computer.

This document describes and provides instructions for using the licensed StorEdge 9900 Storage Navigator software. The Storage Navigator software communicates directly with the StorEdge 9900 subsystems via a local-area network (LAN) to obtain subsystem configuration and status information, and send user-requested commands to the subsystem. The Storage Navigator software displays the detailed subsystem information, and allows you to configure and perform operations on the StorEdge 9900 subsystem.

The StorEdge 9900 subsystem can be connected to two LANs. The internal LAN is a private LAN that is used to connect the SVPs of multiple subsystems. Your intranet is a public LAN that allows you to access one or more SVPs from individual Storage Navigator computers. This configuration allows you to easily access and control the registered StorEdge 9900 subsystems. In a SAN environment, where several subsystems may be connected together, you must designate a primary SVP, which can be either an SVP connected to a StorEdge 9900 subsystem, or a web server with the exact same configuration as an SVP.

Figure 1.1 illustrates the relationship between the Storage Navigator computer(s) and the SVP.

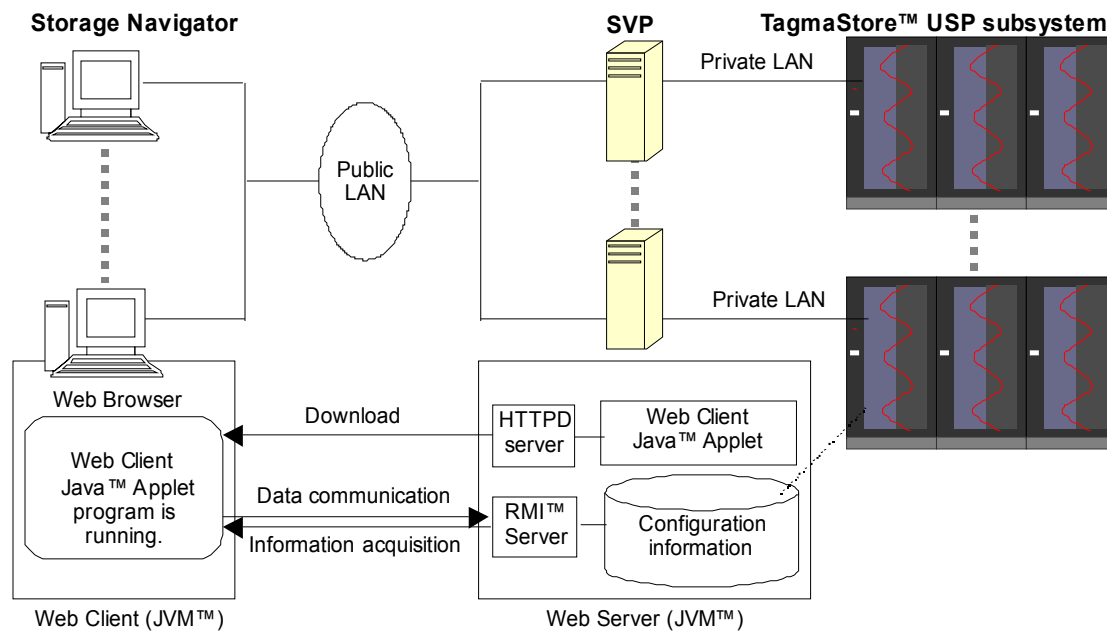


Figure 1.1 Sample Storage Navigator and SVP Configuration

The Storage Navigator Java™ applet program displays the configuration information for the attached StorEdge 9900 subsystems and enables you to perform the following types of operations:

Enabling and disabling options

Viewing the equipment and status information of the subsystem

Viewing the basic information, equipment and status information of the subsystem

Launching the desired option

Editing the storage device list

Editing the user account list

Setting the Storage Navigator environment parameters

Viewing the Storage Navigator log information

Downloading the log and configuration files

Restoring backup files

Viewing Storage Navigator information and changing your own password

Extending cache memory or LUNs using the Just In Time functions

Downloading Storage Navigator trace files using FD Dump Tool

Setting SNMP Agent properties

LUN Expansion (LUSE) operations allow hosts that can only use a limited amount of LUs per fibre interface to have access to larger amounts of data by using expanded LUs (see). See and for LUSE and VLL LUSE specifications.

LUSE operations include the following:

Viewing concatenated parity groups (see section)

Creating new LUSE volumes (see section)

Resetting an unregistered LUSE volume (see section)

Releasing a LUSE volume to individual LUs (see section)

Changing the size of a LUSE volume (see section)

The following guidelines apply to LUSE operations:

Access for the LU(s) to be expanded or released must be set to read/write. For more information on setting LDEV access, please see *StorEdge 9900Open Volume Retention Manager User's Guide* (MK-93RD158).

LUSE volumes can consist of between 2 and 36 LDEVs. The maximum number of volumes includes LDEVs already included in a LUSE volume.

A maximum of 256 expanded LUs can be configured on the same port.

LDEVs that are to be combined into LUSE volumes should have no assigned SCSI paths and be unmounted from the host. These are known as free (or available) LDEVs. For instructions on deleting SCSI paths, please see *StorEdge 9900 LUN Manager User's Guide* (MK-94RD203).

Combining non-sequential LDEVs into a LUSE is supported.

Combining normal volumes and LUSE volumes into the same LUSE volume, and combining existing LUSE volumes into another LUSE volume are supported.

If you combine LDEVs number 00, 03 and 05 in to a LUSE volume ("LUSE 1"), then combine LDEVs number 02 and 04 into a second LUSE volume ("LUSE 2"), and LDEVs number 06 and 07 into a third LUSE volume ("LUSE 3"), you can then combine LUSE 1 and LUSE 3 into a LUSE volume, but you cannot combine LUSE 1 and LUSE 2, because the LDEV range of LUSE 1 overlaps the LDEV range of LUSE 2.

Combining Virtual LVI/LUN volumes into a LUSE is supported, provided they are all of the same size and emulation type. The order of operations is important: you must first create one or more Virtual LVI/LUN volumes, and then combine those VLL volumes into a LUSE volume. For more information on creating VLL volumes, see sections and . For more information on creating LUSE devices see section .

You cannot perform Virtual LVI/LUN operations on an existing LUSE volume because a LUSE volume must have a SCSI path already specified.

TrueCopy-z/OS®, TrueCopy, ShadowImage-z/OS®, and ShadowImage pair volumes cannot be targets of LUSE operations because a LUSE volume must have a SCSI path already specified.

Combining Virtual LVI/LUN volumes and normal volumes into the same LUSE is not supported.

Combining command devices, Just In Time or Volume Migration volumes into a LUSE is not supported.

Combining RAID 1 and RAID 5 volumes into the same LUSE is not recommended.

Combining emulation types (OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L or OPEN-V) into the same LUSE is not supported.

Combining LUSE volumes into larger LUSE volumes is not supported.

Some operating systems may experience slow disk access times with large logical units, particularly if they contain a large number of high-usage files.

The size of a LUSE can affect the amount of time required to perform backups. The maximum supported capacity is 60 TB.

Combining TagmaStore™ subsystem volumes and external volumes into the same LUSE volume is not supported.

When you are online, the host mode must not be 0x0C (Windows®).

LDEVs combined into a LUSE volume must have the same IO suppression mode and cache mode settings.

StorEdge 9900 User and Reference Guide MK-95RD279

Overview of the Key Features of the The StorEdge 9900 constitutes a new computing revolution that promises to deliver efficient and flexible IT infrastructure, breaking away from computing that is rigid and expensive and involves under-utilized resources. The enables you to extend the life of current storage investments and take advantage of new functionality on yesterday's storage products. Multiple and tiered heterogeneous storage systems can be connected to and managed through a unique new feature introduced on the SE 9900. Interoperability issues are eliminated and performance and capacity management is simplified to reduce overall storage costs. The SE 9900 creates a data life cycle management (DLM) foundation and enables massive consolidation and storage aggregation across disparate platforms.

The SE 9900 is a multiplatform, high-performance, low to medium capacity storage array that provides high-speed response, continuous data availability, scalable connectivity, and expandable capacity in heterogeneous system environments. The provides non-stop operation for 7x24 data centers and is compatible with industry-standard software. The advanced components, functions, and features of the represent an innovative and integrated approach to DLM.

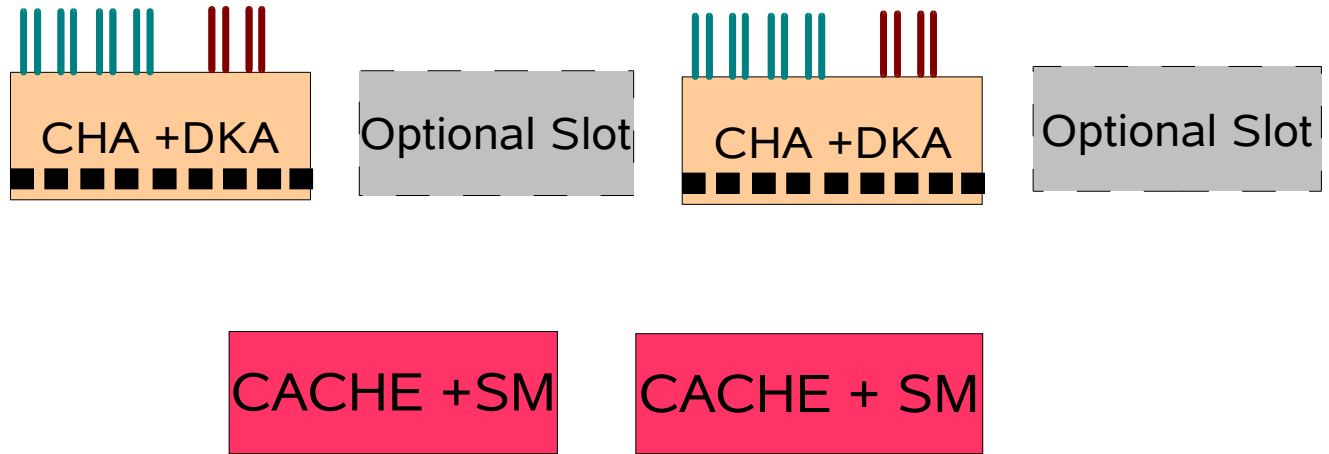
The SE 9900 employs and improves upon the key characteristics of generations of successful Hitachi disk storage subsystems to achieve the highest level of performance and reliability currently available. The features third-generation improvements to the Hierarchical Star Network (HiStar) architecture, the ground-breaking technology introduced and proven on previous-generation Hitachi storage arrays, as well as faster microprocessors on the front-end and back-end directors.

The SE9900 can operate with multihost applications and host clusters, and is designed to handle very large databases as well as data warehousing and data mining applications that store and retrieve terabytes of data. The SE 9900 supports in the future an intermix of fibre-channel, FICON™, and ESCON® host attachment and can be configured for all-open, all-mainframe, and multiplatform operations.

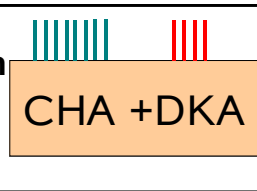
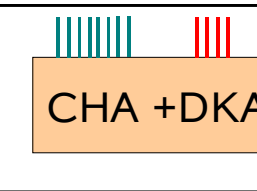
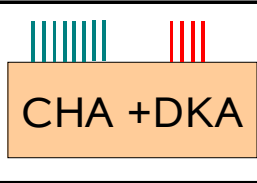
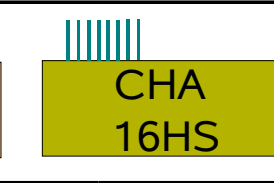
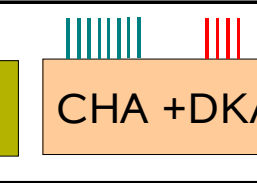
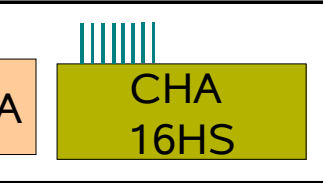
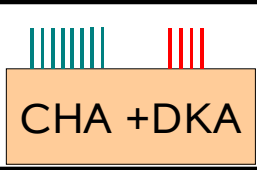
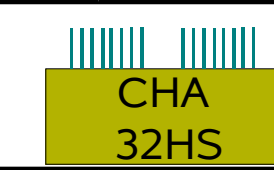
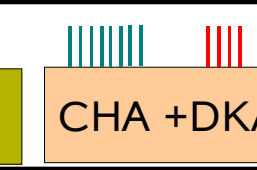
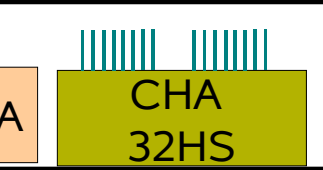
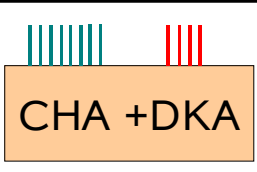
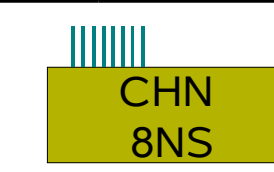
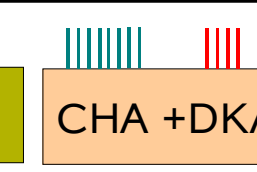
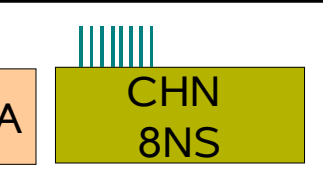
The provides many benefits and advantages as well as advanced new features for the user, including double or more scalability from the 9970 in both capacity and performance. The HiCommand® licensed software products also support the SE 9900for maximum flexibility in configuration and management.

Supported Channel and Disk Adapter Configurations

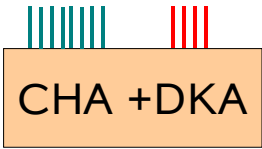
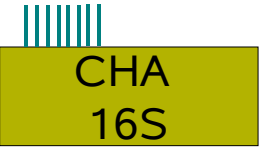
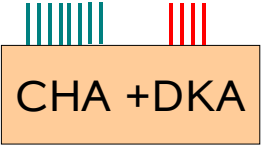
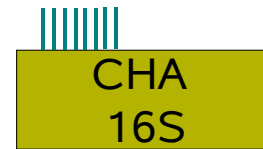
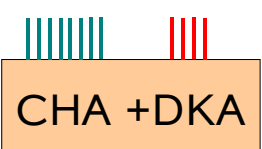
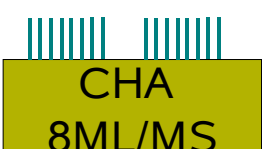
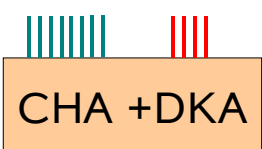
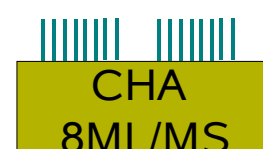
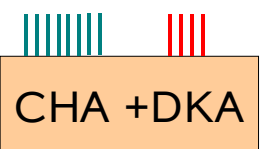
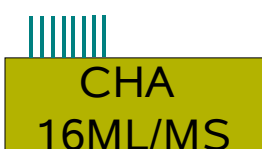
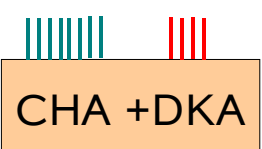
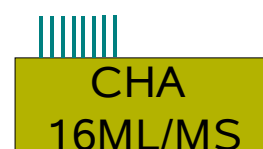
Use MIX PK for A Total of 16 FE ports & 8 BE ports with 16 Processors



Supported PK Configurations At RR/GA

(1)	Base Configuration (16FE + 8BE)		Optional Slot		Optional Slot
(2)	Full Configuration (32FE + 8BE) <i>- Consolidation, Tiered, Remote Copy</i>				
(3)	Full Configuration (48FE + 8BE) <i>- Consolidation, Tiered, Remote Copy</i>				
(4)	NAS + FC <i>- NAS, Tiered, Remote Copy</i>				

Additional PK Configurations (Phase 2)

(5)	ESCON + FC - Mainframe w/ Tiered, Remote Copy				
(6)	FICON + FC - Mainframe w/ Tiered, Remote Copy				
(7)	FICON + FC - Mainframe w/ Tiered, Remote Copy				

What Works With What

Please refer to the following web page for the latest compatibility information. This information changes on a regular basis and it is strongly recommended that this web site be reviewed rather than depending on the information in this "Just the Facts" document which may rapidly become out of date.

- 1) Pls. proceed to <http://sejsc.ebay/>
- 2) Look to your left column on this web page.
- 3) Click on "SE9900 WWWW"

Please refer to the documents described below,.

- What Works With What (WWWW) (Issued by Hitachi LTD and republished by Sun)

This document identifies the the supported combinations of:

Servers + Operating Systems + Switches + Switch Firmware .

If you seek a combination which is slightly different from a supported combination, please place a query to hdsconfig.global@Sun.COM. For anybody wishing to keep up to date on the the latest purely product information regarding the SE 9900 Family of systems it is recommended that you subscribe to this alias.

- Feature Availability Report (FAR) (Issued by Hitachi LTD and republished by Sun)

This document focuses primarily on software support, with specific usefulness centered around TrueCopy Link Matrix, Cluster Support, and Multipathing Support.

Q.

"How do I get a quote?"

A. In the Americas, please engage the Storage Center of Excellence (SCOE) by sending your request to scoe@Sun.com or by engaging your storage specialist.

Compatible Software

The following software is compatible with the Sun StorEdge 9985 system.

Sun Software

- StorEdge Enterprise Backup Software (EBS) 7.,1
- StorEdge QFS software 4.0, or later
- StorEdge SAM-FS software 4.0, or later
- Sun StorEdge Enterprise Storage Manager 2.1 software, or higher
- Sun StorEdge Enterprise Backup software (EBS) 7.1
- Solstice DiskSuite™ 4.2.1 software (in conjunction with Solaris 8 Operating System)
- Solaris Volume Manager software (embedded in Solaris 9 Operating System)
- Sun Cluster 3.0 software, update 3, and 3.1 base
- Sun StorEdge SAN Foundation 4.4 release (SF v.6.4)

Third-Party Software

- VERITAS NetBackup (VxNBU) 5.0, or higher
- VERITAS Volume Manager with DMP (VxVM/DMP) 3.5 and 4.0 for Solaris OS
- VERITAS File System (VxFS) 3.5 and 4.0 for Solaris OS
- VERITAS Volume Replicator 3.5 for Solaris OS
- Legato NetWorker 7.1, or higher

Ordering Information

Q.

"How do I get a quote?"

A. In the Americas, please engage the Storage Center of Excellence (SCOE) by sending your request to scoe@Sun.com or by engaging your storage specialist

11. SPECIFIC Part and Ordering Information

Order Number	List Price (July 2005)	Discount Category	SunSpectrum(SM)
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A. NEW PARTS NOW AVAILABLE FOR SALE:

Order Number	List Price	Discount Category	SunSpectrum(SM) Price*	Note
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Options and Spares

TJ9DKC-F515I-BCSR	\$1,995.00	P	N/A	
	Description: Sun StorEdge(TM) 9985 12U + 4U Bezel will cover the Logic Box and the SVP. The 4U bezel will need to be removed to access the SVP. The bottom 2U portion of the bezel will fold down providing access to the OP-PANEL by the Customer Engineer. This OP-PANEL is located towards the top-left portion of the Logic Box. As the bezel includes Ready/Alarm Message Lamps, the status of the system will be visible when the bottom 2U portion is in the up (closed) position .			
TJ9DKC-F515I-BUSR	\$1,895.00	P	N/A	
	Description: Sun StorEdge(TM) 9985 12U Bezel covers the Disk Chassis or the HDD Box. The 12U Bezel is designed to allow air intake to help with cooling the system. The Bezel key lock is on the top center of the Bezel and allows for locking the Bezel in place.			
TJ9DKC-F515I-UC1R	\$1,995.00	P	N/A	
	Description: Sun StorEdge(TM) 9985 device interface cable kit; 1 * cable unit assembly; required to connect the Disk Chassis R0 to Disk Chassis R1 in the primary HDS Global Rack. If there are two Disk Chassis in the secondary HDS Global Rack, then an additional DKC-F515I-UC1R must be ordered to connect Disk Chassis R2 to Disk Chassis R3.			
TJ9DKC-F515I-UC0R	\$1,995.00	P	N/A	

		<p>Description: Sun StorEdge(TM) 9985 device interface cable kit; 1 * cable unit assembly; which required to connect the System Control Unit to the Disk Chassis R0. One of these cables is required for the entire system.</p>		
	TJ9DKC-F515I-LGABR	\$4,995.00	P	N/A
		<p>Description: Sun StorEdge(TM) 9985 Additional Battery; 2 * battery boxes, 2* battery control printed circuit boards; Required when one of the following two conditions are met:* Shared memory capacity is 4GB (4 sets of the DKCF510I-S1G/S1GR) or greater. * Cache memory capacity is 16GB (4 sets of the DKCF510I-C4G/C4GR) or greater. * Cache memory capacity is 32GB (8 sets of the DKC-F510IC4G/C4GR) .</p>		
	TJ9DKC-F515I-B2R	\$19,995.00	P	N/A
		<p>Description: Sun StorEdge(TM) 9985 Initial Disk Chassis or HDD-BOX, required with basic configuration. Comprised of two chassis. Each chassis consists of two rows of 15 slots . The HDD-BOX does not include any HDDs. The HDDs must be ordered separately. There are a total of 60 slots for HDDs - 4 HDDs (data) plus 1 HDD (parity spare) must be included in initial configuration .</p>		
	TJ9DKC-F515I-MIX2R	\$49,995.00	P	N/A
		<p>Description: This component provides both Channel adapter functionality and Disk Adapter functionality. It includes: " (16) 1-2Gbps Fibre Channel Short Wavelength (multimode) ports ; (8) 2Gbps Fibre Channel Ports to control the data transfer between the cache and the HDDs. This component is comprised of two PCBs.</p>		
	TJ97846423	\$7,995.00	P	N/A
		<p>Description: Sun StorEdge 19 inch Global Rack houses the SE9985 unit which includes Logic, Power Supply Box, SVP (Service Processor), the initial Disk Chassis or HDD Box, and the Optional Disk Chassis or HDD Box. This 19" Global Rack provides 42U (1U = 1.75-inches) of useable space. Any portion not covered by the SE9985 subsystem bezel will be covered by a flat filler plate . US and the Americas electrical power requirements. (Please refer to the 19" Global Rack specification for details.)</p>		
	TJ97846424	\$7,995.00	P	N/A
		<p>Description: Sun StorEdge 19 inch Global Rack houses the SE9985 unit which includes Logic, Power Supply Box, SVP (Service Processor), the initial Disk Chassis or HDD Box, and the Optional Disk Chassis or HDD Box. This 19" Global Rack provides 42U (1U = 1.75-inches) of useable space. Any portion not covered by the SE9985 subsystem bezel will be covered by a flat filler plate. APAC electrical power requirements. (Please refer to the 19" Global Rack specification for more details.)</p>		
	TJ97846425	\$7,995.00	P	N/A

	Description: Sun StorEdge 19 inch Global Rack houses the SE9985 unit which includes Logic, Power Supply Box, SVP (Service Processor), the initial Disk Chassis or HDD Box, and the Optional Disk Chassis or HDD Box. This 19" Global Rack provides 42U (1U = 1.75-inches) of useable space. Any portion not covered by the SE9985 subsystem bezel will be covered by a flat filler plate . EMEA electrical power requirements. (Please refer to the 19" Global Rack specification for more details.)				
TJ9DKC515I-5	\$59,995.00	P	\$2390.0	1	
	Description: Sun StorEdge(TM) 9985 Disk Control Frame with a Logic/Power Supply Box & the SVP (NO CE laptop); Cache/Shared Mem. Pckg:2 slots Mix Adapter. Includes 16-port FED, 8-port BED:2 slots. factory config, supports RAID 5/RAID 6/RAID 1 configs, contains up to 120 HDDs, 1* Modem Card for Remote Maint; 1* LAN Cable; 1* Phone Cable; 1* RJ11 Modular In-line Coupler, 4 Conductor; 1* RJ45 Modular In-line Coupler, 6 Conductor; 1*Microcode Kit; 1*SE9985 Resource Manager Base Kit; 1*SE9985 Resource Manager Lic.				
TJ9044-210388-01	\$0.00	P	N/A		
	Description: Sun StorEdge(TM) 9900 Resource Manager - Complete Edition base kit, no license, product documentation on CDROM; included with purchase of each disk controller frame; (For SE9985)				
TJ9044-210388-03	\$0.00	P	N/A		
	Description: Sun StorEdge(TM) 9900 Resource Manager - Complete Edition, Unlimited Capacity license, license key on CDROM, license certificate on paper; included with purchase of each disk controller frame; (For SE9985)				
TJ9DKCF510I-16HSR	\$62,995.00	P	N/A		
	Description: Sun StorEdge(TM) 9990/9985 Fibre Channel 16-Port Front End Director for Short Wavelength; 2 * 8 port channel adapter printed circuit boards with LC type optical connectors, 1-2Gbps Auto-sensing; All 16 fibre channel ports come standard populated with SE9990/85 Fibre Small Form Factor Pluggable(SFP) Transceivers for Short Wavelength (multi-mode); for the SE9990/9985 integrated disk controller and array frame unit.RoHS Compliant.				
TJ9DKCF510I-1HSR	\$379.00	P	N/A		
	Description: Sun StorEdge(TM) 9990/9985 Fibre Small Form Factor Pluggable (SFP) Transceiver for Short Wavelength; 1 * fibre optical channel adapter conforming to the short wavelength (multi-mode). RoHS Compliant.				
TJ9DKCF510I-8NSR	\$75,995.00	P	N/A		

		<p>Description: Sun StorEdge(TM) 9900 NAS Blade Feature, consists of 2 * 1Gb/sec fibre channel 4-port adapter printed circuit boards for short wavelength, NAS compatible, each adapter contains 1 * Pentium 4 CPU with 4GB memory and two Gigabit Ethernet (GbE) ports with rated throughput of 100 MB/sec; for placement in the Sun StorEdge(TM) 9990/9985 integrated disk controller and array frame unit. RoHS Compliant.</p>			
	TJ9DKCF510I-C4GR	\$18,399.00	P	N/A	
		<p>Description: Sun StorEdge(TM) 9990/9985 Additional Cache Memory Module - 4GB; 8 * DIMM boards each installed with 512Mbit DRAM; for the SE9990/9985 integrated disk controller and array frame unit. RoHS Compliant.</p>			
	TJ9DKCF510I-S1GR	\$6,395.00	P	N/A	
		<p>Description: Sun StorEdge(TM) 9990/9985 Additional Shared Memory Module - 1GB; 2 * DIMM boards each installed with 512Mbit DRAM; for the SE9990/9985 integrated disk controller and array frame unit. RoHS Compliant.</p>			
	TJ9DKUF505I-146J1R	\$4,495.00	P	\$21.0	1
		<p>Description: Sun StorEdge(TM) 9990/9985 146GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 10000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit. RoHS Compliant.</p>			
	TJ9DKUF505I-146JSR	\$4,495.00	P	\$21.0	1
		<p>Description: Sun StorEdge(TM) 9990/9985 146GB Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 10000RPM, FC; contained in a canister for installation in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit. RoHS Compliant.</p>			
	TJ9DKUF505I-72K1R	\$3,795.00	P	\$21.0	1
		<p>Description: Sun StorEdge(TM) 9990/9985 73GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit. RoHS Compliant.</p>			
	TJ9DKUF505I-72KSR	\$3,795.00	P	\$21.0	1
		<p>Description: Sun StorEdge(TM) 9990 and 9985 73GB Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installation in an SE9990 integrated disk controller and array frame unit (DKC510I) and/or disk array frame unit (DKU505I). RoHS Compliant.</p>			
	TJ9DKUF505I-300J1R	\$7,995.00	P	\$21.0	1

		Description: Sun StorEdge(TM) 9990/9985 300GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit. RoHS Compliant.			
	TJ9DKUF505I-300JSR	\$7,995.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990/9985 300GB Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installation in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit. RoHS Compliant.			
+	TJ9DKC-F510I-16HS	\$62,995.00	P	N/A	
		Description: Sun StorEdge(TM) 9990, 9985 Fibre Channel 16-Port Front End Director for Short Wavelength; 2 * 8 port channel adapter printed circuit boards with LC type optical connectors, 1-2Gbps Auto-sensing; All 16 fibre channel ports come standard populated with SE9990/9985 Fibre Small Form Factor Pluggable (SFP) Transceivers for Short Wavelength (multi-mode); for the SE9990/SE9985 integrated disk controller and array frame unit.			
+	TJ9DKC-F510I-1HL	\$949.00	P	N/A	
		Description: Sun StorEdge(TM) 9990 and 9985 Fibre Small Form Factor Pluggable (SFP) Transceiver for Long Wavelength; 1 * fibre optical channel adapter conforming to the long wavelength (single mode).			
+	TJ9DKC-F510I-1HS	\$379.00	P	N/A	
		Description: Sun StorEdge(TM) 9990/9985 Fibre Small Form Factor Pluggable (SFP) Transceiver for Short Wavelength; 1 * fibre optical channel adapter conforming to the short wavelength (multi-mode).			
+	TJ9DKC-F510I-8NS	\$75,995.00	P	N/A	
		Description: Sun StorEdge(TM) 9900 and 9985 NAS Blade Feature, consists of 2 * 1Gb/sec fibre channel 4-port adapter printed circuit boards for short wavelength, NAS compatible, each adapter contains 1 * Pentium 4 CPU with 4GB memory and two Gigabit Ethernet (GbE) ports with rated throughput of 100 MB/sec; for placement in the Sun StorEdge(TM) 9990/9985 integrated disk controller and array frame unit.			
+	TJ9DKC-F510I-C4G	\$18,399.00	P	N/A	
		Description: Sun StorEdge(TM) 9990 and 9985 Additional Cache Memory Module - 4GB; 8 * DIMM boards each installed with 512Mbit DRAM; for the SE9990/9985 integrated disk controller and array frame unit.			
+	TJ9DKC-F510I-S1G	\$6,395.00	P	N/A	

		Description: Sun StorEdge(TM) 9990 and 9985 Additional Shared Memory Module - 1GB; 2 * DIMM boards each installed with 512Mbit DRAM; for the SE9990/9985 integrated disk controller and array frame unit.			
+	TJ9DKU-F505I-146J1	\$6,915.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 146GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 10000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/SE9985 integrated disk controller and array frame unit and/or disk array frame unit.			
+	TJ9DKU-F505I-146JS	\$4,495.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 146GB Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 10000RPM, FC; contained in a canister for installation in an SE9990/SE9985 integrated disk controller and array frame unit and/or disk array frame unit .			
+	TJ9DKU-F505I-72K1	\$5,583.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 73GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit.			
+	TJ9DKU-F505I-72KS	\$3,795.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 73GB Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installation in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit.			
+	TJ9DKU-F505I-300J1	\$7,995.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 300GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installation as a spare drive in an SE9990/9985 integrated disk controller and array frame unit and/or disk array frame unit .			
+	TJ9DKU-F505I-300JS	\$7,995.00	P	\$21.0	1
		Description: Sun StorEdge(TM) 9990 and 9985 300GB Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installation in an SE9990 integrated disk controller and array frame unit (DKC510I) and/or disk array frame unit (DKU505I).			
	W9D-T11-1DSK-1G	\$168.00	S	N/A	
		Description: SE9985 System disk drive Upgrade to 1 Year of Gold Support.			
	W9D-T11-1DSK-1P	\$264.00	S	N/A	

		Description: SE9985 System disk drive Upgrade to 1 Year of Platinum Support.		
	W9D-T11-1DSK-1S	\$108.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 1 Year of Silver Support.		
	W9D-T11-1DSK-24-1G	\$204.00	S	N/A
		Description: SE9985 System disk drive Upgrade to Gold Support + 7X24 On-Site Support for 1 Year		
	W9D-T11-1DSK-24-2G	\$432.00	S	N/A
		Description: SE9985 System disk drive Upgrade to Gold Support + 7X24 On-Site Support for 2 Years		
	W9D-T11-1DSK-24-3G	\$612.00	S	N/A
		Description: SE9985 System disk drive Upgrade to Gold Support + 7X24 On-Site Support for 3 Years		
	W9D-T11-1DSK-2G	\$336.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 2 Year Gold Support.		
	W9D-T11-1DSK-2P	\$528.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 2 Year of Platinum Support.		
	W9D-T11-1DSK-2S	\$216.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 2 Year of Silver Support.		
	W9D-T11-1DSK-3G	\$504.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 3 Years of Gold Support.		
	W9D-T11-1DSK-3P	\$756.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 3 Years of Platinum Support.		
	W9D-T11-1DSK-3S	\$324.00	S	N/A
		Description: SE9985 System disk drive Upgrade to 3 Year of Silver Support.		
	W9D-T11-9985-1G	\$18,924.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 1 Year of Gold Support.		
	W9D-T11-9985-1P	\$29,556.00	S	N/A

		Description: Sun StorEdge 9985 System Upgrade to 1 Year of Platinum Support.		
	W9D-T11-9985-1S	\$11,472.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 1 Year of Silver Support.		
	W9D-T11-9985-24-1G	\$23,832.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to Gold Support + 7X24 On-Site Support for 1 Year.		
	W9D-T11-9985-24-2G	\$48,240.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to Gold Support + 7X24 On-Site Support for 2 Years.		
	W9D-T11-9985-24-3G	\$70,704.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to Gold Support + 7X24 On-Site Support for 3 Years		
	W9D-T11-9985-2G	\$39,072.00	S	N/A
		Description: Sun StorEdge 9985 System Array Upgrade to 2 Year Gold Support.		
	W9D-T11-9985-2P	\$58,944.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 2 Year of Platinum Support.		
	W9D-T11-9985-2S	\$25,272.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 2 Year of Silver Support.		
	W9D-T11-9985-3G	\$57,672.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 3 Years of Gold Support.		
	W9D-T11-9985-3P	\$86,040.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 3 Years of Platinum Support.		
	W9D-T11-9985-3S	\$37,980.00	S	N/A
		Description: Sun StorEdge 9985 System Upgrade to 3 Year of Silver Support.		

Ordering Notes:

- 1 SunSpectrum Instant Upgrade 3year platinum service level recommended.
- + Previously announced part.

* Amounts shown in SunSpectrum(SM) Price column represent monthly service charges for the recommended level of hardware support.

All parts representing Documentation Only should show N/A under the service column. Such products never have a service price.

E. INTEGRATED STACK CONTENTS

N/A

F. SUN UPGRADE ADVANTAGE PROGRAM (UAP) - NEW PARTS

N/A

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Q4FY2005-162I

June 17, 2005

SUN HARDWARE PRODUCT INTRO: [Announcing Sun StorEdge\(TM\) 9985 system](#)

This section contains information for Sun partners. The information in this section should be shared with Sun partners, Sun sales reps and SEs. This section should not be shared with Sun end user customers.

SECTION III - PARTNER INFORMATION

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12. PARTNER BUSINESS PROPOSITION

The SE9985 is a product which complements our partners ability to selling into the High End Data Center. Resellers and System Integrators now have a smaller scale version of the SE9990 that is compatible in hardware, firmware and software where the full scalability of the SE9990 is not required.

13. AVAILABILITY TO ALL PARTNERS

The SE9985 will be available through Sun distributors to resellers who have passed the standard Sun Partner Certification and Training Classes.

14. PARTNER CERTIFICATION AND TRAINING

Please refer to the follow URL for information on

appropriate partner training for the SE9990

<http://partner.sun.com/US/training/programs/docs/strategic-datacenter-program.pdf>

15. ORDERING PROCESS

The ordering process remains the same with these new SE9900 series products.

16. SUPPORT AND WARRANTY

Leverage standard Sun Support and Warranty

17. CONFIGURATOR AVAILABILITY INFORMATION

(Note: Not all customers worldwide will have availability to all Sun configurators)

Will the products in this intro appear in the following configurators and if so, on what date?

WebDesk?	N	The SE9900 products are not in Webdesk, they are in Partner Express.
Partner WebDesk?	N	The SE9900 products are not in Webdesk, they are in Partner Express.

18. PARTNERS QUESTIONS AND ANSWERS

Q. What level of certification is required of partners before they can sell SE9985s?

A. A partner should be qualified at the "Data Center" level before before committing to sell the SE9985. Please refer to the following URL:

<http://partner.sun.com/US/training/programs/docs/strategic-datacenter-program.pdf>

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Licensing Guidelines

This section covers licensing for a broad set of features associated with the SE 9985. Much of the licensing information contained is also applicable to the SE 9990; SE 9990 JFT will be updated at a later date to reflect the new licensing guidelines.

This part of the JTF is divided into two sections.

Section 1 provides an broad outline of how software is licensed across many different software features.

Section 2, places the changes and new information in context of the SE 9990.

Licensing for the SE 9900 program is complicated and hard to understand. Hitachi Ltd (Japan) and Hitachi Data Systems (Santa Clara, CA) are working on a "Licensing Simplification Program." With that said, this section is being written to bridge the gap until the simplification program is available. Thank you for your patience as Sun SE 9900 Product management teams works with HDS Santa Clara to resolve these issues.

Section 1. How products are licensed on the SE 9985.

Note 1: Presented Capacity is effectively the Total Usable Capacity. The term "Presented Capacity" is really a placeholder, and is in place in case it is needed. In the past, HDS suggested that a customer could divide up a external storage system and use part as external storage and part as production. HDS has come back and indicated such configuration is *not supported*.

= [External Usable = (Total Usable Capacity – Local Capacity Used for Production Usage)]

Note 2: Usable capacity = total of primary or secondary volumes, no matter if the volume is internal to the SE 9985 or on an external device.

1. Features which are licensed based on SE 9985 by Internal Capacity Only.

1.1.Resource Manager – Unlimited Capacity License

Repeat: this is for internal capacity of the SE 9985 only.

Separate licenses still must be purchased for the external storage virtualized behind the SE 9985. These licenses belong to the external storage, and not the SE 9985. Here is how to think about this. The Resource Manager License must cover both internal and external storage capacity but the cost associated with this license should be for internal capacity of the SE 9985 only. By providing the Unlimited Capacity License for Resource Manager, this eliminates the need for the \$0 licenses as used with the SE 9990. This is a significant difference. The Resource Manager price is heavily discounted and so the customer should not view this as paying for something they are not using. Instead, they should see the heavily discounted price as a joint Sun/HDS

1.2.HiCommand Device Manager - choose licenses which equal the "Total Internal Raw Capacity" of the SE 9985.

1.3.HiCommand Tuning Manager – choose licenses which equal "Total Internal Raw Capacity of the SE 9985."

1.4. Remember for points 1.1, 1.2, 1.3. above, the external storage must have it's own license in addition to the license residing on the SE 9985.

2. Features which are licensed based on External Storage Capacity Only.

- 2.1. Universal Volume Mgr. – choose licenses equaling Total Usable Capacity presented from all external devices. No Internal SE 9985 Capacity is to be considered in the license calculation. Please see d
3. Please refer to the following Sun Intro on July 26 for more information on tiered storage licenses. [Resource Manager External Storage Support Licenses.ID: 4610 Q4FY2005-166](#)
4. Features which are licensed based on SE 9985 Internal and External Capacities.
- 4.1. Use this guidance if this product is Raw Capacity based on a stand alone SE 9985.
- a) If No External Storage, then the capacity to be licensed equals the amount of SE 9985 Internal Raw Only.
- b) If there is External Storage then the amount to be licensed equals SE 9985 Internal Raw Capacity plus the Usable Presented Capacity from external devices.
- c) The list of products in this category are:
- Volume Migration
 - Performance Monitor
 - Server Priority Manager
 - Virtual Partition Manager
 - Multi-platform Backup
 - HiCommand Tiered Storage Manager
 - Data Retention Utility
- 4.2. If the feature is Usable Capacity based on a stand alone SE9985.
- a) These products are based on the total needed (usable) capacity. (i.e. the licensing is still based on total primary or secondary volumes, no matter if the volume is internal to the SE 9985 or on the external device.)
- b) The list of products in this category are:
- TrueCopy Synchronous
 - TrueCopy Asynchronous
 - ShadowImage In-System Replication
 - Compatible Replication for IBM z/OS
 - Cross System Copy
- 4.3. If Product is Capacity Unlimited in a stand alone SE9985.
- a) These products have no capacity limitations and will support all internal and external capacities.
- b) The list of product in this category are:
- Serverless Backup Enabler
 - Cross-OS File Exchange
 - DB Discovery

Section 2. Licensing in context of SE 9985 and SE 9990

First, here is what is new and different:

Resource Manager on the SE 9985 is sold as an unlimited license. Please note that Resource Manager is a chargeable item. Resource Mgr. is Mandatory and is configured automatically with the hardware.

There is also some conflicting information regarding whether UVM license based on raw or usable capacity.

The answer is that UVM is licensed on Usable Capacity Usable Capacity of the external Systems, and does not need to be licensed for any internal SE9985 capacity.

Here is what is different about licensing on the SE 9985:

The direct answer is that some of the idiosyncrasies associated with licensing the SE 9990 are removed. Therefore if you have 25 TB of usable capacity presented to you by a SE 9980 to a SE 9985, then you order 25 TB of UVM licenses.

The need to use \$0 dollar licenses to remove the cost of licensing Resource Manager on the SE 9990 for the external storage has been removed. Under the new plan associated with the SE 9985, only the costs associated with licensing the internal storage of the SE 9985 for Resource Manager are required. This is accomplished by using "Unlimited License" for Resource Manager on the SE 9985. This effectively allows charging a price commensurate with and limited to internal storage on the SE 9985, but extends licensing to cover the external storage.

Universal Volume Manager/Resource Manager and External storage

Here is a general description of the typical situation, and how to address it. The most common general situation is centered around having an SE 9985 and virtualizing tiered storage behind it.

What constitutes tiered storage may take the form of several vendors equipment. However, for simplicity sake and in order to focus on the most common field issues, we will consider this issue in terms of Hitachi products and Sun products.

Conceptually, the most common case at this point of time may likely be SE 9985 with either a SE 9980 or SE 9970 virtualized behind it as external storage. From a software perspective, the two most common issues center around how to license Resource Manager and Universal Volume Manager. Sub-issues revolve around capacity measurement nomenclature such "presented capacity", Usable Capacity, and Raw Capacity.

Let's solve for the capacity measurement nomenclature first.

Two licensing key concepts to remember when external storage is involved with an SE 9985 are:

1. License Price will take into account the Internal Raw and External Usable (Presented) Capacity, except as stated above in the license methods such as with Capacity Unlimited Products (i.e. Resource Manager) and Universal Volume Manager (only External Usable Capacity).

A) Note that Presented Capacity may vary according how the customer uses their external storage. We have cases where the customer intends to use part of the their external storage (for example, a SE 9980) for local production and the remainder for external storage.

2. Don't pay twice for the same TB of a software license. But software may be required to be purchase individually on an SE 9985 and all external subsystems. For instance Resource Manager, see below.

So let's apply the above concepts to this the specific case of a SE 9985 with a SE 9980 as external storage, where you have 10 TB of storage on the SE 9985, and 6 TB on the SE 9980.

Here is how we would license it.

For Universal Volume Manger, you would buy enough licenses for the 6 TB of external usable capacity.

For Resource Manager, you would buy the single Capacity Unlimited License, with nothing to ever buy again for Resource Manager (No Upgrade in capacity required. *Note* Each Hitachi type external device must be licensed with its own Resource Manager license (based on that systems licensing method).

You are done.

To put things in context, here is an examination of what is different between a SE 9985 and a SE 9990.

What is different from the SE 9990 is that the Resource Manager required \$0 dollar licenses to support external storage, and these are not used on the SE 9985, as the SE9985 license key does not limit capacity.

Assume you are seeking to license Resource Manger for the following: SE 9990 with 10 TB of internal storage, and three external devices, each within 5 TB. For the SE 9990, you would purchase a 25 TB license which would cover both 10 TB of SE 9990 internal storage and the 15 TB of external storage. But the way you would pay for it would be to use the regular non-zero dollar conventional licenses to purchase 10TB for the internal raw capacity of the SE9990 and the \$0 licenses to “pay” for the 15 TB for the three external storage devices. The extra 15TBs needed to support the three external devices is \$0 because of the rule, you don’t pay for the same TB twice. As stated above, each of the external storage devices must have their own Resource Manager license.

Note On July 26th, part numbers will be available to order the 15TBs of \$0 licenses for Resource Manager, rather than having to use the SAR process to get the \$0 license today.

With respect to Resource Manger, this is done quite differently on the SE 9985. With the SE 9985, Resource Manager is provided with an Unlimited Capacity License, thus the license key will support your entire internal and external storage capacity. Thus there is no need to upgrade the Capacity of an SE 9985 Resource Manager. But like with the SE 9990, all Hitachi External Devices must have their own Resource Manager license.

License must cover both internal and external but is charge for internal capacity.

You are now done.

II. Software Transfer Program (Technology Upgrades) between SE 9985 and other members of the SE 9900 Family such as the SE 9980, SE 9970,SE 9960,SE 9910.*

There is currently *NO* Software Transfer Program to the SE 9985 from other members of the SE 9900 Family such as the SE 9980, SE 9970,SE 9960, or SE 9910.

The Software Transfer Program is for technology upgrades, where an older generation subsystem is removed and replaced with a net new generation subsystem.

III. My customer seems to be paying for the same Terabyte of software License twice?

Using the Two licensing key concepts described above for external storage, and repeated here, how does my customer not pay twice?

1. License Price will take into account the Internal Raw and External Usable (Presented) Capacity, except as stated above in the license methods, such as with Capacity Unlimited Products (i.e. Resource Manager) and Universal Volume Manager (only External Usable Capacity).

2. Don't pay twice for the same TB of a software license.

But some software may be required to be purchase individually on an SE 9985 and all external subsystems. For instance Resource Manager, see below.

To meet these concepts, software credits will be allowed for certain product licenses already purchased on an SE9900 (10/60/70/80) that is now being externalized to the SE 9985. As an example, If you purchased 10TBs of ShadowImage on an SE 9980 and now are externalizing the SE 9985, you will be able to get credit for a 10TB ShadowImage license on the SE9985.

So let's apply the above concepts to this the specific case of a SE 9985 with a SE 9980 as external storage, where you wish to use ShadowImage.

1. Have ShadowImage on the SE 9985 for 2TBs. Now externalizing a SE 9980 with no ShadowImage. In this case there is nothing to receive credit as the SE 9980 was not licensed for that product.

2. Have ShadowImage on the SE 9985 for 2TBs. Now externalizing a SE 9980 with a 3TB ShadowImage License. Using the SAR process, you will receive a credit for 3TBs on the SE 9985. In this case, upgrade the existing SE 9985 2TB SI License to 5TBs, and receive a SAR for the 2-5TB Upgrade on the SE 9985.

Note – Product Codes for this software credit will be made available in the near future.

Release Schedule

- Revenue Release is July 12, 2005
 - This means the product is quotable and orderable
- General Availability is July 26, 2005
 - This is when volume shipment occurs.

The following hardware components are available at the initial release of the StorEdge 9985 system:

- Modular rack with 3rd generation non-blocking switch
- 120 total disk drive capacity
- 32GB data cache
- 6GB control memory
- 16PB internal and external storage support
- 72GB disk drives
- 146GB disk drives
- 300GB disk drives
- 48 FC ports.
- Up to 1 NAS Blade

The following software components are available at the initial release of the StorEdge 9985 system:

- Open system support only
- StorEdge 9900 HiCommand Device Manager
- StorEdge 9900 HiCommand Tuning Manager
- StorEdge 9900 HiCommand Data Link Manager
- StorEdge 9985 Universal Volume Manager
- StorEdge 9900 SANtinel
- StorEdge 9900 Graph-Track
- StorEdge 9900 Remote Console – Storage Navigator
- StorEdge 9900 Cache Residency
- StorEdge 9900 Performance Monitor
- StorEdge 9900 Server Priority Manager
- StorEdge 9900 Volume Migrator
- StorEdge 9900 Resource Manager
- StorEdge Traffic Manager
- StorEdge 9900 Cross-System Copy
- StorEdge 9900 ShadowImage In-System Replication
- StorEdge 9900 True Copy Remote Replication

Post GA hardware enhancements to the StorEdge 9985 system will be released. These include:

- 2nd Modular Rack
- 64GB data cache
- iSCSI blade feature
- FICON
- ESCON
- Additional external storage pooling support

Post GA, software enhancements to the StorEdge 9985 system will be released. These include:

- Mainframe support
- StorEdge 9900 Business Continuity Manager
- StorEdge 9995 FlashCopy V2
- StorEdge 9900 Copy-on-Write Snapshot
- StorEdge 9985 Universal Replicator

Competitive Comparison

When you look strictly at the facts, nothing on the market compares to the Sun StorEdge 9985 system. But that won't stop our competition at the highest end of the centralized storage platform market from trying to win hearts and minds through creative positioning.

In this section, you'll learn what the overall marketplace is like and who's likely to say what. You'll also find three competitive snapshots of our strongest competitors, and three matrixes that show how the Sun StorEdge 9985 compares with our closest competitors in three areas: hardware, business continuity, and storage area management.

Of course, under no circumstance should these materials be shared with customers.

They are intended merely to arm you for discussion on competitive features should such discussion ensue. Our Competitive Snapshots will give you a strategy to counter whatever the competition might throw at you. We hope the Snapshots' format makes them easy to scan for the information you need.

Overview of the Market

The usual suspects are going to focus lots of attention on answering the StorEdge 9985 challenge, and the primary competitors are IBM, HP, EMC, and STK. As they do when competing with the Sun StorEdge 9900 Series enterprise storage systems, these vendors are going to market their high-end systems to compete with StorEdge 9985. HDS and HP will be selling their own versions of StorEdge 9985, so displaying our continued mutual respect in selling situations will be important.

The two most certain candidates for direct competition are:

- EMC, with the EMC Symmetrix DMX Series

IBM, with the IBM Enterprise Storage Server (ESS Shark) and IBM SAN Volume Controller. With its unique features and functions, StorEdge 9985 solutions can be targeted for the highest-level business requirements that even the Sun StorEdge 9980 enterprise system can't achieve. The StorEdge 9980 system already represents the pinnacle of high-end enterprise storage systems, and the StorEdge 9985 represents an evolution of this standard.

Competitive Overview Chart

Note 1 :SE 9985 is represented at full capacity in these charts, so please pay attention to the Phase I and Phase II delivery charts as you represent what features are delivered when to your customers.

Note 2: There are no performance numbers available for the SE 9985 at this time. The numbers you may see are theoretical numbers without the background configuration information.

	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	StorEdge 9985 Competitive Advantage
Packaging	Modular rack mounted, logic/power supply, SVP and disk chassis components	Modular rack, controller / expansion trays	Modular rack, controller / expansion trays	Integrated control/array, single bay frame	Higher availability, better connectivity, more functionality
Architecture	Universal Star Network™ Crossbar Switch	Dual Controller	Direct Matrix	Direct Matrix	Universal Storage Platform functionality at a lower price-point and smaller form factor
Raw Capacity: Fibre Channel unless otherwise noted	365GB - 72TB	584GB-67.2TB	1.2TB-17.5TB	4.7TB-21TB	SE9985 is raw capacity leader.
Maximum internal bandwidth	12GB/sec		3.2GB/sec	8GB/sec	SE9985 has more internal bandwidth than the competition
Maximum internal bandwidth (data)	8.5GB/sec	N/A	3.2GB/sec	8GB/sec	SE9985 separates data bandwidth from control information bandwidth
Maximum internal bandwidth (control information)	3.5GB/sec	N/A	independent messaging matrix 6.4 GB/sec. Separate Ethernet connection for environmentals.	independent messaging matrix 6.4 GB/sec. Separate Ethernet connection for environmentals.	Universal Star Network's switched internal networks, which separate internal cache and path resources for data and command/control information, enable it to dynamically optimize storage resources to meet application requirements for both performance and availability
HDD technology options - Fibre Channel unless otherwise noted	73GB(15K RPM) 146GB(10K RPM) 300GB(10K RPM)	73GB (15K RPM) 146GB (10K RPM) 300GB (10K RPM)	73GB (10K RPM) 73GB (15K RPM) 146GB(10K RPM)	73GB (10K RPM) 73GB (15K RPM) 146GB(10K RPM)	
HDD I/F	2Gb/sec FC-AL	2Gb/sec FC-SW	2Gb/sec FC	2Gb/sec FC	
Internal Storage Minimum-Maximum number of HDDs	5 - 240	8 - 224	16-120	-144	
External Storage Support	16PB	NO	NO	NO	SE9985's unique embedded virtualization and complementary management software enable simple connection and centralized management for open systems and mainframe storage with a single user interface, increasing efficiency while reducing complexity and TCO.
Model Upgrade Options	NO	NO	NO	NO	
Number of Controllers	Universal Star Network architecture	2 PowerPC 750GX 1GHz	2 (FEBE boards) 500MHz	8 (FEBE boards) 500 MHz or 1GHz	The Uni-Star design provides two separate caches and internal networks to avoid contention between application IO and system management for resources.
Connectivity Options	Fibre Channel, NAS, FICON, ESCON	Fibre Channel, FICON, ESCON	Fibre Channel, FICON, GbE, iSCSI	Fibre Channel, FICON, GbE, iSCSI, ESCON	SE9985 sSupports NAS and Fibre Channel SAN simultaneously
Port Connections	16-48 Fibre Channel @ 2Gb/sec 1 NAS Blade 16 FICON @ 2Gb/sec 16 ESCON	8 Fibre Channel or FICON @ 2Gb/sec	8-16 Fibre Channel @ 2Gb/sec 4 FICON @ 2Gb/sec 4 GbE-SRDF 4 GbE iSCSI	16-48 Fibre Channel @ 2Gb/sec 2-24 FICON @ 2Gb/sec 2-8 GbE-SRDF 2-24 iSCSI 16-48 ESCON	SE9985 embedded NAS ports enable unmatched NAS consolidation with single point-of-control with access to SE9900 replication tools
Fibre Channel Bandwidth to host	9600MB/sec	1600MB/sec	3200MB/sec	9600MB/sec	SE9985 has greater Fibre Channel bandwidth to hosts than any other mid-range modular competitor.
Fibre channel bandwidth to drives	1600MB/sec	4 redundant loops 1,600 MB/sec	8-16 Fibre Channel @ 2Gb/sec 3200MB/sec	16 Fibre Channel @ 2Gb/sec (std) 32 Fibre Channel @ 2Gb/sec (P2)	
Active loops per number of HDDs	8 FCAL/120 HDD	4 / 16	8-16 DMX drive channels	16 or 32 DMX drive channels	
Maximum LUNs	16,384	8192	1024	8000	SE9985 provides twice the maximum LUNs of the nearest competitor.

RAID Support	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
RAID-0	NO	NO	YES	YES	
RAID-1	YES	NO	YES	YES	
RAID10	RAID1+	RAID10	YES	YES	
RAID-3	NO	NO	NO	NO	
RAID-5	YES	YES	YES	YES	
RAID-6 DP	YES	NO	NO	NO	Better data protection, rapid rebuild in the event of HDD failure
Availability	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
Non-disruptive component replacement	MAJOR FRU	MAJOR FRU	MAJOR FRU	MAJOR FRU	
Non-disruptive hot-pluggable disks	YES	YES	YES	YES	
Non-disruptive microcode updates	YES	YES	YES	YES	
Performance	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
Minimum-Maximum Cache	Mirrored - 64GB 4GB Global Cache	Mirrored (2GB / controller) 4GB	NOT Mirrored 32GB	NOT Mirrored 128GB 4GB	SE9985 offers larger data cache than every midrange modular system. SE9985 has flexible global cache rather than the controller-dedicated caches of modular competitors.
Cache Partitioning	YES	NO	NO	NO	Cache Residency Manager allows SE9985 cache resource to be allocated to partitions based on application requirements
Control Memory	2GB - 6GB	N/A	Utilizes data cache for control info	Utilizes data cache for control info	The Universal Star Network design provides two separate caches and internal networks to avoid contention between application IO and system management for resources.
IOPs Cache Burst Rate	N/A	217,000	?	?	SE9985 delivers superior IOPs performance. With Global Cache that can also be partitioned. Plus, with its superior connectivity the SE9985 will also have much greater throughput for mixed workloads.
SPC-1 IOPs Benchmark	Not available	Not Available	Not available	Not available	
Cache Binding	Hitachi Cache Residency Manager feature (formerly FlashAccess)	NO	Cache QoS	Cache QoS	SE9985 Cache Residency Manager feature ensures cache residency for high-performance data.
Advanced Function	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
NAS Support	Embedded NAS ports	IBM NAS500G	Celerra Network Storage	Celerra Network Storage	SE9985's embedded NAS connectivity provides enterprise-level reliability, scalability, and performance with unique virtualization, replication, and partitioning capabilities.
iSCSI Support	via switch	NO	YES	YES	
Software	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
Management Software	SE9900 Universal Volume Manager Software, Resource Manager™ Utility Package, and HiCommand® Suite and Storage Area Management (SAM) Software	Multiple Device Manager / DS Storage Manager	Control Center / Symmetrix Manager	Control Center / Symmetrix Manager	Users gain a single point of control management interface for data lifecycle management and Application Optimized Storage™ solutions from Hitachi Data Systems, using multiple differentiated tiers of externally attached storage with HiCommand Tiered Storage Manager and other HiCommand software.
Common APIs	YES	YES - (DS6000/DS8000 Series only)	Within DMX family	Within DMX family	

Remote Copy	SE9900 TrueCopy Remote Replication Software (synchronous and asynchronous modes), SE9900 Universal Replicator Software— Journal-based	IBM PPRC Metro Mirror Global Copy Global Mirror	SRDF Synch SRDF/A Asynch Open Replicator	SRDF Synch SRDF/A Asynch Open Replicator	SE9900 Universal Replicator software's unique journal-based replication technology lowers cache utilization, offloads replication overhead, and maximizes use of available network bandwidth resources. With a Universal Volume Manager license, ALL heterogeneous externally connected storage can be replicated
Point in Time (PIT) Copy	SE9900 ShadowImage™ In-System Replication Software—full volume, SE9900 Copy-on Write Snapshot Software (formerly QuickShadow), SE9900 Compatible Mirroring Software for IBM FlashCopy V2	FlashCopy - full volume	TimeFinder - full volume Snap - pointer-based images	TimeFinder - full volume Snap - pointer-based images	SE9985 offers a complete set of PIT copy solutions, including SE9900 Compatible Mirroring software for IBM FlashCopy V2. With a Universal Volume Manager license, ALL heterogeneous externally connected storage can be replicated
Serverless Disk Copy and Tape Backup	Serverless Backup Enabler	IBM Tivoli Storage Manager (Windows environments only)	SAN Copy between CX / Symmetrix / non-EMC arrays - DeltaMaps Incremental copy	SAN Copy between CX / Symmetrix / non-EMC arrays - DeltaMaps Incremental copy	SE9985 provides Disk -to-Tape Coexistence with Serverless Backup Enabler (eCopy) and easy integration with existing file level backup using VERITAS NetBackup.
LU-Change-Ownership	YES	NO	NO	NO	
LUN Security	Volume Security	DS Storage Manager	Symmetrix Manager	Symmetrix Manager	
HOST Storage Groups Multiple LUN0/port	YES	YES	Storage Groups LUN0/port 1	Storage Groups LUN0/port 1	Multiple heterogeneous hosts can share a single physical port enabling consolidation
Storage Partitioning	Private Virtual Storage Machines	NO	NO	NO	Mainframe LPAR customers who wish to extend their server workload isolation and QoS to include data isolation and QoS can configure and dedicate a Network Storage Controller Private Virtual Storage Machine to each mainframe LPAR that requires it.
Array-based WORM Data Protection	YES	NO	NO	NO	Only SE9985 provides a disk system based facility to assign Read/Write, Read-Only and Protect access permission to logical volumes in their disk subsystem. Customers can provide regulatory compliant protection to data from unauthorized and potentially destructive operations.
Dynamic LUN Management	Logical Volume Concatenation	NO	Logical Volume Concatenation	Logical Volume Concatenation	
HOST Failover	HDLM	IBM SSD Subsystem Device Driver	PowerPath	PowerPath	
SAN Support	Non-proprietary	Non-proprietary	Proprietary	Proprietary	
SAN Management	SE9900 HiCommand Storage Services Manager Software and HiCommand Path Provisioning Manager Software, both powered by AppIQ	Tivoli SAN Manager	ECC SAN Manager	ECC SAN Manager	Sun has in-depth relationship on SAN and performance management with AppIQ across SE6000 line
Prioritize server access to storage	SE9900 Server Priority Manager Software (formerly Priority Access)	NO	NO	NO	Server Priority Manager software lets customers define and optimize the data access performance of the storage system for individual servers. Customers can ensure that production servers have prioritized access to data over development servers.

Heterogeneous Tiered Storage Management / Migration	HiCommand Tiered Storage Manager Software	SAN Volume Controller Migration	Open Replicator for Symmetrix Invista	Open Replicator for Symmetrix Invista	Tiered Storage Manager software provides a new, unique way to move application data between tiers of storage without needing to quiesce or pause running applications using that data. Tiered Storage Manager software provides a new, unique way to move application data between tiers of storage without needing to quiesce or pause running applications using that data.
Replication services Configuration / Management	HiCommand Replication Monitor	TotalStorage Productivity Center for Replication	ECC Replication Manager SRDF/TimeFinder Manager Symmetrix Data Mobility Manager	ECC Replication Manager SRDF/TimeFinder Manager Symmetrix Data Mobility Manager	
Backup-Restore Environment Management	HiCommand Backup Services Manager Software, powered by APTARE® (VERITAS NBU)	Tivoli Storage Manager	Legato NetWorker ECC ARM & StorageScope (EDM, Networker, TSM, NBU)	Legato NetWorker ECC ARM & StorageScope (EDM, Networker, TSM, NBU)	Competitive solutions are limited to passive historical reporting. Backup Services Manager software proactively avoids data loss through advanced forecasting and analysis capabilities. It also has a bottleneck analyzer, unique in its ability to monitor the entire backup path in real time, which correlates many data points to identify root causes of problems, with links to problem management for alerting and rapid problem resolution.
Open Systems Support	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
Maximum Attached Hosts	6144	1024	128		SE9985 enables storage consolidation for large numbers of heterogeneous hosts
RS/6000 AIX	YES	YES	YES	YES	
HP-UX	YES	YES	YES	YES	
Sun Solaris	YES	YES	YES	YES	
Windows NT	YES	YES	YES	YES	
Windows 2000	YES	YES	YES	YES	
Compaq Alpha	YES	?	YES	YES	
Sequent Dynix	NO	?	YES	YES	
SGI IRIX	YES	?	YES	YES	
NCR	NO	?	NO	NO	
Novell Netware	YES	?	YES	YES	
LINUX	YES	YES	YES	YES	
OpenVMS	Yes	?	YES	YES	
NetApp Data ONTAP	YES	YES	NO	NO	
IBM z/OS	YES	YES	YES	YES	
VMWare	YES	YES	YES	YES	
Apple MAC OS	YES	YES	NO	NO	
Warranty & Support	Sun StorEdge 9985	IBM DS6800	EMC DMX800	EMC DMX1000	
Warranty Period	3 years	HW - 4 YRs SW 4 YRs	HW - 2 YRs SW - 90 days	HW - 2 YRs SW - 90 days	
Standard support level	24x7, 4HR	9x5, NBD	24x7, 4HR	24x7, 4HR	
Remote Support	HiTrack	YES	YES	YES	

1st yr-24X7, 2nd-3rd Yr, parts exchange

Detailed Competitive Overview

Sun StorEdge 9985

The Sun StorEdge 9985 competes with EMC DMX line and IBM DS6000/8000 line with superior features and price/performance advantage. The industry leading in-system virtualization feature sets it apart from EMC and IBM. In fact, StorEdge 9985 can be the foundation for a comprehensive storage solution that EMC and IBM can only match by using multiple technology pieces at high cost and the burden of integration. Consider the following facts: *StorEdge 9985 is more than just storage; it's an architectural foundation for combining storage, software, and services.*

- StorEdge 9985 internal bandwidth is 50% or more than competition
- Virtualization provides up to 16PB of external storage.
- Unique integrated file service through NAS blade.
- Storage partitioning and cache partitioning capabilities protect line-of-business (LOB) storage investment and enable storage utility-type charge-back.
- State of art data replication software suite
- The Sun StorEdge 9985 Universal Replicator for the StorEdge 9985 software represents the first storage-based replication software facility that is server-free and application-transparent, while providing disk-journal-based, multi-target replication features to data in heterogeneous, tiered-storage environments.

Key Advantages Over EMC and IBM

There are several ways in which Sun's StorEdge 9985 can be seen to beat EMC's and IBM's closest offerings.

- It's a far superior consolidation platform.
- It enables application oriented storage solutions with unique, application-centric management capabilities.
- It simplifies and unifies business continuity and storage area management.
- It enables customers to manage external storage systems without inserting a virtualization appliance.
- It's an architectural foundation for data lifecycle management or information lifecycle management strategy in a single platform.

With that, presented in the following tables are individual snapshots comparisons for EMC, IBM and STK.

Competitive Snapshot: EMC

Overview	
<p>Competing against any EMC platform implies competing against all four of its networked storage platforms, including the Symmetrix DMX Series, the CLARiiON CX Series, the EMC Network Attached Storage “family,” and Centera Content Addressed Storage (CAS). EMC is particularly adept at cultivating unfair competitive comparisons with customers and changing their proposed platform during the evaluation process. For example, EMC has a history of positioning a high-end modular CLARiiON CX700 against the enterprise Sun StorEdge 9970 high-end modular storage with the intent of creating a cost advantage for the EMC solution. EMC has also made it a common practice to lead with the CLARiiON CX Series and “up sell” to the Symmetrix. Therefore, it's critical to know the entire collection of EMC platforms and be prepared to educate the customer on the appropriate positioning of those alternatives.</p>	
Products that might get bid against StorEdge 9985 platform	
Summary of the DMX Series	<p>EMC enjoys all of the benefits of past market leadership including a substantial Symmetrix installed base and enviable brand recognition. EMC continues to spread the message that the Symmetrix DMX provides the highest performance and availability in the enterprise storage market. The Symmetrix DMX was introduced to the market on 3 Feb 2003 and has since been enhanced twice, with the addition of the DMX3000 on 30 July 2003 and the most recent DMX-2 hardware enhancement on 9 Feb 2004. While the fast pace of DMX enhancements is cast by EMC as response to customer demand, it's really a series of failed attempts to catch up to the Sun StorEdge 9900 Series systems.</p> <p>There are three major levels of Symmetrix DMX hardware in the market today: the “hybrid” DMX800, the standard integrated DMX models (DMX1000, DMX2000, and DMX3000), and the integrated DMX-2 models (DMX1000-M2, DMX1000-P2, DMX2000-M2, DMX2000-P2, and DMX3000-M2). EMC has stated that they believe that most customer requirements will be met by non-DMX2 levels of hardware.</p>
The “hybrid” DMX800 & CX700	<p>The DMX800 combines the lower-cost “rack and stack” packaging associated with midrange or modular storage with the enterprise-level Enginuity operating environment. It is the latter that solely defines the DMX800 system as a Symmetrix. While the DMX800 is more costly compared to the high end of the CLARiiON CX Series, it lacks the availability and scalability of the remaining Symmetrix DMX models nor can it be upgraded to the integrated DMX line. DMX 800 has many limitations and is not well received in the market space. SE9985 can be positioned against DMX800 with far superior features and price/performance. SE6920 should be used to position against CX700.</p>
The integrated Symmetrix DMX models	<p>The DMX1000, DMX2000, and DMX3000, along with the DMX800 are positioned by EMC as sufficient to meet most customer requirements. DMX1000 & DMX2000, specifically, utilize the 500MHz PowerPC microprocessors and can scale to a maximum of 144 & 288 HDDs respectively. The -p version of DX1000 and DX200 use more disk directors for the benefit of better disk path performance at the expense of front-end channel director capability. SE9985 can compete effectively with DMX 1000 & DMX 2000 and their high performance variance in many competitive instances.</p>

The integrated DMX-2 models

The DMX1000-M2, DMX2000-P2, DMX2000-M2, DMX2000-P2, and DMX3000-M2 models announced on 9 Feb 2004, are positioned by EMC for the most demanding customer environments. These models utilize 1GHz PowerPC microprocessors (as well as hardware and Enginuity performance enhancements) and scale to a maximum of 576 HDDs. Most likely StorEdge 9990 should be used to compete against this line of DMX products for ultimate performance and scalability.

Response Tactics

- EMC is adept at choosing a market message and consistently delivering that message with an authoritative, visionary tone.
- EMC's current market message is Information Lifecycle Management or ILM.
- Customers are more skeptical than they have ever been about EMC's marketing message and in many cases do not believe that EMC alone can drive the industry to ILM nirvana. With that said, EMC deserves credit for initiating the ILM discussion and in many cases the company has defined the term ILM for a great number of analysts and customers.
- The Symmetrix DMX Series is one of four networked storage platforms that EMC prescribes in the first phase of an EMC ILM implementation.
- In the enterprise market, EMC has seen the most significant decline, beginning with the introduction of the the StorEdge 9900 Series. Since the introduction of the StorEdge 9900 Series, Sun has been the market and technology leader in enterprise storage and EMC has been playing catch-up with both the Symmetrix 8000 and DMX Series of storage systems.
- The greatest advantage that EMC holds is its substantial Symmetrix-based install base. Depending upon your perspective, this can be a matter of "customer loyalty" or "customer lock-in." In many cases it's a little of both. The loss of Symmetrix footprints impacts hardware revenue but has an even greater impact on software revenue. EMC also controls the re-sale market by invalidating the support contract when a symmetrix or DMX is re-sold especially in the event of a competitive replacement
- Hence, EMC often appears as a low-price leader on hardware, seeking to maintain customer and footprint control with the long-term objective of preserving software revenue.

Competitive Strengths

- . Aggressive sales and marketing campaign, driven through its ILM vision.
- . Distributor relationship with Dell and others seems to be working; even leveraging DMX sales
- . Largely through acquisition and partnership, EMC has partially addressed some of the competitive deficiencies of the EMC Symmetrix DMX Series, specifically storage capacity, availability, and connectivity.
- . Installed base, whether through customer lock-in or customer loyalty.
- . Broad suite of complementary software products.

Competitive Weaknesses

- DMX revenue continues to go down quarter over quarter – EMC is playing defense to maintain footprint
- No in-system virtualization like SE9990 class – the new Invista virtualization platform starts at \$225,000 with no data replication feature and mainframe connectivity
- No native NAS capability like NAS blade
- Lack of mirrored write cache
- Frequently criticized by customers for being arrogant and price gouging
- EMC continues to bet their future on a hybrid, switch-wannabe, Direct Matrix Architecture. Increased storage capacity without any enhancements to the architecture or additional internal paths is an invitation to performance problems. Performance doesn't scale with capacity.
- EMC follows Sun. EMC is a technology laggard. Switched architecture, more HDDs, asynchronous remote copy, FICON - all Sun firsts, compared to EMC.
- Lack of credibility in delivering consultative as well as integration and implementation services.
- Unproven asynchronous remote replication via SRDF/A.
- No RAID-6

Competitive Pricing

EMC was regarded as premium-priced storage up until recently. Market share loss, feature/function delay and a generally more competitive environment has forced EMC to lower prices. In an effort to regain lost share in key markets, such as IBM S/390®-z/OS® environments, EMC has directed its sales organizations to not lose the deal even if they have to be the low-price bidder in some cases.

Much of EMC's competitive positioning has keyed around their software offerings, which have been shown to be expensive, point-product shelfware in many cases. The Sun StorEdge 9985 is clearly years ahead of EMC DMX and our application-oriented software is far more integrated than anything EMC can offer. Pointing out the many unique advantages of StorEdge StorEdge 9985, coupled with the superiority of Sun HiCommand Storage Services Manager and Application Optimized Storage solution software will overwhelm EMC.

Hardware Offerings	
High-end Symmetrix DMX Series	Symmetrix is EMC's enterprise storage system brand. Although Symmetrix has been in the market since December 1990, the current Symmetrix DMX Series, based on the Direct Matrix Architecture was introduced to the market on 3 Feb 2003. Since the 3 Feb 2004 architecture and product introduction, the Symmetrix DMX Series has been enhanced twice: on 30 July 2003 with the introduction of the DMX3000 and again on 9 Feb 2004 with the DMX-2 level of hardware. EMC currently sells nine distinct models of the DMX Series from the "hybrid" DMX800 up to the high-end DMX3000-M2 with a maximum configuration of 576 HDDs.
Modular The CLARiiON CX Series	CLARiiON represents EMC's modular or midrange storage system. The CLARiiON product was obtained by EMC through the Data General acquisition in 1999. The most recent CLARiiON CX Series was introduced in late 2002 and was updated in early 2004 with three new models: the CLARiiON CX300 departmental storage system, the CLARiiON CX500 workgroup storage system, and the CLARiiON CX700 Data Center storage system. EMC has introduced a new, low-cost, entry-level CLARiiON storage system, the AX100 SATA system, to be sold primarily through their channel partners. Disk Libraries 300 and 700 were introduced in early 2004 to address the disk-to-disk backup requirements by integrating FalconStor technology with CX300 and CX700.
NAS EMC's Network Attached Storage	NAS offerings include the Celerra Clustered Network Server (CNS); the Celerra Gateway NSX Series for high-end, NS500/704G (gateway to SAN) and NS500/700 (add iSCSI) for midrange; as well as the entry-level NetWin 110/200, based on Microsoft Windows Storage Server 2003 operating system. All of these offerings use either Symmetrix or CLARiiON for the storage device.
Archive storage The Centera Content Addressed Storage	Centera is the fourth and newest storage platform available from EMC. Born of the April 2001 acquisition of FilePool, EMC introduced Centera in April 2002 as a unique solution for the storage of fixed content. In 2003, compliance model is introduced to address post-9/11 regulatory requirements

Storage Management Software

EMC continues to invest in management; especially for heterogeneous environments. With InVista and VMWare virtualize the data path, EMC is looking for technology that can augment the ControlCenter as the management layer of EMC and non-EMC storage assets. This is critical for EMC to compete with traditional server and network management companies such as IBM and HP. The acquisition of NY-based SMARTS is a good example. The description of the technology is operating system of operating systems. The SMARTS software correlate events among heterogeneous networked storage and look for exceptions that would indicate the root cause of the problem. Clearly, substantial work needs to be done to ensure full integration with half a dozen of management software that EMC developed for each of its platform. Given EMC's track record of lip service when it comes to embrace industry standards, the resulting management software would clearly be another lock in

Business Continuity

Although EMC has a comprehensive suite of business continuity solutions, EMC continues to deliver products specific to each of their storage platforms and have nothing to match Universal Replicator software. For example, EMC continues to push SRDF for true DR applications even with the announcement of InVista.

Service Offerings

EMC Global Services' offerings are organized into four primary categories—Consulting Services, Implementation and Integration Services, Support and Management Services, and Education—which extend into EMC's indirect sales channel via the Authorized Services Network (ASN) Partner Program. EMC's strongest service revenue comes from maintenance. Consulting service, which is tied to Accenture, remains small (\$28M out of \$375M in Q1FY05). Beyond that, the proprietary EMC-provided professional services, and partner-provided implementation, integration, and support services, are ramping slowly with all the recent software acquisition.

Data/Information Lifecycle Management Strategies	
Summary of ILM strategy	<p>On 8 September 2003, EMC launched a full offensive of marketing hype for Integrated Lifecycle Management (ILM). Today, almost every EMC hardware, software, and service offering is marketed as a component of ILM. Although many companies now highlight an ILM strategy, EMC was first-to-market with an ILM story. Most customers and analysts derive their understanding of ILM from EMC documents and presentations.</p> <p>According to EMC, there are three major customer challenges related to information management: strong growth of information, information is playing a more important role in determining business success, and information changes in value, and many times not necessarily in a linear fashion. These challenges are the foundation of the business requirement for ILM.</p> <p>The process of implementing and expanding upon an information lifecycle management strategy consists of four activities.</p>
Classifying data and applications...	... on the basis of business rules and policies to enable differentiated treatment of information
Implementing policies with information management tools...	...from creation to disposal of data
Managing the environment...	...with heterogeneous and integrated tools that interface with multivendor platforms and reduce operational complexity of point solutions
Matching tiered storage resources to classes of data...	...storing information in the right type of infrastructure based on its current value
ILM road map	
Phase 1	<ul style="list-style-type: none"> · Enable networked storage · Automate the environment · Classify applications/data
Phase 2	<ul style="list-style-type: none"> · Define business policies for various information types · Deploy ILM components into principal applications
Phase 3	<ul style="list-style-type: none"> · Implement ILM across applications · Policy-based automation · Full visibility into all information

Every product is now placed in an ILM context

EMC's ILM road map phase 1 focuses on products and solutions available today with the goal of being "ILM-enabled" across a few enterprise-critical applications. In phase 1, the goal is to get the customer's environment to an automated networked storage environment. This is the basis for any policy-based information management. The value of tiered storage platforms can be exploited manually until ILM is fully implemented. Symmetrix DMX will be positioned as a networked storage system and therefore part of phase 1 on their ILM road map.

EMC has firmly embraced ILM as the definition of their overall strategy in the storage market. ILM is EMC's vision for storage. By describing ILM as the extraction of maximum value from information at the lowest total cost over the information life-span, EMC gives storage executives and administrators an ILM vision they can easily relate to on a high level. ILM is by nature a solution and, as such, this makes services and software an integral part. Since EMC's goal is to increase software and services revenue as hardware revenue decreases, ILM as the guiding and governing light of EMC storage strategy makes perfect sense.

By virtue of extensive investments for both internally developed and externally acquired products and an omnipresent marketing campaign spelling out their ILM road map and vision, EMC has established a leadership role as an ILM provider.

EMC marketing now places every storage product in an ILM context. When all recent acquisitions are considered, EMC's ILM "coverage" spans across all types of data (structured, semi-structured, and unstructured), includes all of their hardware platforms plus almost all of their key software products, and has drawn in the necessary partners to fill out the remaining gaps (for example, ADIC for tape). This allows EMC to place all storage initiatives in an ILM context and to claim to be the #1 ILM company.

Recommended Strategy AGAINST EMC	
Focus prospects on the superiority of the Sun hardware platform.	<ul style="list-style-type: none"> · DMX line is lagging in in-system virtualization to consolidate and to provision storage assets. · DMX architecture is EMC continues to bet their future on a hybrid, switch-wannabe, Direct Matrix Architecture. More storage capacity without any enhancements to the architecture or additional internal paths is an invitation to performance problems. · EMC platforms lack mirrored-write cache. · No RAID 6. · Inferior price/performance
Push the importance and benefits of the replication and common management of StorEdge 9985 and all other Sun storage.	<ul style="list-style-type: none"> · EMC platforms continue be isolated from one another: lack of common management tools, specialized Centera platform not SAN-enabled for fixed content, etc. · Sun SAM Suite and its HiCommand modules, as well as StorEdge 9990/9985 provide unmatched commonality and single point of command for all storage needs. · Universal Replicator, multi-hop replication and VPSM are stand-out features for 9990 class; granted the best in industry

<p>Elevate the importance of StorEdge 9985 system exclusives in the minds of customers. However, please promote primarily for mainframe accounts, and lead with the SE 6920 in Open Systems accounts.</p>	<ul style="list-style-type: none"> · StorEdge 9985 internal capacity is superior to DMX800/1000 and is at parity with DMX 2000 with better maximum internal and external capacity (combined) is 16 times or more with virtualized external storage · Unique multiprotocol connectivity and Host Storage Groups maximize the flexibility of any solution built around StorEdge 9985. · "Virtual Private Storage Machine (VPSM) capabilities can guarantee QoS, allow depreciation of storage investment at LOB level if required, and simplify “storage utility” type charge-back . "VPSM" is complementary to Dynamic System Domains in Sun Servers, and support a customer's "Server Provider" Business Model initiatives. · Connectivity for external storage systems enables storage aggregation and makes multitiered storage management and data movement practical, not just something to prepare for. · Universal Replicator provides the enterprise performance associated only with storage-based replication along with the cost benefits and higher data protection of disk-journal-based technology. It can greatly simplify the task of highly resilient multi-target replication in heterogeneous, tiered storage environments. · StorEdge 9985 NAS Blade(s) offer the ideal consolidation platform for plug-and-play, mission-critical file sharing, offering fully integrated, centrally managed, highly available system versus versus EMC NSX class.
<p>Highlight Sun's advantages in Replication Technology.</p>	<ul style="list-style-type: none"> · EMC has unproven asynchronous remote replication via SRDF/A, whereas Sun StorEdge 9900 True Copy Remote Replication Remote Replication software pioneered replication over any distance and has unmatched data integrity safeguards. · StorEdge 9985 Universal Replicator software takes the True Copy Remote Replication technology to a higher level, with the advantages of n-to-n replication for any platform that can connect to Universal Replicator software and the advantages of disk-based journaling. · We are particularly strong with mainframe offerings, from compatibility with IBM replication software to Sun StorEdge Business Continuity Manager software (formerly StorEdge CopyCentral software) for automating overall process.
<p>Help prepare your prospect for EMC's misleading competitive positioning practices.</p>	<ul style="list-style-type: none"> · They may position a lower-cost product against StorEdge 9985 to win a deal, knowing they can up-sell later. Therefore, you need to know most of the EMC line and the appropriate positioning and capabilities of each platform.

<p>Stress that while EMC is trying to get customers to the preparatory “level 1” in ILM, StorEdge 9985 makes ILM practical today .</p>	<ul style="list-style-type: none"> · EMC has optimized within various product line and thus created much incompatibility between DMX, CX, AX and NS lines. EMC will resort to Control Central as the cure for all but it's nothing more than a glue to mask the differences of various operating systems and Control Center is not SMI-S compliance. Not to mention the stiff price tag. · Virtualization technology such as InVista is incomplete and unproven. Any customer interested in domain storage and solution integration in Data Center space would find SE9985 much more attractive together seamlessly to implement ILM is only glued together with an HTML launch menu. · StorEdge 9985 simplifies data movement across not only tiers of Sun storage but also for all other tiers of storage. That ability coupled with the superiority of StorEdge 9900 HiCommand Storage Services Manager software at controlling heterogeneous environments and our strength in data movement software makes us much more capable today. Application oriented storage solutions are already real.
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Competitive Snapshot: IBM

Overview	
<p>IBM can be expected to utilize their full storage product suite as they compete against StorEdge 9985. IBM has two storage system lines and can address both mainframe and open systems requirements. IBM also offers an in-band virtualization appliance SVC that can attach both IBM product lines as well as non-IBM systems. IBM recently OEMed the entire NetApp product line which includes gateway product to sit in front the DS6000/DS8000 line to provide file services. Finally, IBM will use “one-stop shopping” appeal against us with deals that include servers and its full-scope service and solutions offering.</p>	
Products that Might be Bid Against StorEdge 9985	
DS 6000/8000	<p>New line of high storage, replacing ESS 800, as IBM's top of the line array systems that can support both mainframe and open system. Still based on p-series server clustering technology, DS6000 and DS 8000 move to industry standard FC disk subsystems for backend. Priced competitively and with new 4 year warranty, DS 6000/8000 would be of interest to existing Shark customer base. In addition IBM will stress performance, accessibility, security, and reliability needed to support 24/7 operations of the “on-demand world.”.</p>
SAN Volume Controller (SVC)	<p>SAN Volume Controller (SVC) is a out-of-band virtualization engine comprised a SAN volume manager with up to 4 2-node clusters of x-series servers. It can virtualize IBM, EMC, HDS, HPQ and Sun/HDS array products. Snapshot and remote replication are supported via majority of FC switches/Directors. Currently, SVC only supports AIX, HP-UX, Windows, Linux and Netware hosts. No mainframe support has been announced but IBM allow Shark/DS6000/DS8000 storage systems to be attached to both the SVC and a mainframe host at the same time.</p>
IBM DS4100, DS4300 and DS4800	<p>IBM DS4XXX line are open systems storage systems OEMed from Engenio. DS4XXX are targeted at the midrange market where open system attach is essential. No mainframe attach is being planned.</p>
IBM NAS500G / NetApp V-Series	<p>The recently announced OEM relationship with NetApp means the home-grown NAS500G is near the end of its life. V-Series, previously known as g-filer, can support HDS 9900 and 9500 classes of products. iSCSI is the newest enhancement. V-series is not selling well and it's there primarily for strategic reason. V-Series can support all ESS and DS4000 class of products. The SE9900 NAS blade is a much better choice with it fully integrated, centrally managed & high performance</p>

Response Tactics

IBM's competitive strategy centers on their "On Demand" marketing campaign. Central to delivering On Demand storage will be IBM hardware products (servers, disk, tape, SAN infrastructure), IBM Tivoli software, IBM Virtualization Family (software and appliances) and IBM Global Services. IBM has several alternative tactics to draw on depending on the nature of the competitive situation. Much emphasis is placed on the benefits of IBM as a single-source supplier for all components of the solution.

IBM has succeeded with Shark/ESS 2105 not by challenging the Sun 9900 family's obvious superiority but rather by positioning Shark/DS6000/DS8000 as "good enough and cheap enough for mainframe" to attract cost sensitive customers. They underscore that posture by being the low-price bidder. IBM's value proposition of "good enough + cheap enough" for Shark proves to be a compelling argument for many customers.

With the advent of SAN Volume Controller and SAN File System, IBM has created an alternative competitive tack, positioning the SVC virtualization appliance as a centralized migration and consolidation platform to manage IBM Shark and DS systems plus other heterogeneous storage systems with one set of replication and management services for all attached storage. IBM's primary value message for SVC is that it eliminates SAN "storage islands," recoups stranded capacity, provides centralized management for all SVC storage, offers dynamic data migration, and provides a common platform for advanced functions like replication services with a single software license fee, regardless of the storage attached to SVC.

Both IBM strategies contain problems for customers:

- DS6000/DS8000 may be cheap but its bus architecture is a major bottleneck that inhibits its ability to adequately service demanding, disparate, multi-tenant workloads.
- Shark's architecture also inhibits large-scale storage consolidations, requiring multiple DS6000/DS8000 footprints when a single StorEdge 9985 Series system would suffice. As a result, DS6000/DS8000 is inherently less efficient and more complicated to manage in a large-scale consolidation.
- DS6000/DS8000 management tools are not as well integrated as HiCommand software modules and fail to provide application-level storage management.
- SVC software is a Linux application running on Intel servers. It can be clustered, but customers are understandably reluctant to run all their storage resources through Linux and Intel servers.
- SVC represents a huge conversion project that will consume administrative resources "On Demand" like a locust swarm. It's not as easy as IBM marketing implies.

This is why IBM recommends a phased approach to SVC implementation, one application at a time.

This means double systems and all the complications that implies. How long will two storage management platforms be running side-by-side before SVC consolidation benefits can be reaped?

- SVC Copy Services appear to be familiar but have been completely rewritten for SVC—a risk for early implementers.
- An SVC + SFS implementation is essentially a locked-in commitment to IBM storage. It constitutes a proprietary solution. As an IBMer has said: "Once you convert—we've got you."

Competitive Strengths

- IBM Global Services
 - One-stop shopping for server, storage, software, and services
 - Shark/DS6000/DS8000 has widespread acceptance and large install base, especially in z/OS
 - IBM “good enough” marketing campaign seems to be working
 - Claims up to 6x throughput performance improvement over ESS 800
 - Leveraging proven server clustering and partitioning technology to validate the HA nature of the new DS6000/DS8000 architecture but DS6000 which uses Linux remains a questionable part of the high availability design
- Demonstrated commitment to SMI-S- and CIM-compliant software and hardware
- Claimed field upgradeability between model 810 and 830
- Large ESS and DS/FAStT install base provides lots of opportunity
- SVC provides an relatively a low cost way to support attachment of large variety of non-IBM storage
- For installed base, SVC affords consolidation, tiered storage and asset utilization
- Claimed SMI-S and CIM- compliant
- 4-year 9x5 warranty

Competitive Weaknesses

- . No in-system storage virtualization capability
- . ■ The new 4 year warranty is only 9x5 – not suitable for mission critical environments
- . ■ No easy upgrade path between ESS 800 or DS6000 to DS8000
- . Bus-architecture bottlenecks remain to limit the throughput performance
- . Capacity, connectivity, performance, availability and replication nowhere near that of StorEdge 9985 and SE9990
- . No application integrated solutions
- ■ Logical Partitioning (LPAR) are limited to DS8000 model 830 only; SE9985 offers 8 VPSM
- . DS6000 has no ESCON connectivity
- Do not support internal or external SATA or nearline drive attach to offer true multi-tier storage
- IBM In-band virtualization appliance unproven, especially in large consolidations of heterogeneous storage systems
- DS6000 uses a specialized Suse Unix kernel with un-proven maturity and security for data center applications
- SVC versions of PPRC and Compatible Mirroring for IBM FlashCopy are complete re-writes—immature, have limited functionality
- . No multi-hop or N to 1 replication
- . No RAID 6
- . ■ Claimed large cache but little more than half of the cache are used for actual data; the rest is used by OS.

Competitive Pricing

IBM is usually the low-price bidder on storage to gain footprint. This is the essence of their “good enough—cheap enough” strategy. If their low prices can avert the focus away from DS6000/8000 relative deficiencies compared to StorEdge 9990/9985 family systems, they have a fighting chance. The gimmicky 4-year warranty is a similar attempt to lure customers who believe in “good enough” story. IBM is also a major practitioner of bundling and will deploy everything they have to gain an advantage through package deals.

To battle this strategy effectively, you must 1) use StorEdge 9985 or 9990 Series advantages to project a lower TCO over the life time of the products due to extendable architecture and proven software suits, and 2) gain recognition for the value of better performance and the ability to tune performance when handling multiple application loads. Lastly, remind customers the investment protection afforded by the in-band virtualization and NAS option which IBM have to add expensive hardware and software to match while further complicating the management aspect of IT operation.

Hardware offerings	
<p>IBM may play between DS4800, DS6000, DS8000 and SVC when up against StorEdge 9985. But they will certainly not abandon “good enough” when they can’t really match either the first or second tier of our offerings.</p>	
<p>High-end Total Storage DS6000/8000 Series</p>	<p>IBM will position the DS8000 as the choice enterprise storage system, identifying HDS, and EMC as primary competitors. DS 6000, lacking mainframe connectivity and logical partitioning capability, is really a midrange product for 1 or 2 applications only. Nevertheless, IBM will propose DS6000 when customers object to the high costs of DS8000.</p> <ul style="list-style-type: none"> · Highly scalable enterprise storage · LPAR (Logical Partitioning) helps with resource provisioning and application/host isolation · Capabilities that support continuous availability · Advanced functionality for disaster recovery and backup · Share data across multiple platforms: z/OS, UNIX, Linux, and Windows · Multiple connectivity options: Fibre Channel/FICON, ESCON, and SCSI · Local, remote, and long-distance storage system-based data replication options · Web-based management tools · CIM and SMI-S compliant
<p>Modular IBM DS4800 Modular Storage</p>	<p>Will also be positioned against StorEdge 9985 when there are no S/390-z/OS connectivity requirements. IBM has been positioning the DS4800 as a high-performance (First to market with 4 Gb FC), enterprise disk storage system comparable to Shark in regards to performance, capacity, advanced functionality, and reliability. Since FAStT supports S-ATA disk drives it is likely that it will be offered to help lower the costs of IBM storage solution proposals, particularly when there are ILM requirements, i.e., tiered storage.</p>
<p>Virtualization appliance SAN Volume Controller (SVC)</p>	<p>Given the opportunity, IBM will attempt to insert the SAN Volume Controller (SVC), a storage virtualization appliance with no native storage of its own, into the role of high-end storage system. Since the SVC sits in the data stream, it serves as a front-end for storage systems such as Shark, DS/FAStT, and non-IBM arrays. SVC is an integral part of IBM’s overall storage strategy to move storage intelligence and functionality out of the storage system and into the storage network, and IBM is aggressively marketing it. If IBM is successful, the actual storage systems behind an SVC will have difficulty differentiating themselves or providing unique value, relegated by SVC to serve as raw storage and nothing more.</p>
Storage Management Software	

IBM's offerings include tools to manage DS arrays through DS manager or multiple IBM and no-IBM storage through MDM (Multi-Device Manager). Effort has been put in to improve the diagnostic and pre-emptive aspect of device management. IBM management software claims SMI-S compliance.

Business Continuity

IBM provides advanced function copy services for each of its storage product lines. For the SVC, DS6000/8000 and DS4000 families, these copy services are specific to each product line despite common copy product names and do not provide inter-family replication. SVC can provide copy services for ESS or DS6000/8000 and DS4000 storage systems, but only once the storage resource has been "virtualized" by the SVC appliance; the DS6000/8000 or DS4000 system-based IBM Compatible Mirroring for IBM FlashCopy/PPRC code is/can not used by the SVC or the individual storage systems at that point. This places IBM in the position of having three different versions/types of each PIT or remote copy product, one for each storage family and one for the SVC. Once this is understood, IBM's motivations to push customers to an SVC-based storage solution become obvious. Residing within the SVC are not only do IBM's key value propositions to the customer, but also lower storage product costs for IBM.

Service Offerings

IBM's storage services are now driven by the managed-hosting and outsourcing engagements of IBM Global Services (IGS). Storage services are integrated with its broader set of IT services, which enable on-demand business models through outsourcing, managed hosting, or customer-enabled solutions. Additional storage-related services are integrated with consulting services and “On Demand Business” infrastructure solutions. The company is investing heavily in "on demand" services, including storage services and developing or acquiring new tools and technologies to execute against this strategy.

IGS claims to have more than 180,000 service professionals in 160 countries (having acquired roughly 31,000 from PwC Consulting). As a result of the PwC Consulting acquisition, IGS assumes the top revenue position in all worldwide IT professional service segments (except process management services)—and accounts for approximately 45 to 50 percent of IBM's overall revenue.

Data/Information Lifecycle Management Strategies

IBM doesn't have a specific ILM strategy per se. Instead, they incorporate the variety of products, practices, services, and processes other vendors typically refer to as ILM/DLM into an “On Demand Storage Environment,” which is a subset of their overall “On Demand” strategy. “On Demand” is about every aspect of a business, internal as well as external, functioning as one cohesive unit. By virtue of the sheer size of IBM—especially its Global Services unit, but also including a complete catalog of products and partners—IBM can and does portray itself as all things to all people.

The storage environment aspect of On Demand centers the around several main areas:

<p>Disk systems house information as part of larger solutions; these can be offsite, pay-as-you-go external systems.</p>	<ul style="list-style-type: none"> · IBM positions its virtualization hardware and software as the vehicle to streamline IT infrastructures while lowering cost and increasing productivity. · IBM frequently bundles a collection of existing hardware, software, and services as a new branded solution. For example: <ul style="list-style-type: none"> Data Retention 550 for management and enforcement of data retention policies (includes IBM servers, disk, and tape, as well as Tivoli software) Content Manager for Message Monitoring and Retention for e-mail/messaging regulatory compliance Tivoli Security Compliance Manager for data access, privacy, and auditing regulatory compliance Lotus Workplace for Business Controls for Sarbanes-Oxley Act compliance · More typically, storage products or product families are portrayed relative to a given industry solution, i.e., IBM TotalStorage PACS Solutions, etc.
<p>IBM Tivoli software solutions fall under two broad categories.</p>	<ul style="list-style-type: none"> · Business continuity · Business efficiency <p>(Dozens of specialized Tivoli titles)</p>

<p>IBM Global Services offerings are designed to assess, plan, and implement solutions using IBM disk, tape, and storage products Management software, Storage and Storage Networking.</p>	<ul style="list-style-type: none"> · Existing On Demand solutions implemented in a variety of industries: Automotive, Banking, Electronics, Health Care, Insurance, Retail, Telecom, etc.
<p>IBM On Demand Storage Environment definition</p>	<ul style="list-style-type: none"> · Data is classified (processes and practices) · Active files are pooled (virtualization) · Inactive files are stored in variable-cost storage hierarchy (storage orchestration) · Infrastructure changes are nondisruptive (virtualization) · Management interfaces are common and open (SMI-S enabled) · Administrative efficiency is enhanced (workflow automation) · Human errors (human) are eliminated (workflow automation)
<p>IBM TotalStorage Open Software Family provides “storage orchestration” and workflow automation in the On Demand storage environment.</p>	<ul style="list-style-type: none"> · Supports platforms, applications, networks, and storage in heterogeneous LAN/SAN environments · Enterprise Storage Management for active data · Tivoli Storage Resource Manager · Tivoli SAN Manager · TotalStorage Multiple Device Manager · Hierarchical Storage Management for inactive data · Tivoli Storage Manager for Space Management · Archive Management with automation technology · Tivoli Storage Manager Archive · Recovery Management with automation technology · Tivoli Storage Manager
<p>IBM TotalStorage Virtualization Family facilitates hardware changes without interrupting applications.</p>	<ul style="list-style-type: none"> · IBM SAN Volume Controller (SVC) virtualizes the disks · Network Appliances full line of iSCSI/NAS systems and NAS gateway · Attaches IBM and non-IBM disk storage systems · Common replication platform for all attached disk
<p>IBM SAN File System (SFS) supports “utility storage.”</p>	<ul style="list-style-type: none"> · SFS supports tiers of storage segmented according to business need

Differentiators

- IBM Global Services organization size, depth, and breadth lends credence to IBM's know-all, be-all claims
- Full range of product options that span solution requirements from servers to storage to software
- Virtualization appliances such as SVC help to pool storage and replicate data across IBM and some no-IBM disk storage systems
- SFS, like SVC, provides similar benefits for discrepant file storage with mainframe-class storage management (DFSMS) feature to open systems

Recommended Strategy Against IBM	
Focus on the TCO and the business benefit of Sun hardware platform	<p>DS6000/8000 may be cheap for initial purchase but over the life span of the applications. Similarly, good enough” for some uses, but for true multi-tenant and multi-tier storage not for the uses that bring out the best in a StorEdge 9985</p> <ul style="list-style-type: none"> · Talk about Hi-Star, NAS blade, FICON and 64GB are far superior for storage workload than a cluster of AIX/Linux servers glued to generic FC drive trays through a pair of FC switch · Capacity, connectivity, performance, and replication are nowhere near that of StorEdge StorEdge 9985 when against DS6000 · Little or no integration with key enterprise applications · SVC PPRC and Compatible Mirroring for IBM Compatible Mirroring for IBM FlashCopy have different from Shark versions
Point out the benefits of in-system virtualization if the customer is seriously considering consolidation with ease of management	<p>SE9985 and SE 9990 are in a class by themselves – offers top notch data center features and true in-system storage resource consolidation capability.</p> <ul style="list-style-type: none"> · IBM would have to offer SVC technology at \$220K+ to match Sun virtualization and VPSM · SE9985 has the best-in -class replication software to support true multi-tenant and multi-tier data movement which is the building block of ILM · SVC versions of PPRC and Compatible Mirroring for IBM Compatible Mirroring for IBM FlashCopy are complete re-writes—immature, have limited functionality <ul style="list-style-type: none"> - No asynchronous support in initial releases - PPRC Synchronous limited to 10km Fibre Channel distance

<p>Elevate the importance of StorEdge 9985 exclusives in the minds of customers</p>	<ul style="list-style-type: none"> · StorEdge 9985 internal capacity is twice or more than DMX 800/1000 and DS6000. As far as external capacity is concern, there is no match to SE9985.. · StorEdge 9985 offers minimum 50% more internal bandwidth than competitors in its class. · Unique multiprotocol connectivity and Host Storage Groups maximize the flexibility of any solution built around StorEdge 9985. · Virtual Private Storage Machine (VPSM) capabilities can guarantee QoS, allow depreciation of storage investment at LOB level if required, and simplify “storage utility” type charge-back . "VPSM" are complementary to Dynamic System Domains in Sun Servers, and support a customer's "Server Provider" Business Model initiatives · Connectivity for external storage systems enables storage aggregation and makes multitiered storage management and data movement practical, not just something to prepare for. · Universal Replicator software provides the enterprise-performance associated only with storage-based replication along with the cost benefits and higher data protection of disk journal-based technology. It can greatly simplify the task of highly resilient multi-target replication in heterogeneous, tiered storage environments. · StorEdge 9985 has unmatched security services. · StorEdge 9985 NAS Blade Features offer the ideal massive consolidation platform for plug-and-play, mission-critical file sharing offering the highest bandwidth, reliability, and capacity to reduce NAS “islands” through consolidation and simplify management.
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Frequently Asked Questions

Q. What software that was announced for the SE9990 is supported on the SE9985?

A. The following Sun StorEdge 9900 Software is supported on both the SE9990 and SE9985:

- SE9900 Universal Volume Manager
- SE9900 HiCommand Tiered Storage Manager
- SE9900 TrueCopy Remote Replication
- SE9900 TrueCopy Asynchronous Extension
- SE9900 Resource Manager
- SE9900 HiCommand Device Manager
- SE9900 HiCommand Tuning Manager
- SE9900 HiCommand Dynamic Link Manager
- SE9900 Virtual Partition Manager
- SE9900 Compatible Replication for XRC
- SE9900 Performance Monitor
- SE9900 Volume Migration
- SE9900 Server Priority Manager
- SE9900 Data Retention Utility
- SE9900 ShadowImage In-System Replication
- SE9900 Multiplatform Backup
- SE9900 Cross-OS File Exchange Lic
- SE9900 Serverless Backup Enabler Lic
- SE9900 DB Discovery - Oracle 9i on Solaris
- SE9900 Cross-System Copy
- SE9900 NAS Blade Manager
- SE9900 NAS Anti-Virus Agent Lic
- SE9900 NAS Backup Restore Lic
- SE9900 NAS File Sharing Open Source
- SE9900 HiCommand Storage Services Manager

Q. Does the SE9985 provide mainframe support?

A. Mainframe support will not be available at time of announce, it is scheduled to be supported within "Phase II" of this release which is targeted for Q2FY06.

Q. What power is available for the SE9985?

A. 30 amp and 50 amp are both available on the SE9985.

AC Input
Single Phase
60Hz : 200V, 208V or 230V at 30 amps
50Hz : 200V, 220V, 230V or 240V at 50 amps

Q.

"How do I get a quote?"

A.

In the Americas, please engage the Storage Center of Excellence (SCOE) by sending your request to scoe@Sun.com or by engaging your storage specialist

Q.

What does "Parts Exchange" mean in context of Sun Service offerings?

A.

It means that after a failed component is removed by authorized service personnel, the customer is responsible for sending it to Sun, and Sun will send back a replacement part.

Q. How many service processors are in the SE9985?

A. There is one service processor in the SE9985. You cannot put two service processors within the SE9985.

Q. Can I use a SVP from the SE 9990 in a SE 9985? Can I use a SVP from A SE 9985 in a SE 9990.

A.

These are different SVP, and are not interchangeable. The answer to both questions is no.

Q. How many racks comprise the SE9985?

A. The SE9985 will consist of one rack. The SE9985 will allow another rack to be attached to it, consisting then of two racks in phase II, which is expected in Q2FY06.

Q. Does the SE9985 run the same microcode as the SE9990?

A. The SE 9985 runs microcode which is very similar to the microcode in their SE 9990.

Microcode

V03:

SE 9990 = 50-03-93 00/00

SE 9985 = 50-03-94 00/00

V04:

SE 9985 and SE 9990 microcode different

V05:

Convergence of SE 9985/SE 9990 microcode 4QCY05

Q. How does the SE9985 compare to other members of the SE9900 Family of products?

A. Key features will consist of the following. All figures are maximum figures assuming Phase II results achieved. Please pay careful attention to the Phase I and Phase II Feature release schedules.

	SE 9985	SE 9990	SE 9970	SE 9980
Packaging	19"Rack (1)	Multi-cabinet	Single cabinet	Multi-Cabinet
Architecture	Crossbar	Crossbar	Crossbar	Crossbar
Aggregate internal bandwidth	12GB/s	81GB/s	7.9GB/s	15.9GB/s
Virtualization	Yes	Yes	No	No
Maximum Raw Capacity (Internal)	72 TB	332 TB	18.5 TB	149.5 TB
Internal and External Capacity (Raw)	16 PB	32 PB	N/A	N/A
Max # of HDDS	240	1,152	128	1,152
Max # of LUNs	8,192	16,384	16,384	16,384
Max data cache	64GB	128GB	64GB	128GB
Mirrored cache boards	Yes	Yes	Yes	Yes
Max shared memory	6GB	6GB	6GB	6GB
FC Connectivity Performance	2Gb/s	2Gb/s	2Gb/s	2Gb/s
Max theoretical host support	6144	24,576	6144	8192
Fibre Channel Connectivity	48	192	48	64
Multi-protocol support	FC/NAS FICON ESCON	FC/NAS FICON ESCON	FC/NAS FICON ESCON	FC/NAS FICON ESCON
HDD				
73 GB 10K	No	No	Yes	Yes
73 GB 15K	Yes	Yes	Yes	Yes
146 GB 10K	Yes	Yes	Yes	Yes
146 GB 15K	No	Future	No	No
181 GB 10K	No	No	Yes	Yes
300 GB 10K	Yes	Yes	No	No
RAID 1,10,5	Yes	Yes	Yes	Yes
RAID 6	Yes	Yes	No	No
Service Processor (Maximum)	1	2	2	2
Advance Software Features				
Remote Replication				
TrueCopy Synch	Yes	Yes	Yes	Yes
TrueCopy Asynch	Yes	Yes	Yes	Yes

Universal Replicator	Later	Later	No	No
Point in Time Snapshot Shadow Image	Yes	Yes	Yes	Yes
Partitioning Virtual Partitioning Manager	Yes	Yes	No	No
Array Based WORM data protection Data Retention Utility	Yes	Yes	Yes	Yes

Q. Can you quickly explain some of the advanced software features which run on the SE9985?

A. The SE9985 has a very similar feature set when compared the SE9990. The SE9985 uses the same software as the SE9990; therefore the SE9985 supports the new features recently introduced for the SE9990. These features include:

StorEdge 9990 Universal Volume Manager - This is the software which implements External Storage and provides the virtualization of a multi-tiered, heterogeneous storage. The StorEdge 9990 Universal Volume Manager supports the operation of multiple storage systems connected to a StorEdge 9990 to be managed as if they were all in a single system through common management tools and software.

StorEdge 9990 Virtual Partition Manager - supports the logical partitioning of ports, cache, and disk capacity (parity groups) on the StorEdge 9990 to create independently managed Virtual Private Storage Machines

StorEdge 9990 Universal Replicator - This is disaster recovery software which provides data replication across all systems managed by a StorEdge 9990s. The Universal Replicator's significant advantage over competitive products derives from advanced technology including disk-based journaling, and pull technology which off-loads processing from the central site. Initially available in 2 Data Center configurations, it will in the future be enhanced to include 3 DataCenter configurations. Universal Replicator is based on True Copy Asynchronous product with additional code to provide its advanced features. Universal Replicator may be combined with TrueCopy Synchronous to provide a no-data loss solution for shorter disaster recovery distances.

StorEdge 9900 Cross System Copy - SE9900 Cross System Copy is primarily for data migration between different platforms as well as file distribution.

*SE9985 Unique - Sun StorEdge(TM) 9900 HiCommand Storage Services Manager(HSSM) 4.2 Software - HSSM 4.2 delivers the most comprehensive, standards-based management platform that integrates heterogeneous SAN management, storage resource, operations, and application management, and

provisioning.

Sun StorEdge 9900 HiCommand Tiered Storage Manager Software - The primary objective of this software package is to support a customer's Data Lifecycle Management initiatives with transparent, nondisruptive data volume movement to the appropriate tier of storage. Different tiers of storage may have different attributes such as cost, performance, level of data protection and types of storage management tools. Underlying data movement engine is SE 9900 Volume Migrator, formerly known as Cruise Control.

StorEdge 9900 Protection Manager 4.1 enables disk-to-disk-based rapid backup and recovery operation for Microsoft Exchange Server, Microsoft SQL Server, and Microsoft NT File System (NTFS), taking advantage of StorEdge 9990/9985 storage system replication technologies.

Protection Manager 4.1 major enhancements include the support of TrueCopy Remote Replication software and Universal Replicator software that enables remote disaster recovery backup against risks including storage system failure and local disaster. Through support of Microsoft Volume Shadow Copy Service (VSS), integration is now provided for NTFS backup and recovery for file servers as well as the capability to take multiple generation backups. And support of dynamic disks through Logical Disk Manager (LDM), found in Microsoft Windows, VERITAS Volume Manager (VxVM) and VERITAS Volume Cluster Server (VCS) expands Protection Manager supporting system configuration.

StorEdge 9900 Serverless Backup Enabler (e-Copy) for the Sun StorEdge 99X0 Systems. E-Copy provides advanced backup protection via the SCSI standards embedded in the storage array in conjunction with existing backup software, such as VERITAS NetBackup(TM). e-Copy manages the actual backup data movement directly from disk-to-tape without impacting server or LAN resources.

Sun StorEdge 9900 HiCommand Replication Monitor (HRpM) 4.1 is a monitoring/reporting application that interfaces to replication management functions provided by an Element Manager (Storage Navigator, CCI or HiCommand Device Manager) for Sun StorEdge 9900 systems and replication software. HRpM allows the customer to get a visual reference for data under replication management along with a point in time status indicator of pairs. For troubleshooting, the HRpM software also provides for user notification of pairs suspended due to errors. For usability, different views of the replication relationship of pairs, including hosts, arrays, consistency groups and configuration files, is available. For multiple data center locations, the initial release of each HRpM instance (server) will act independently.

Please note that all other software running on the SE9990 also run on the SE9985.

These software packages include:

- * Sun Dynamic Link Manager (SDLM)
- * HiCommand Device Manager
- * HiCommand Resource Manager
- * HiCommand Tuning Manager
- * Performance Monitor
- * Server Priority Manager
- * Volume Migration

Q. What languages will the SE9985 product documentation be available?

A. English and Japanese are the only languages currently supported. Strategy for further localization is reviewed on a periodic basis.

Q. Will the product/s be fully regulatory compliant to be sold worldwide by RR and GA dates?

A. Yes, the product/s will be fully regulatory compliant to be sold worldwide by RR and GA dates.

Q. What is a Front End Director and what is a Back End Director?

A. The Front End Director was previously known as a CHA or Channel Host Adapter. This is the adapter which faces toward the host servers.

The Back End Director used to be known as a ACP or Array Control Processor and this is what controls the disk drives.

Q. What are the minimum and maximum capacities of the SE9985 at time of release?

A.

	Minimum	Maximum
Data cache	4 GB	32 GB
Shared Memory	2 GB	6 GB
HDD	(3D +1P) + Spare	120
Ports (FC)	16	48

Q. In what increments can data cache be ordered?

A. Data cache can be ordered in 4GB memory module increments

Q. In what increments can shared memory be ordered?

A. Shared memory can be ordered in 1GB memory module increments

Q. Is data cache and shared memory and switch now combined on one printed circuit board?

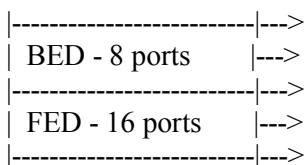
A. Yes. Data cache and shared memory are now placed on one printed circuit board. These printed circuit boards are mirrored across a hardware-based cluster.

Q. How many slots does the SE9985 come with?

A. The SE9985 comes with six slots which accommodate adapter cards.

Q. Can you tell me more about the new Channel Adapters which combine the function of the Front End Director and Back End Director on the same printed circuit board.

A. There is a channel adapter referred to as a "Mixed Adapter" which includes a 16 port FED and a 8 port BED in one printed circuit board.



This single printed circuit board occupies one slot. However, they must always be ordered in pairs. The pairs are arranged into two different hardware clusters.

Q. Are there dedicated slots on the SE9985?

A. Yes, there are dedicated slots on the SE9985. Slots 1A and 2F will accept only the "Mixed Adapter" board. Slots 1C and 2D will accept only the boards which have both data cache and shared memory on them.

The "Optional Slot" is a multi-purpose slot. The optional slot can accommodate FED (CHA), NAS Blade (CHN), and Mainframe adapter such as FICON and ESCON. The "Optional Slots" are designated 1B and 2E.

Q. Can you summarize the port capacities of various adapters?

A. Yes, the port capacities of various adapters are as follows:

"Mixed Adapter" = 16 FED FC ports and 8 BED FC Ports
FED (CHA) = 16 or 32 FC ports
ESCON = 16 Ports
FICON = 8 ports in phase I, 16 Ports in Phase II
NAS Blade: 8 Ethernet ports.

Q. Is the SE9985 RoHs(Reduction of Hazardous Materials) compliant at RR, July 12, 2005?

A. The SE9985 is not RoHs(Reduction of Hazardous Materials) compliant

in July 12, 2005.

The SE9985 is expected to become RoHs (Reduction of Hazardous Materials)compliant by December 2005.

Q. How many models of the SE9985 are there?

A. There is only one model of the SE9985. It will be released in two phases, with the second phased 2QFY06. The second phase will provide mainframe support (such as ESCON and FICON) and expand the number of disk drives it can accommodate.

Q. Will the 100% Data Availability Guarantee be available on the SE9985?

A. Yes, 100% Data Availability Guarantee will be available on the SE9985.

Q. What part numbers from the SE9985 cannot be used in the SE9990?

A. The SE9985 data cache/ shared memory/switch boards cannot not used in the SE9990. The SE9985 uses a new board which combines data cache and shared memory and switch on a single board. In the SE9990, data cache and shared memory are on two separate boards.

The “Mixed Adapter” in the SE 9985 cannot be used in the SE 9990.
The SVP in the SE 9990 cannot be used in the SE 9985.

Q. Can you use the same disk drives from a SE9990 in the SE9985?

A. Yes, you can use the same disk drives from a SE9990 in the SE9985.

The following disk drive part numbers are available for both the SE9990 and SE9985:

TJ9DKU-F505I-146JS
TJ9DKU-F505I-146J1
TJ9DKU-F505I-72KS
TJ9DKU-F505I-72K1
TJ9DKU-F505I-300JS
TJ9DKU-F505I-300J1

Also with this announcement, the following RoHS compliant hard disk drive are being made available for the SE9990 and SE9985:

TJ9DKUF505I-146JSR
TJ9DKUF505I-146J1R
TJ9DKUF505I-72KSR
TJ9DKUF505I-72K1R
TJ9DKUF505I-300JSR

TJ9DKUF505I-300J1R

Q. What other SE9985 part numbers are common with the SE9990 and are now RoHS compliant?

A. The following RoHS compliant part numbers are being made available with this announcement for both the SE9990 and SE9985:

TJ9DKCF510I-16HSR
TJ9DKCF510I-1HLR
TJ9DKCF510I-1HSR
TJ9DKCF510I-8NSR
TJ9DKCF510I-C4GR
TJ9DKCF510I-S1GR

Q. Can you use the new "Mixed Adapter" (the Mixed FED/BED Combo Adapter) in the SE9990?

A. No, you cannot use the new "Mixed Adapter" (the Mixed FED/BED Combo Adapter) in the SE9990.

Q. Can you use the memory used for data cache and shared memory in the SE9990 in the SE9985?

A. Yes, but you cannot take the data cache and shared memory boards and place them in the SE9985.

Q. How many BED Ports are there?

A. There are 8 backend ports. Each "Mixed FED/BED Combo Adapter" contains 16 FC ports and 8 BED ports. Each of these "Mixed FED/BED Combo Adapters" is really a pair of boards which, each of which occupies a slot and therefore consumes 2 slots.

Q.
Can I use the BED from a SE 9990 and place it in a SE 9985?

A.
The maximum amounts of BEDs is provided by the "Mixed Adapter" and you cannot place a BED from a SE 9990 in a SE 9985.

Q. How many FED ports are there?

A. There is a maximum of 48 FC ports supported by Front End Directors. The "Mixed FED/BED Combo Adapter" provides 16 ports and a dedicated FED (same as used in the SE9990 and what was previously referred to as a CHA or Channel Host Adapter) with up to 32 FC ports goes into the slots designated at "Optional Slot". 16 FC ports on the "Mixed Adapter" plus 32 ports on the FED equals 48 ports.

Q. What comprises aggregate system bandwidth of the SE9985?

A. 8.5 GB/sec data bandwidth
3.5 GB/sec control bandwidth
Aggregate system bandwidth is 12 GB/sec

Q. How does the virtualization of the SE9985 systems compare to that of the SE6920 series?

A. The SE9985 system provides virtualization features via software that is embedded in the array. The SE6920 virtualization is enabled through hardware that sits between the host and array system.

Q. What is the maximum number of disk drives which can be contained in the SE9985 rack?

A. 120 disk drives can be contained in the SE9985 rack. The rack contains, at time of announce, both the Logic Box (where you put your adapters) and room for disk drives. In phase II, a second rack will become available, which will boost disk drive capacity to 240 disk drives.

Q. When should SE9900 HiCommand be ordered?

A. SE9900 Remote Console-Storage Navigator is sufficient to manage a single storage system. When multiple systems are installed, HiCommand provides a central control point for managing the storage systems.

Q. Is Resource Manager included with the purchase of the SE9985?

A. Resource Manager is mandatory when ordering the SE 9985. It is a chargeable item. Resource Manager is available with an unlimited license on the SE 9985. See Licensing guidelines section in this document for further licensing information.

Q. When the second rack comes out for attachment to the SE9985 control unit in 2QFY06(phase II), can I attach it as *internal* storage to the SE9990, SE9980, SE9970, SE9960 and SE9910.

A. This second rack for the SE9985 may *not* be connected as *internal storage* to SE9990, SE9980, SE9970, SE9960, and SE9910.

Q. What is the clock speed of the microprocessor on the FED and BED?

A. The clock speed of the microprocessor on the FED and BED is 400 MHz.

Q. Will single phase 30 amp and 50 amp be available worldwide, including Japan?

A. Yes, Single phase 30 amp and 50 amp be available worldwide, including Japan.

Q. What are the dimensions of the SE9985?

A. The dimensions of the SE9985 are as follows:

Width: 610*3 mm

Depth: 925 mm

Height: 1,920 mm

Q. Can my customer deploy the SE9985 in any standard 19" rack?

A. No. The SE9985 is only available in a customized HDS 19" rack. In addition, Sun has contractual obligations to deploy the SE9985 in the HDS 19" rack.

Q. Is installation included in the price of Sun StorEdge 9985 System?

A. SE9985 product purchase includes Sun StorEdge(SM) 9990 Installation Service, (9990 Installation) a basic install offering, for new system(minimum 1 controller unit) purchase. This installation is provided during normal business hours.* The official service listing, including scope, tasks, deliverables and customer responsibilities for this and other service programs for Sun contracted customers, is maintained at:

<http://www.sun.com/service/servicelist/>

StorEdge 9985 product purchases sold for installation into existing SE9985 systems, i.e. incrementally-sold single drive canisters, also include installation, provided during normal business hours.* Sun reserves the right to require customer to perform installation activities for certain optional components should it be determined that Sun's presence on-site is not necessary, e.g. for very basic product upgrade purchases such as power cords.

SE9985 Installation does not include the installation of optional third-party SAN components. Installation of optional third-party SAN components may involve additional charges.

SE9985 installation does not include any consulting engagement services. Customers are encouraged to utilize Sun Services consulting for SAN architecture and implementation engagements.

*If installation is performed outside of normal business hours, for customers in all geography's except United States, the customer should be charged a separate line item charge for the following part: EIS-9900. The extra charge for after-hours installations applies

to initial controller purchases and to any add-on purchases to existing controller units.

If installation is performed outside of normal business hours, for customers in United States, the customer should be charged a separate line item charge for the following part: EIS-9900-E. The extra charge for after-hours installations applies to initial controller purchases and to any add-on purchases to existing controller units.

Q. How is the StorEdge 9985 positioned relative to Sun's other disk storage systems?

A. The StorEdge 9000 product family is THE choice for customers who demand the absolute highest levels of data availability and mainframe connectivity. With the introduction of the StorEdge 9985, Sun's StorEdge 9900 series customers now have a smaller-scale alternative to the StorEdge 9900 that is compatible in hardware, firmware, and software. The StorEdge 9985 is ideal for existing StorEdge 9900 environments where space is a consideration and the scalability of a StorEdge 9990 is not required.

The Sun StorEdge 6000 product family is aimed at offering the most cost-effective combination of data availability, performance, scalability, and features. The StorEdge 6920 remains THE choice in delivering high-end application/storage consolidation and business continuity capabilities to enterprise customers in the mid market. The Sun StorEdge 3000 product family offers complete, yet compact storage solutions for workgroup environments. These systems deliver high performance, reliability, and scalability, as well as a small footprint. StorEdge 3000 products maximize performance and availability for workgroup applications and offer a flexible, cost-effective approach for growing storage demands.

Q. What does "Parts Exchange" mean in context of Sun Service?

A. Here is the Sun Service nomenclature: 2nd - 3rd year – Parts Exchange
Parts exchange means that the customer is responsible for send the suspect part back to Sun, and send will send back the replacement part. Only authorized service personnel may remove a suspect part

Q. What will be part of the SE9985 Phase II release?

A. The following features will be released in phase II for the SE9985:

Phase II Deliverables

Mainframe (MF) connectivity added	ESCON, FICON
Port count	8 Ficon, 16 ESCON
Maxium #of Disk	240
Maximum amount of data cache	64 GB

Shadow Image MF support	Yes
TrueCopy Synchronous MF Support	Yes
Business Continuity MF support	Yes
FlashCopy v2 MF support	Yes
Support for 2 racks (total)	Yes

Q. When will the Phase II features be released for SE9985?

A. The Phase II features are scheduled to release in Q2FY06 timeframe.

Q.
What is a Hitachi TagmaStore SE 9985 (NSC 55)?

A.

This is the Hitachi Data Systems name for the SE 9985. They are the same product with different names. There are no differences between these products.

Q. Where can I find a boot support matrix for the SE 9900 Family of products?

A. For access to the boot support matrix for the SE9900 Family of products please visit the following website:

<http://scalablesystems.sfbay/marketing/iomatrix/>

This is really broader effort which includes multiple servers and storage products. NWS and SSG agreed to that boot support will be published at this location maintained by SSG.

This is a cooperative effort between Network Storage Division (NWS), Scalable Systems Group (SSG), Integrated System Test (IST), Central Storage System Test (CSST).

SSG is currently thinking that boot support should not be available on the SE 9985 or SE 9990. In addition, their recent Hitachi Data Systems document indicates that boot is not supported on the SE 9990.

Q. When reviewing SE9985 documentation (provided by Sun or our supplier), you might see the word "Mix" within a diagram, what does "Mix" mean?

A. The word "Mix" within a diagram is shorthand for the "Mixed FED and BED Combo Adapter", which is a more detailed way of describing it.

Q. Where can I find more information on the Front End Director and Back End Director for the SE9985?

A. For more information and details on the Front End Director and Back End Director for the SE9985, please refer to the SE9985 Just the Facts, SunWIN token # 445485.

Or please contact your Storage Specialist to access the SE9985 User Guide, which is located within the Technical documentation section of the PXtool.

Q. Where can I find the What Works With What (WWWW) documents for the SE9985?

A. You have access to the latest, detailed Support Matrices. These support matrices change very rapidly, and it is important to consult the Support Matrices directly rather using this Sun Intro document.

The SE9900 Family What Works With What (WWWW) support matrix can be found at SunWin token # 344150 or the following URL:

* New SE 99XX WWWW material is available at the following location.

- >>>>>>>> 1) Pls. proceed to <http://sejsc.ebay/>
2) Look to your left column on this web page.
3) Click on "SE9900 WWWW"

Q. Is there a separate What Works With What (WWWW) for the SE9985?

A. No, The SE9990 and SE9985 will share the same WWWW.

Q. Is the SE9985 Internationalization (i18n) and Localization (i10n) compliant?

A. The HiCommand Storage Management Suite is i18n compliant. The system is available with English and Japanese documentation.

Q. How is the StorEdge 9985 positioned relative to the StorEdge 6000 midrange line?

A. The StorEdge 9000 product series is THE choice for customers who demand the absolute highest levels of data availability and mainframe connectivity. With the introduction of the StorEdge 9985, StorEdge 9900 series customers now have a smaller-scale alternative to the StorEdge 9990 that is compatible in hardware, firmware, and software. The StorEdge 9985 is ideal for existing StorEdge 9900 environments where space is a consideration and 9900 scale is not required. The StorEdge 9985 should be sold into existing StorEdge 9900 environments as a:

- * Replacement for the StorEdge 9970
- * Smaller scale alternative to the StorEdge 9990
- * Mainframe storage solution

The Sun StorEdge 6000 product family is aimed at offering the most cost-effective combination of data availability, performance,

scalability, and features. The StorEdge 6920 remains THE choice in delivering high-end application/storage consolidation and business continuity capabilities to enterprise customers in the mid market. The 6920 should be sold to mid-market enterprise customers requiring:

- * Application and storage consolidation
- * Business continuity and DR
- * Application specific price/performance
- * Multi-tiered storage
- * Scaling and upgrading of existing Sun storage environments

Please refer to the SE6920/SE9985 positioning guide in SunWin under token 445670 for more details.

Support Services

SunSpectrum Support Offerings

The SunSpectrumSM program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the SolarisTM Operating Environment software, and telephone support for SunTM software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise Services representatives for program and feature availability in their areas.

SunSpectrum program support contracts are available both during and after the warranty program. Customers may choose to uplift the service and support agreement to meet their business needs by purchasing a SunSpectrum contract. For more information on the SunSpectrum program offerings refer to the following URL:

http://service.central/TS/ESP/SunSpectrum/Feature_Matrix/index.html.

The Gold/Platinum levels of SunSpectrum support contracts are outlined below.

SunSpectrum Program Support

Program	Description
Mission-Critical SunSpectrum PlatinumSM Support	Designed to support client-server, mission critical solutions by focusing on failure prevention, rapid recovery and year round technical services planning. Support is provided 24 x 7.
Business-Critical SunSpectrum GoldSM Support	Includes a complete package of proactive and responsive services for customers who require maximum uptime for their strategic business-critical systems. Support is provided 24 x 7.

SunSpectrum Instant Upgrades

Where available, customers will be able to upgrade the enhanced warranty offering to a SunSpectrum Platinum (SM) service contract which includes 2 hours (average response) on-site service. (Platinum service may not be available in all areas. Consult with an Sun Enterprise Services Sales Representative for details.)

For StorEdge 9985:

Part Number	Description
W9D-T10-9985-3P	3-year SunSpectrum Platinum SM program upgrade for Sun StorEdge 9985 controller
W9D-T10-1DSK-3P	3-year SunSpectrum Platinum program upgrade for Sun StorEdge 9985 disk

Sun Software Standard Support (ST)

Extended local business hours coverage 12 hours a day, five days a week

- Four (4) hour telephone response time for urgent* issues during extended local business hours
- Two (2) authorized contacts
- Unlimited technical support incidents
- You rate the priority of your support requests
- Technical assistance from experienced support engineers
- Web-based incident submission and tracking through Sun's Online Support Center
- Software enhancement releases and patches
- 7x24 access to Sun's online technical knowledge database
- SunSpectrum InfoExpress newsletter

Optional Services:

- Dedicated or Assigned Service Account Manager
- Dedicated Technical Support Engineer
- Additional authorized contacts

Specific features and service options may not be available in all regions. Coverage hours and response times may vary by country or location. After hours support may not be available in your local language.

Sun Software Premium Support(PR)

- 7x24 online and telephone technical support
- Live call transfer for urgent issues
- Three (3) authorized contacts per eight hour shift
- Unlimited technical support incidents
- You rate the severity of your support requests
- Technical assistance from experienced support engineers
- Web-based incident submission and tracking through Sun's Online Support Center
- Software enhancement releases and patches
- 7x24 access to Sun's online technical knowledge database
- SunSpectrum InfoExpress newsletter
- Interoperability Support

Optional Services:

- Dedicated or Assigned Service Account Manager
- Dedicated Technical Support Engineer
- Additional authorized contacts

Specific features and service options may not be available in all regions. Coverage hours and response times may vary by country or location. After hours support may not be available in your local language.

Warranty Information

This information applies to Sun StorEdge 9985, 9980 and 9970 systems. This does not include third-party switch, director or HBA products. These products, while related to the StorEdge 9900 Series

products, have standalone product support information (warranty, W9D parts and pricing, installation policy, SunSpectrum pricing, etc.) that are unique to each of these products.

The official StorEdge 9900 Series warranty statements are maintained at Sun's external web site at www.sun.com/service/support/warranty.

Sun warranty on StorEdge 9900 Series products currently includes an enhanced warranty with:

3 years coverage

1st year - 7 x 24 Same Day 4-hour* on-site response

2nd - 3rd year – Parts Exchange

(Parts exchange means that the customer is responsible for send the suspect part back to Sun, and send will send back the replacement part. Only authorized service personnel may remove a suspect part)

Business Hour Phone Support.

*average response times.

Installation Information

Summary of installation charges for initial install and add on upgrades

StorEdge 9985 :

For customers outside of United States:

Installation Charge	Normal Business Hour	After Hour
Base Charge	No charge, included with product purchase, order EIS-9985-NC	Extra charge required. Order EIS-9900 per event
1Disk charge	No charge, included with product purchase ,EIS-9900-1DSK-NC	No extra charge required

For customers in United States:

Installation Charge	Normal Business Hour	After Hour
Base Charge	No charge, included with product purchase	Extra charge required. Order AR-99-INS-BAS2 per install event
1 Disk charge	No charge, included with product purchase	No extra charge required

StorEdge 9985 product includes Sun StorEdge (SM) 9900 Installation Service, (9900 Installation) a basic install offering, for new subsystem (minimum 1 control unit) purchases. This installation is provided during normal business hours.¹ 9900 Installation currently includes the high-level deliverables shown

¹ If installation is performed outside of normal business hours, for customers in all geography's except United States, the customer should be charged a separate line item charge for ONLY the following part: EIS-9900. The EIS-9900-4DISK charge does not apply in this scenario. The extra charge for after-hours installations applies to initial controller purchases and to any add-on purchases to existing controller units.

If installation is performed outside of normal business hours, for customers in United States, the customer should be charged a separate line item charge for ONLY the following part: AR-99-INS-BAS2. The AR-99-INS-PER-4DSK charge does not apply in this scenario. The extra charge for after-hours installations applies to initial controller purchases and to any add-on purchases to existing controller

below. The official service listing, including scope, tasks, deliverables and customer responsibilities for this and other service programs for Sun contracted customers, is maintained at:

<http://www.sun.com/service/servicelist/>

StorEdge 9985 product purchases sold for installation into existing 9985 systems, i.e. incrementally-sold single drive canisters and/or 4-disk canister groups, also include installation, provided during normal business hours.¹ Sun reserves the right to require customer to perform installation activities for certain optional components should it be determined that Sun's presence on-site is not necessary, i.e. for very basic product upgrade purchases such as power cords for which Sun's presence on-site is not required.

9900 Installation does not include the installation of optional third-party SAN components. Installation of optional third-party SAN components may involve additional charges.

9900 installation does not include any consulting engagement services. Customers are encouraged to utilize Sun Services consulting for SAN architecture and implementation engagements. Customers may also utilize Implementation Service for Sun StorEdge 9900 Series for implementation services that go beyond the basic installation provided by 9900 Installation.

Sun StorEdge 9900 Installation Service currently includes the following high-level deliverables. See service listing for official scope, tasks, deliverables and customer responsibilities.

Site Audit

- Review customer physical environment

- Document environmental states

Installation Planning

- Plan, confirm and schedule resources

- Plan and confirm delivery & install dates

- Create installation related documentation

Installation Specification

- Discuss customer-defined RAID, LUN, connectivity requirements

- Review remote monitoring requirements, including customer analog line

Statement of Installation

- Verify completion of pre-installation tasks

- Verify supported configuration

- Customer sign off to begin installation

Hardware and software installation

- Unpack 9900 components.

- Review packing list

- Install and configure HBA's in Sun servers

- Install Solaris patches, if applicable.

- Connect controllers, disk frames and StorEdge 9985 components

- Connect subsystem to host server(s)²

units.

² Connection of 9900 subsystem to host(s) through switches may involve additional charges and strong recommendation to customer to utilize Sun Professional Services engagement.

Power up and verify functionality (diagnostic level.)

Install remote console components into customer-supplied workstation

Connect service processor to customer phone line.

Install Sun StorEdge 9900 Remote Response components

Install and configure Resource Manager components per customer definition

Configure disk groups, LUNs, port mapping per customer definition

Installation Verification

Verify Sun server host connections to LUNs

Verify Sun StorEdge 9900 Remote Response with remote support center

System Turnover

Installation review and customer sign off

Provide system reference documentation

Basic installation does not include any consulting engagement services.

Customers are encouraged to utilize Sun Professional Services for SAN architecture and implementation engagements. Sun Support Services maybe utilized for the switch/Director installation (not architecture/implementation) on a time and material basis, depending on product complexity and local field office availability.

A GNSS TE (Global Network Storage Sales Technical Engineer) must recommend a SAN configuration and be approved by Storage Control Center via the QTF (Quote Tracking Form.). The configuration must be in accordance with the WWW (What Works With What) matrix is posted at

<http://gnss.ebay/dscgi/ds.py/View/Collection-732>

SunSpectrum Instant Upgrade (W9D) and Sun StorEdge 9900 Remote Response

Where available, customers will be able to upgrade the enhanced warranty offering to a SunSpectrum Platinum (SM) service contract which includes 2 hours (average response) on-site service. (Platinum service may not be available in all areas. Consult with an Sun Enterprise Services Sales Representative for details.)

StorEdge 9900 Series customers are eligible to receive Sun StorEdge 9900 Remote Response service as long as product is maintained under Sun warranty or SunSpectrum Gold (SM) or SunSpectrum Platinum service. Access to Sun StorEdge Joint Support Center is provided for StorEdge 9900 Series customers whose products are maintained under Sun warranty or SunSpectrum service.

Questions and Answers

Q. What is Sun Support Services policy on third-party servers connected to StorEdge 9900 Series products?

A. StorEdge 9900 Series products are designed for attachment to Sun Solaris and other open systems (HP-UX, IBM AIX), non-UNIX (i.e. Linux, Windows) and mainframe server platforms. The details of these supported configurations are provided in the WWW matrix.

Sun Support Services will diagnose and troubleshoot the 9900 up to the point of connection of 9900 to the host server if connected in these heterogeneous and multi-platform environments in accordance with the WWW matrix. Sun does not provide third-party host server break-fix warranty or contract support.

Q. What is Sun Support Services policy on StorEdge 9900 Series SAN support?

A. Sun currently sells Brocade and McData switch and director products as external SAN interconnect in support of StorEdge 9900 Series products. The design of such a SAN must be in conformance with Sun configuration rules. These rules are developed by NWS, working in conjunction with its partners. The current rules are listed in the WWW matrix mentioned above. SAN's not developed in accordance with these rules may result in switch-to-host, switch-to-storage or switch-to-switch connections which cannot be supported by Sun.

Sun highly recommends the use of Sun Professional Services or highly accredited channel partner with strong Sun storage expertise for the proper design and implementation of a Storage Area Network in order to properly translate customer requirements into a feasible and supportable SAN solution.

For all interconnect components not sold by Sun but listed in the WWW matrix, Sun will support the 9900 subsystem connection(s) in that particular SAN environment, provided proper configuration rules are followed. Sun will not provide warranty (break-fix) support for any interconnect component not sold by Sun.

Q. What are Sun Support Services capabilities across customers' heterogeneous operating system environments?

A. Sun Support Services' operating system expertise is tops in Sun Solaris. In addition, Sun's Customer Care Centers provide support expertise for customer product connections involving qualified Sun storage products attached to non-Solaris hosts. This currently includes Windows 2000, Windows NT, Linux, IBM-AIX and HP-UX. The nature of this support expertise includes single path interoperability, dual path fail-over involving the Sun StorEdge Traffic Manager software, and the limited ability to re-create customer interoperability involving non-Solaris equipment operating within the approved configurations. (The ability to re-create customer interoperability configurations varies depending on supported geography.)

Sun does not provide break-fix support for non-Sun servers or HBAs, but does provide support for Sun storage connections into those hosts when operating within the approved configurations. Qualified and supported configurations can be found at:

http://www.sun.com/storage/san/multiplatform_support.html.

Q. How does Sun Support Services provide a compelling reason to repeatedly choose Sun StorEdge for data center storage?

A. Sun Support Services provides true end-to-end support expertise across customers' storage environment, server environment and interconnect. This goes beyond what any storage-only vendor can provide. As an example, Sun has a highly trained and experienced group called Storage ACES which spans Sun Support Services, Sun Professional Services, sales and product engineering. This is a global Sun community which shares best practices in storage and storage networking, where storage does not equal storage alone. Some team members have spent their entire career in storage while others bring a wealth of expertise from server support perspective including boot disk, server/storage clustering, volume management and application support. All members are expected to have expertise that spans beyond pure storage.

Sun Support Services also provides a centralized means in each major geography to provide integrated pre-sales configuration verification, pre-installation and installation control, and post-sales engineering control for product configurations via Sun Storage Control Centers. These centers also provide a means to coordinate the receipt and problem resolution dispatch for Sun StorEdge 9900 Remote Response, which is part of Sun Remote Services remote proactive, preemptive and preventive support.

Sun Support Services provides Sun StorEdge customers with exclusive access to the Sun StorEdge Joint Support Center. The StorEdge Joint Support Center provides co-dedicated Sun and Hitachi Data Systems server, storage and interconnect equipment as well as personnel to provide joint problem resolution for Sun StorEdge customers.

Sun Support Services provides Solution Centers, parts depots and field engineering offices worldwide. These Solution Centers are networked worldwide to form a tight knit of shared best practices and knowledge management to leverage Sun's experience and solutions across the world to local Sun customers.

Sun Support also provides expertise that spans to numerous third-parties via Sun Support's extensive network of vendor support agreements. This expertise is in the form of product and support knowledge across interconnect and interoperability of third-party products with Sun storage and servers. SunSpectrum Gold and Platinum customers can also gain access to the VERITAS-Oracle-Sun Joint Esc1STtion Center (VOS JEC) and to Sun's Vendor Integration Program (SunVIP [SM].)

Q. How does Sun Support compare against the competition in data center storage system support?

A. Storage-only vendors do not have Sun's expertise of Sun field and in-house experts across Sun servers, non-Sun server attachments to Sun storage, Sun storage, non-Sun storage attachments to Sun servers, Fibre networking including SAN and server cluster interconnect, Ethernet management and Sun software including server applications and storage applications.

Only Sun StorEdge 9900 customers have access to the Sun StorEdge Joint Support Center, which provides co-dedicated Sun storage and server experts along with HDS storage experts to resolve complex issues across servers, storage and interconnect.

Only SunSpectrum Gold and Platinum customers have access to SunVIP and VOS JEC (VERITAS Oracle Sun Joint Escalation Center.)

StorEdge 9985 Warranty Upgrade Part Numbers and Descriptions

StorEdge 9985 Controller

<u>PART NUMBER</u>	<u>NOTE(S)</u>
W9D-T10-9985-1P	1,2 STOREEDGE 9985 CONTROLLER UPGRADE TO 1 YEAR OF PLATINUM SUPPORT.
W9D-T10-9985-2P	1,2 SE9985 CONTROLLER UPGRADE TO 2 YEARS OF PLATINUM SUPPORT.
W9D-T10-9985-3P	1,2 SE9985 CONTROLLER UPGRADE TO 3 YEARS OF PLATINUM SUPPORT.

StorEdge 9985 Disk

W9D-T10-1DSK-1P	1,2 SE9985 DISK UPGRADE TO 1 YEAR OF PLATINUM SUPPORT.
W9D-T10-1DSK-2P	1,2 SE9985 DISK UPGRADE TO 2 YEARS OF PLATINUM SUPPORT.
W9D-T10-1DSK-3P	1,2 SE9985 DISK UPGRADE TO 3 YEARS OF PLATINUM SUPPORT.

Ordering Notes

1) Order quantity "1" of 1-, 2-, or 3-year W9D part number for StorEdge 9985 controller unit, plus quantity "n" of same term W9D part number for StorEdge T10-1DSK, where "n" equals the number of disks being configured.

2) The W9D part numbers for control unit and disk groups cover the StorEdge 9900 subsystem warranty upgrade, including all other StorEdge 9900 part numbers (i.e., cache memory, hot spares, channel adapters.)

This does not cover warranty upgrades for any Sun-sold switches or director products for SAN configurations. Appropriate W9D part numbers for SAN components must be ordered separately.

3) Order quantity 1 of this part number for software support. See also Footnote 4 for raw capacity licensed products and Footnote 5 for usable capacity licensed products.

-----EXAMPLES-----

CS Software description	CS part number	SS support part number
SE9980/9970 Resource Manager Complete Base	T9-200041-01	T9-200041-1ST
	T9-200041-1PR	
	T9-200041-3ST	
	T9-200041-3PR	

4) Order quantity "n" of this part number where “n” = each raw TB of 9900 configured capacity (rounded up to nearest whole number) in this capacity range.

-----EXAMPLE-----

To order support for SE9980/9970 Resource Manager Complete for SE9980 configured with 12.4 TB raw capacity. Order the following:

Tier	ES Support Part No.	Qty
Tier 1 (1 TB)	T9-2000036-1ST	1
Tier 2 (2-6TB)	T9-2000037-1ST	5
Tier 3 (7-15TB)	T9-2000038-1ST	7

5) Order quantity "n" of this part number where “n” = each usable TB of 9900 configured capacity (rounded up to nearest whole number) in this capacity range.

-----EXAMPLE-----

To order support for SE9980/9970 ShadowImage In-System Replication for SE9980 configured with 5.4 TB usable capacity used for primary/secondary volumes.

Order the following:

Tier	ES Support Part No.	Qty
Tier 1 (1 TB)	T9-200015-1ST	1
Tier 2 (2-6TB)	T9-200016-1ST	5

ShadowImage In-System Replication usable capacity licensing for 9980/9970 is based on **total usable capacity of all primary and secondary volumes.**

True Copy Remote Replication usable capacity licensing for 9980/9970 is based on **total usable capacity of all primary logical devices and secondary logical devices in local 9980/9970 system**. Each 9980/9970 system running True Copy Remote Replication (local and remote system) requires its own True Copy Remote Replication license.

Extended Remote Copy usable capacity licensing for 9980/9970 is based on **total usable capacity of all the S/390 emulation source logical devices under XRC control** (i.e., only the source devices.) With XRC3, the remote subsystem does not require an XRC license.

Sun Educational Services

Sun StorEdge 9990 System Installation and Administration (NWS-3311)

This course is intended to provide students with the knowledge to successfully describe, install, configure, access, maintain, and diagnose the Sun StorEdge 9985 system. Students receive classroom training and hands-on experience with the Sun StorEdge 9985 system.

People who need product specific training on the Sun StorEdge 9985 system should consider taking this course.

Upon completion of this course, students should be able to:

- Describe the features, functions, components, and architecture of the Sun StorEdge 9985 system
- Describe virtualization strategies and implementation on the Sun StorEdge 9985 system
- Install the Sun StorEdge 9985 system hardware
- Attach production hosts to the Sun StorEdge 9985 system
- Configure storage on the Sun StorEdge 9985 system
- Maintain the Sun StorEdge 9985 system
- Diagnose Sun StorEdge 9985 system failures
- Perform system and network administration
- Administer storage with basic storage management software tools

For further information on this course, please visit the Sun Educational Services Web site at:

<http://www.sun.com/service/suned/>, or to order, please call: 1-800-422-8020

Sun Professional Services

Sun StorEdge 9985 Implementation Service

The Storage and Data Management Practice supports the release of J2 (SE 9985).

For the SE 9985, Sun Support Services will deliver Professional Services relating to the installation, and implementation of complete data management solution. The CSO will be responsible for the pre-sales assessment, architecture and design of these solutions. Implementation services will be developed on an ad hoc basis for each customer/gem as has been done in FY2005.

GEM based CSO pre-sales engagement managers will be the focal individuals for these activities today. Over time this may shift to support services field marketing.

Installation

Planning for Installation and Operation

This chapter provides information for planning and preparing a site before and during installation of the SE 9985™ SE 9985. Please read this chapter carefully before beginning your installation planning. Figure 5.1 shows a physical overview of the SE 9985.

If you would like to use any of the SE 9985 features or software products (e.g., Hitachi TrueCopy, Hitachi ShadowImage), please contact your Hitachi Data Systems account team to obtain the appropriate license(s) and software license key(s).

Note: The general information in this chapter is provided to assist in installation planning and is not intended to be complete. The DKC515I (SE 9985) installation and maintenance documents used by Hitachi Data Systems personnel contain complete specifications. The exact electrical power interfaces and requirements for each site must be determined and verified to meet the applicable local regulations. For further information on site preparation for SE 9985 installation, please contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center.

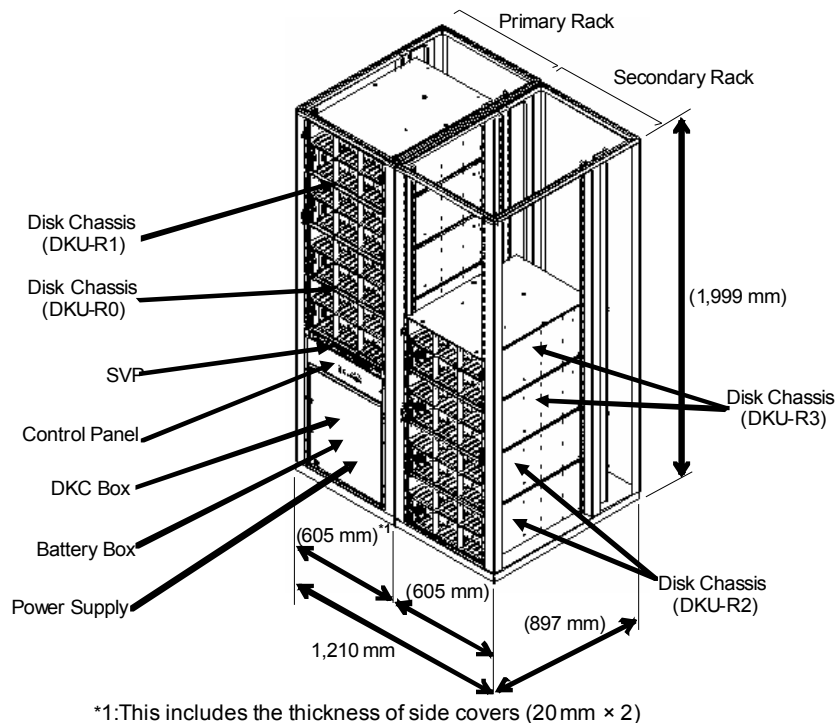


Figure 5.1 Physical Overview of the SE 9985




User Responsibilities and Safety Precautions

Before the SE 9985 arrives for installation, the user must provide the following items to ensure proper installation and configuration:

- Physical space necessary for proper subsystem function and maintenance activity
- Electrical input power
- Air conditioning
- Floor ventilation areas (recommended but not required)
- Cable access holes
- RJ-11 analog phone line (for Hi-Track® support)

Safety Precautions

For safe operation of the SE 9985™ SE 9985 disk subsystem, observe the following precautions:

- Obey all safety messages. Safety messages are marked by the safety alert symbol  as follows. When warning labels become dirty or start peeling off, replace them.
 - a)  **WARNING:** Indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.
 - b)  **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 - c) **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
- Read and follow the safety guidelines and procedures in this manual and related manuals. Keep in mind that the hazard warnings in this manual or on the machine cannot cover every possible case, as it is impossible to predict and evaluate all circumstances beforehand. Be alert and use your common sense.
- Before performing power-down or power-up, make sure that the disk subsystem is not undergoing any maintenance and is not being used online.
- Do not place objects against the front or sides of the racks, or on top of the racks. These areas must be kept clear to allow flow of cooling air.
- Maintenance of the machine must be done only by trained and qualified field engineers.
- For troubleshooting, perform only the instructions described in this manual. If you need further information, please contact Hitachi Data Systems maintenance personnel.
- In case of a problem with the subsystem, report the exact circumstances surrounding the problem and provide as much detail as possible to expedite problem resolution.
- About the handling of the battery for timers built in SVP.

CAUTION: RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

Dimensions, Physical Specifications, and Weight

Figure 5.2 and show the physical dimensions for the single- and twin-rack configurations of the SE 9985™ SE 9985. Table 5.1 lists the physical specifications for the SE 9985 components.

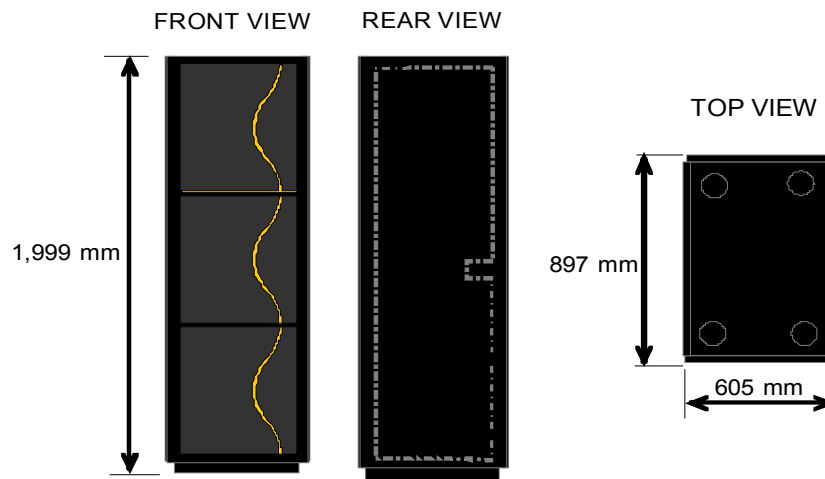


Figure 5.2 Physical Dimensions: Single-Rack Configuration

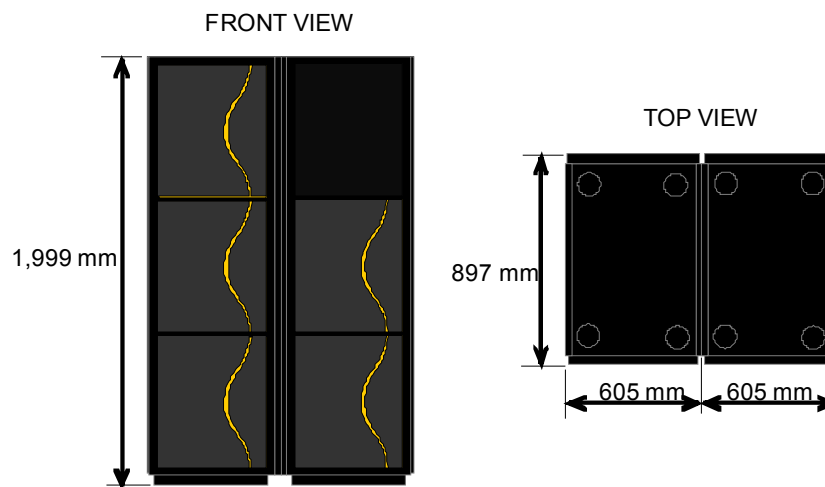


Figure 5.3 Physical Dimensions: Twin-Rack Configuration

Table 5.1 Component Specifications: Weight, Heat Output, Power Consumption, Dimensions, Air Flow

Model Number	Weight (kg)	Heat Output (kW)	Power Consumption (kVA)	Dimension (mm)			Air Flow (m ³ /min.)
				Width	Depth	Height	
DKC515I-5/5R	70.0	0.638	0.658	480	648	703 (Note)	7.0
DKC-F515I-B2R	74.0	0.100	0.103	480	648	522	8.0
DKC-F515I-LGABR	8.0	0.044	0.045	—	—	—	—
DKC-F515I-UC0R	2.5	—	—	—	—	—	—
DKC-F515I-UC1R	1.5	—	—	—	—	—	—
DKC-F515I-EXC0R	2.9	—	—	—	—	—	—
DKC-F515I-BCHR	TBD	—	—	—	—	—	—
DKC-F515I-BUHR	TBD	—	—	—	—	—	—
DKC-F515I-BCSR	TBD	—	—	—	—	—	—
DKC-F515I-BUSR	TBD	—	—	—	—	—	—
DKC-F515I-MIX2R	5.0	0.370	0.381	—	—	—	—
DKC-F510I-C4G/C4GR	0.2	0.014	0.014	—	—	—	—
DKC-F510I-S1G/S1GR	0.06	0.011	0.012	—	—	—	—
DKC-F510I-16S/16SR	5.4	0.313	0.323	—	—	—	—
DKC-F510I-8MS/8MSR	5.7	0.346	0.356	—	—	—	—
DKC-F510I-8ML/8MLR	5.7	0.346	0.356	—	—	—	—
DKC-F510I-16MSR	5.6	0.35	0.361	—	—	—	—
DKC-F510I-16MLR	5.6	0.35	0.361	—	—	—	—
DKC-F510I-16HS/16HSR	5.0	0.287	0.296	—	—	—	—
DKC-F510I-32HS/32HSR	5.8	0.382	0.394	—	—	—	—
DKC-F510I-32FSR	TBD	TBD	TBD	—	—	—	—
DKC-F510I-1HL/1HLR	0.02	—	—	—	—	—	—
DKC-F510I-1HS/1HSR	0.02	—	—	—	—	—	—
DKC-F510I-8NS/8NSR	6.5	0.446	0.46	—	—	—	—
DKC-F510I-MDMR	0.04	0.006	0.006	—	—	—	—
DKU-F505I-72KS	1.1	0.022	0.024	—	—	—	—
DKU-F505I-146JS/146JSR	1.0	0.023	0.025	—	—	—	—
DKU-F505I-146KS	1.0	0.023	0.025	—	—	—	—

Note: This includes the thickness of the SVP (43.2 mm).

Service Clearance, Floor Cutout, and Floor Load Rating Requirements

This section specifies the service clearance requirements (a + b) for the TagmaStore SE 9985 based on the floor load rating and the clearance (c).

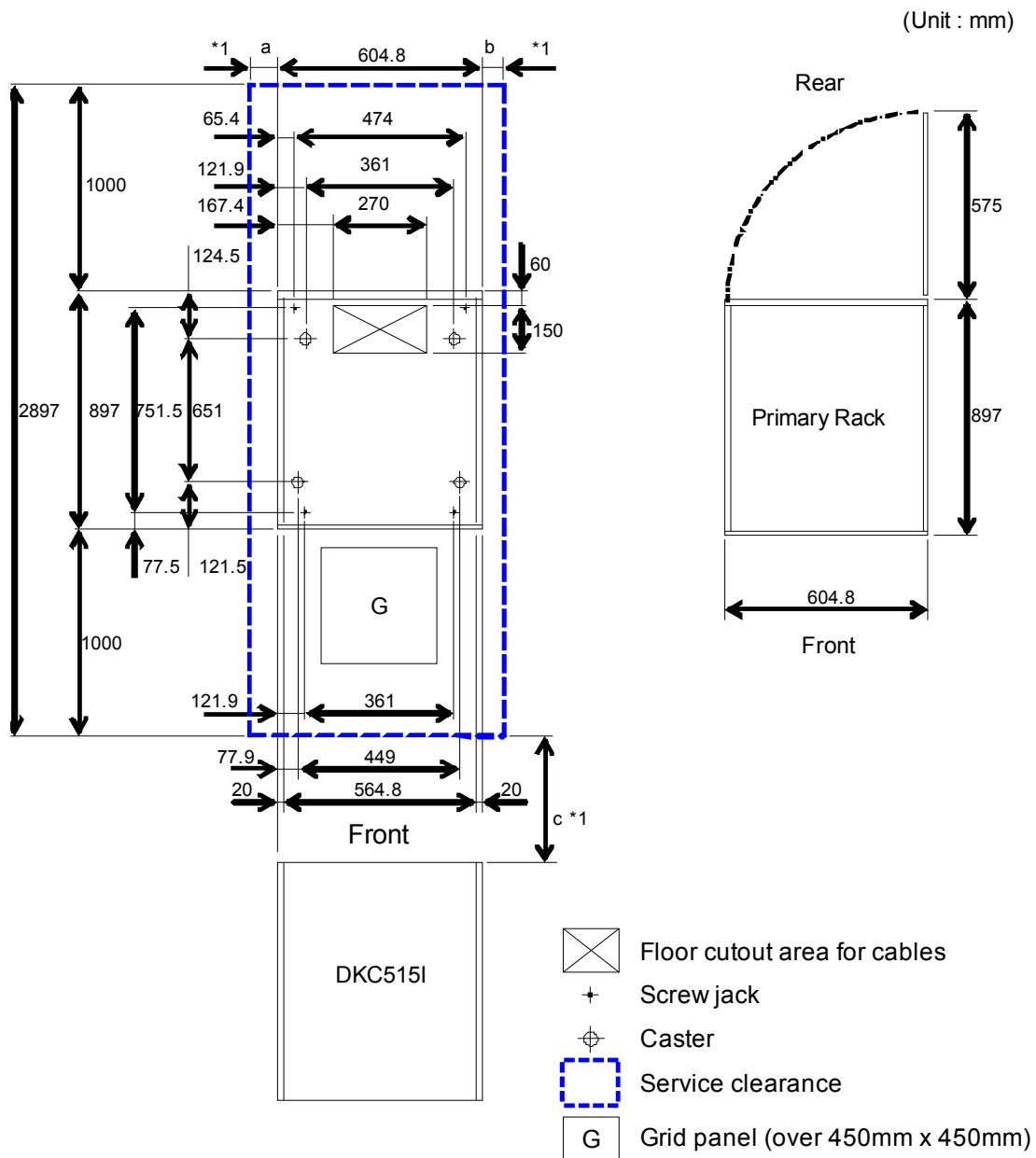
- Figure 5.4 shows the service clearance and floor cutout for the single-rack configuration. Table 5.2 shows the floor load rating requirements for this configuration.
- Figure 5.5 shows the service clearance and floor cutouts for the twin-rack configuration. Table 5.3 shows the floor load rating requirements for this configuration.

Caution: The service clearance is required for service work. Do not use this space for storage of any article to prevent damage.

Note: Actual clearances for installation should be decided after consulting with construction specialist responsible for installation building, as clearances could vary depending on the size/layout of the system and building conditions.

Note: When various configurations of subsystems are arranged in a row, use the clearance values based on the maximum subsystem configuration.

Note: For efficient maintenance operations, it is recommended that clearance (c) be made as large as possible.



*1 Clearance (a+b) depends on the floor load rating and clearance c. Table 5.2 lists the floor load rating and required clearances.

Allow clearance of 100 mm on both sides of the subsystem when the kick plates are to be attached after installation. However, when subsystems of the same type are to be installed adjacently to each other, clearance between the subsystems may be 100 mm.

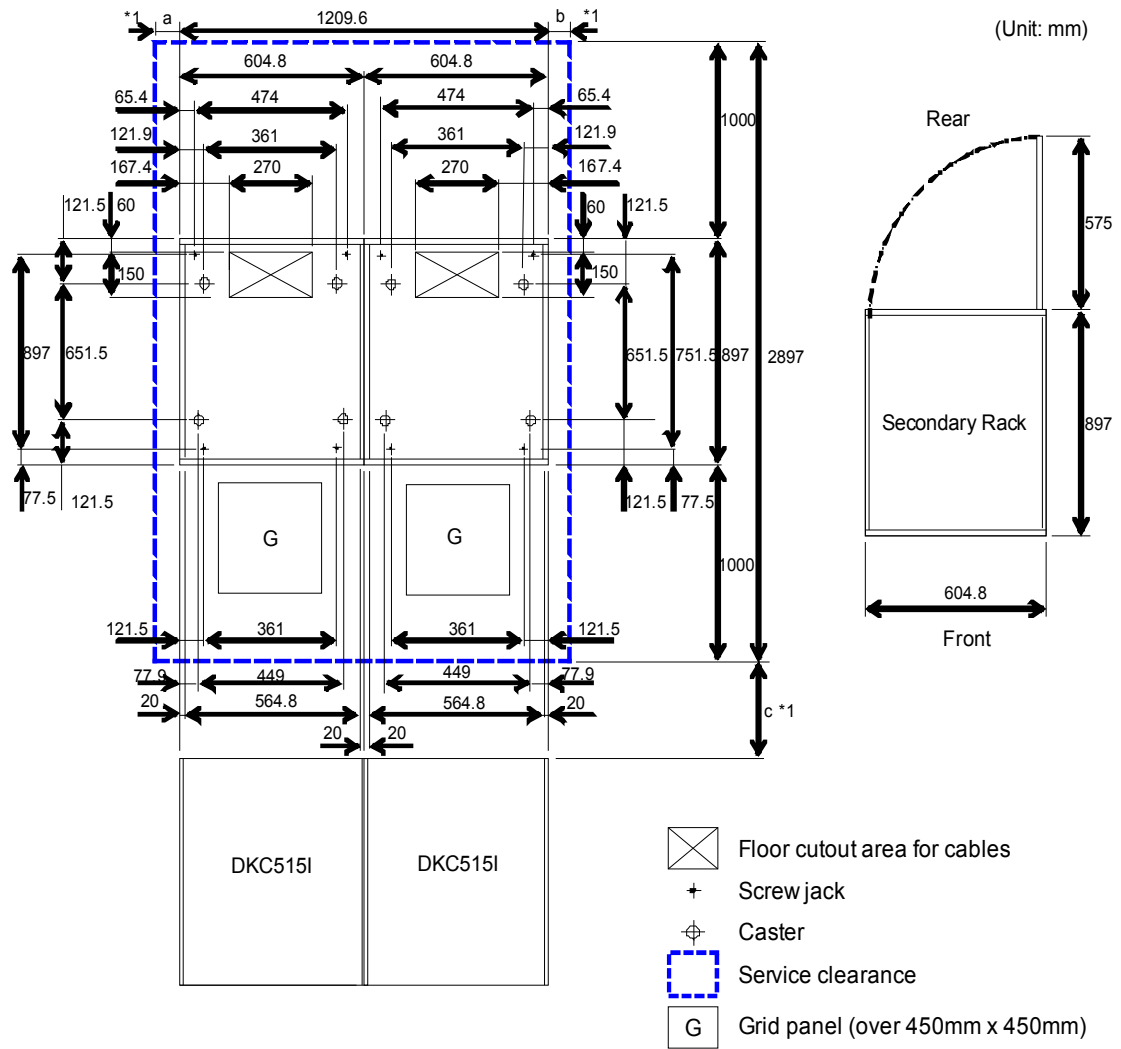
*2 Dimensions in parentheses show allowable range of the floor cutout dimensions. Basically, position the floor cutout in the center of the subsystem. However, the position may be off-center as long as the cutout allows smooth entrance of an external cable (check the relation between the positions of the cutout and the opening on the bottom plate of the subsystem) and it is within the allowable range.

*3 This dimension varies depending on the floor cutout dimensions.

Figure 5.4 Service Clearance and Floor Cutout for Single-Rack Configuration

Table 5.2 Floor Load Rating and Required Clearances for Single-Rack Configuration

Floor Load Rating kg/m ² (lb/ft ²)	Required Clearance (a+b) in meters				
	Clearance (c) in meters				
	c = 0	c = 0.2	c = 0.4	c = 0.6	c = 1.0
500 (102.4)	0.2	0.2	0.2	0.2	0.2
450 (92.2)	0.2	0.2	0.2	0.2	0.2
400 (81.9)	0.2	0.2	0.2	0.2	0.2
350 (71.7)	0.3	0.2	0.2	0.2	0.2
300 (61.4)	0.6	0.4	0.3	0.2	0.2



*1 Clearance (a+b) depends on floor load rating and clearance (c). Floor load rating and required clearances are in Table 5.3.

Figure 5.5 Service Clearance and Floor Cutouts for Twin-Rack Configuration

Table 5.3 Floor Load Rating and Required Clearances for Twin-Rack Configuration

Floor Load Rating kg/m ² (lb/ft ²)	Required Clearance (a+b) in meters				
	Clearance (c) in meters				
	c = 0	c = 0.2	c = 0.4	c = 0.6	c = 1.0
500 (102.4)	0.2	0.2	0.2	0.2	0.2
450 (92.2)	0.2	0.2	0.2	0.2	0.2
400 (81.9)	0.2	0.2	0.2	0.2	0.2
350 (71.7)	0.4	0.3	0.2	0.2	0.2
300 (61.4)	0.8	0.6	0.5	0.4	0.2

Power Specifications and Requirements

The SE 9985 operates on single-phase 20-Amp power. This section provides the power specifications and requirements for the TagmaStore NSC subsystem. Figure 5.6 shows the AC power input locations for the power distribution units (PDUs) on the primary and secondary racks. Table 5.4 lists the inrush current and leakage current specifications for AC power inputs.

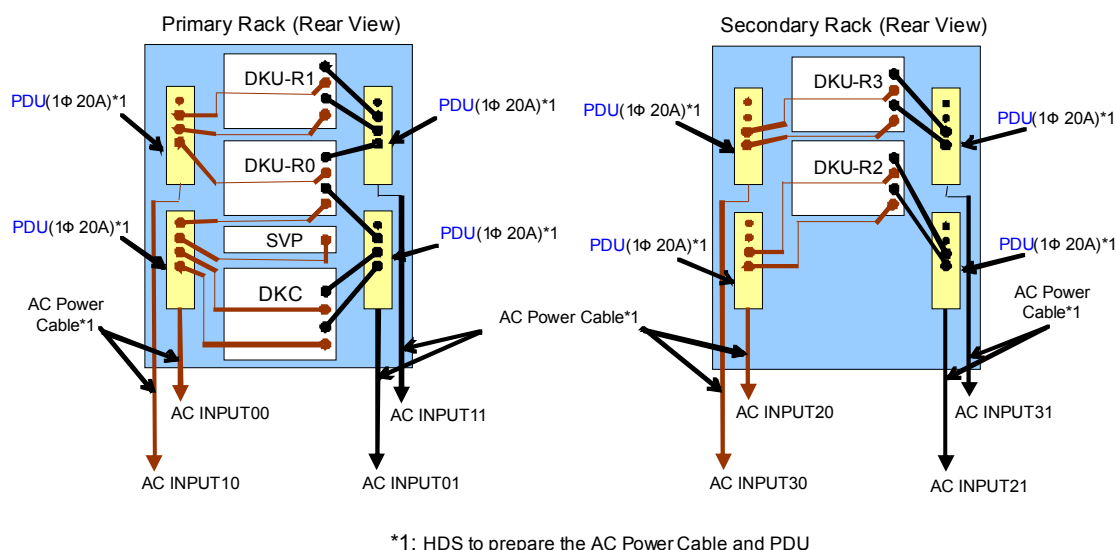


Figure 5.6 AC Input Locations

Table 5.4 Inrush Current and Leakage Current

Rack	AC INPUT Location No.	Input Power	Inrush Current			Leakage Current
			1st (0-p)	2nd (0-p)	1st (0-p) Time (-25%)	
Primary rack	00	1-phase/20A	116.8 A	38.1 A	0.2 ms	2.2 mA
	01	1-phase/20A	35.6 A	33.0 A	0.4 ms	1.7 mA
	10,11	1-phase/20A	35.6 A	33.0 A	0.3 ms	1.2 mA
Secondary rack	20,21,30,31	1-phase/20A	25.4 A	24.1 A	0.2 ms	1.0 mA

Power Specifications of PDU

Figure 5.7 shows the power specifications for the PDUs on the racks (primary rack shown).

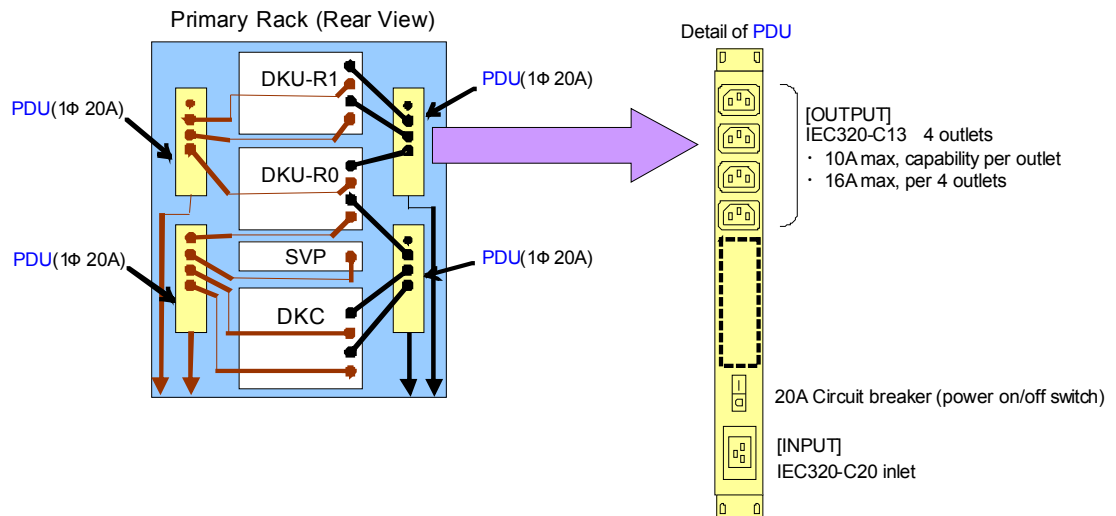


Figure 5.7 PDU Power Specifications

Breakers

For both racks, AC power is supplied to each PDU from the breaker. Figure 5.8 and Figure 5.9 show the breaker configurations for the primary and secondary racks, respectively.

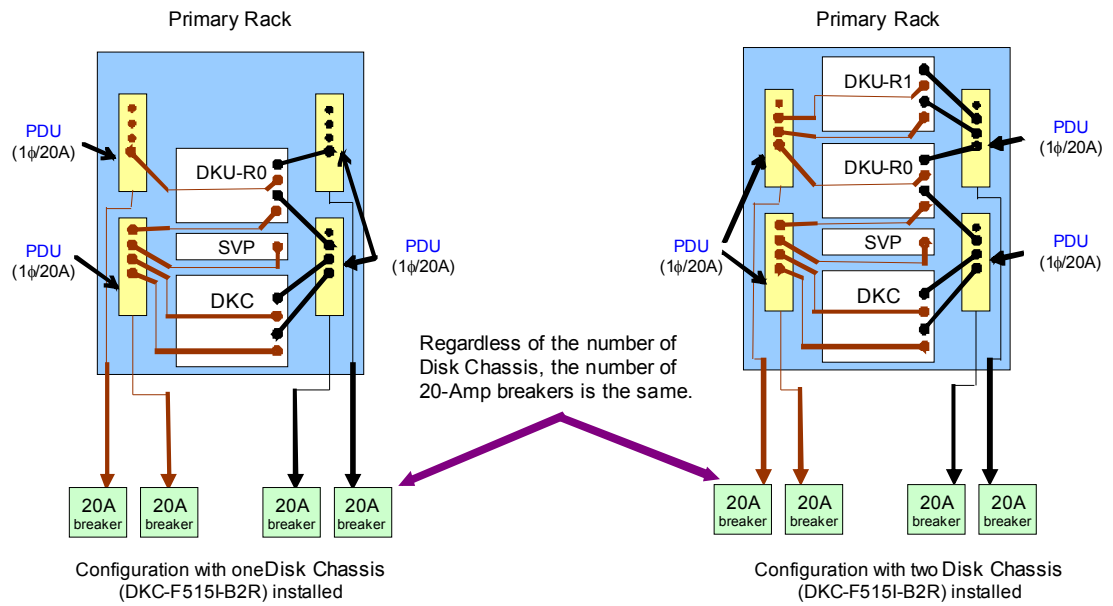


Figure 5.8 Breaker Configurations for the Primary Rack

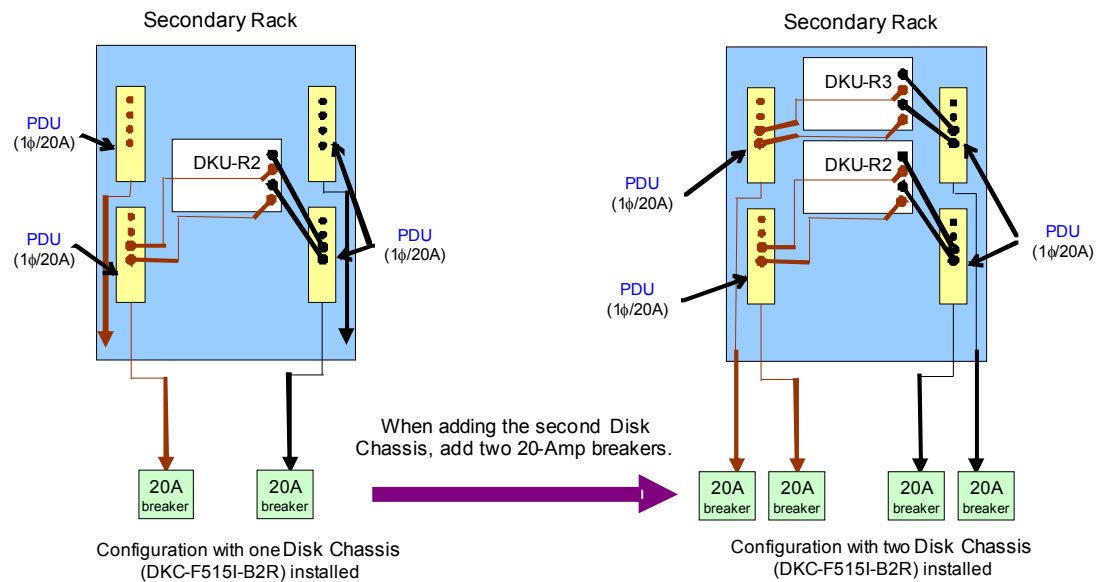


Figure 5.9 Breaker Configurations for the Secondary Rack

Connection to Power

The AC power input for the SE 9985 has a duplex PDU structure. This duplex structure enables the entire rack to remain powered on in the event that power is removed from one of the two power distribution panels (PDPs).

- **Direct connection to power.** Figure 5.10 shows the power connections when the AC input lines are connected directly to the power facility.
- **Power connection via UPS.** Figure 5.11 shows the power connections when half of the AC input lines are connected to an uninterruptable power supply (UPS), and the other half of the AC input lines are connected directly to the power facility.

Caution: When installing the TagmaStore NSC, make sure to connect the AC cables between the PDUs and PDPs correctly. If these cables are connected incorrectly, a system failure will occur when one of the AC inputs is interrupted. Figure 5.10 illustrates both the correct connections (drawing on the left) and the incorrect connections (drawing on the right).

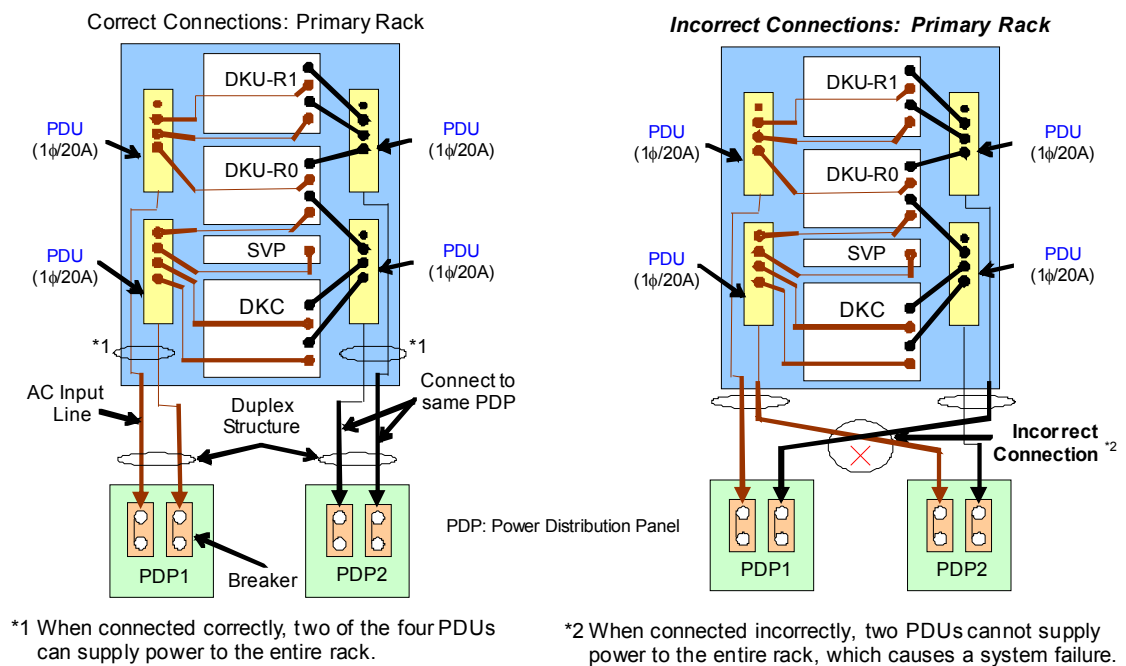


Figure 5.10 Direct Power Connection

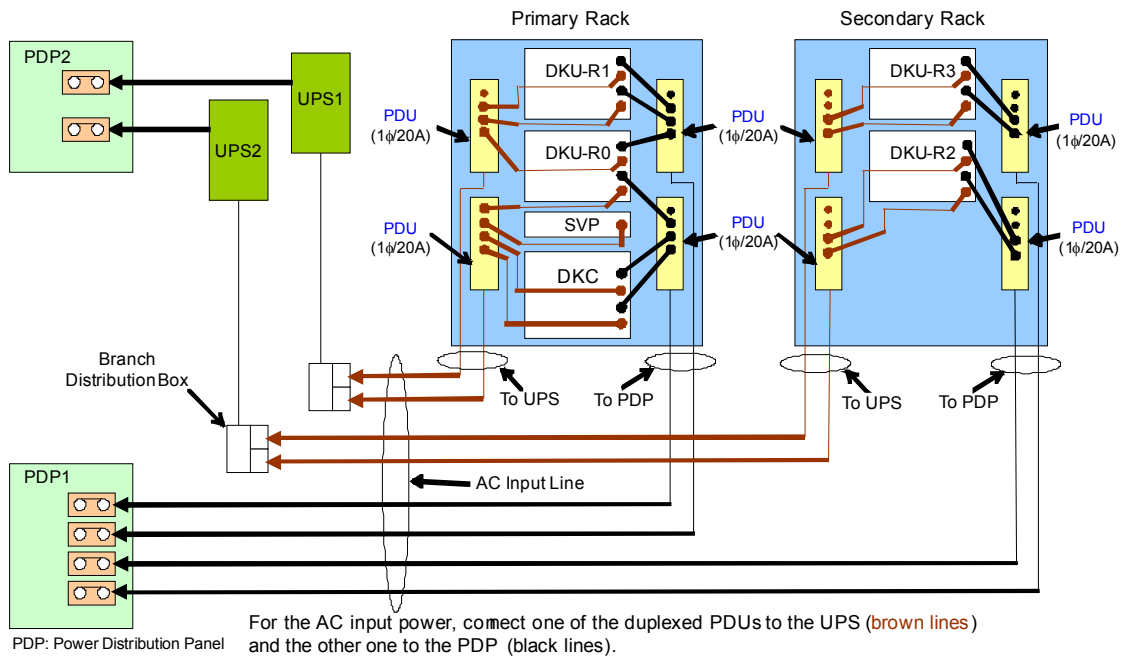


Figure 5.11 Power Connection via UPS

Input Voltage and Input Frequency Requirements

Table 5.5 lists the input voltage and input frequency requirements for the TagmaStore NSC.

Table 5.5 Requirements for Input Voltage and Input Frequency

Frequency	Input Voltages (AC)	Conditions	Tolerance(%)
60Hz ±0.5Hz	200V, 208V or 230V	1 Phase	+6% or -8%
		2 Wire + Ground	
50Hz ±0.5Hz	200V, 220V, 230V or 240V	1 Phase	+6% or -8%
		2 Wire + Ground	

Circuit Breaker and Plug Requirements

Table 5.6 lists the requirements for circuit breaker rating and number of plugs.

Table 5.6 Requirements for Circuit Breakers and Plugs

Primary Rack		Secondary Rack	
Rating	Number of Plugs	Rating	Number of Plugs
20A	4	20A	2 ^{*1} / 4 ^{*2}

*1: When one disk chassis (DKC-F515I-B2R) is installed.

*2: When two disk chassis (DKC-F515I-B2R) are installed.

Channel Specifications and Requirements

Table 5.7 lists the specifications for each SE 9985 open-systems channel option. Each channel adapter (CHA) feature consists of a pair of cards.

Database Validator: All fibre-channel options for the SE 9985 are equipped with the Database Validator function (see section). When data for an Oracle® database is written from the host to the array, the array checks the integrity of the data. If an error is detected with this function, the array does not write the erroneous data to the data volume in order to keep data integrity of the database.

Table 5.7 Open-Systems Channel Specifications

Item	Fibre 8 ports/option	16 ports/option	32 ports/option	NAS 8 ports/option
Option name	MIX2R ^{*1}	16HS ^{*1}	32HS ^{*1}	8NS
Host interface	FCP	FCP	FCP	Gigabit Ethernet
Data transfer rate (MB/s)	100 / 200	100 / 200	100 / 200	100
Number of options installed	1	1	1	1
Number of ports / Option	8	16	32	8
Number of ports / subsystem	8	16	16	16
Max. cable length: short wave	500 m / 300 m ^{*2}	500 m / 300 m ^{*2}	500 m / 300 m ^{*2}	500 m / 275 m ^{*3}
Max. cable length: long wave	10 km	10 km	10 km	—

*1 The fibre-channel adapters require an LC-type connector for multimode/single-mode fiber-optical cable. When an FC adapter is connected to a host or switch device with an SC-type connector, you must have a cable which has an LC-type connector plug at one end and an SC-type connector plug at the other end.

*2 Indicates when 50 / 125-µm multimode fiber cable is used. If 62.5 / 125-µm multimode fiber cable is used, 500 m (100 MB/s) and 300 m (200 MB/s) are decreased to 300 m and 150 m respectively.

*3 Indicates when 50/125 µm multi-mode fiber cable is used. If 62.5/125 µm multi-mode fiber cable is used, maximum length is decreased to 275 m.

Environmental Specifications and Requirements

Table 5.8 lists the environmental specifications and requirements for the SE 9985. The recommended operational room temperature is 21-24°C (70-75°F).

Table 5.8 Temperature and Humidity Requirements

Item	Condition Operating (Note 1)	Non-Operation (Note 2)	Shipping & Storage (Note 3)
Temperature (°C)	16 to 32	-10 to 43	-25 to 60
Relative Humidity (%) (Note 4)	20 to 80	8 to 90	5 to 95
Max. Wet Bulb (°C)	26	27	29
Temperature Deviation (°C/hour)	10	10	20
Vibration (Note 5)	5 to 10 Hz: 0.25 mm 10 to 300 Hz: 0.05 g	5 to 10 Hz: 2.5mm 10 to 70 Hz: 0.5 g 70 to 99 Hz: 0.05mm 99 to 300 Hz: 1.0 g	0.5 g, 15 min. The resonant frequency with the highest numerical value found between 3 Hz to 100 Hz. (Note 6)
Shock	—	8 g, 15 ms	Horizontal: Incline Impact 1.22 m/s (Note 7) Vertical: Rotational Edge 0.1 m (Note 8)
Acoustic level (Note 9)	65 dB	—	—

g = acceleration due to gravity (9.8 m/sec²)

Note 1: Environmental specification for operating condition should be satisfied before the disk subsystem is powered on. Maximum temperature of 32°C should be strictly satisfied at air inlet portion. Recommended temperature range is 21 to 24°C.

Note 2: Non-operating condition includes both packing and unpacking conditions unless otherwise specified.

Note 3: On shipping/storage condition, the product should be packed with factory packing.

Note 4: No condensation in and around the drive should be observed under any conditions.

Note 5: The above specifications of vibration apply to all three axes.

Note 6: See ASTM D999-01 The Methods for Vibration Testing of Shipping Containers.

Note 7: See ASTM D5277-92 Test Method for Performing Programmed Horizontal Impacts Using an Inclined Impact Tester.

Note 8: See ASTM D6055-96 Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates.

Note 9: Measurement point: 1 m above the floor and 1 m from the surface of the product.

Troubleshooting

Troubleshooting

The SE 9985™ SE 9985 provides continuous data availability and is not expected to fail in any way that would prevent access to user data. The READY LED on the SE 9985 operator panel must be **ON** when the subsystem is operating online.

Table 6.9 lists potential error conditions and provides recommended actions for resolving each condition. If you are unable to resolve an error condition, contact your Hitachi Data Systems representative, or call the Hitachi Data Systems Support Center for assistance (see section).

Table 6.9 Troubleshooting

Error Condition	Recommended Action
Error message displayed.	Determine the type of error (refer to the SIM codes in section). If possible, remove the cause of the error. If you cannot correct the error condition, call the Hitachi Data Systems Support Center for assistance.
Fence message is displayed on the console.	Determine if there is a failed storage path. If so, toggle the RESTART switch, and retry the operation. If the fence message is displayed again, call the Hitachi Data Systems Support Center for assistance.
ALARM LED is on.	If there is an obvious temperature problem in the area, power down the subsystem (call the Hitachi Data Systems Support Center for assistance), lower the room temperature to the specified operating range, and power on the subsystem (call the Hitachi Data Systems Support Center for assistance). If the area temperature is not the obvious cause of the alarm, call the Hitachi Data Systems Support Center for assistance.

Service Information Messages (SIMs)

The SE 9985 generates service information messages (SIMs) to identify normal operations (e.g., TrueCopy pair status change) as well as service requirements and errors or failures.

SIMs can be generated by the front-end and back-end directors and by the SVP. All SIMs generated by the SE 9985 are stored on the SVP for use by Hitachi Data Systems personnel, displayed by the Storage Navigator software, and reported via SNMP to the open-system host. The SIM display on SE 9985 Storage Navigator enables users to remotely view the SIMs reported by the attached SE 9985s. Each time a SIM is generated, the amber Message LED on the SE 9985 operator panel turns on. The Hi-Track® remote maintenance tool also reports all SIMs to the Hitachi Data Systems Support Center.

SIMs are classified according to severity: service, moderate, serious, or acute. The service and moderate SIMs (lowest severity) do not require immediate attention and are addressed during routine maintenance.

Figure 6.12 illustrates a typical 32-byte SIM from the SE 9985. SIMs are displayed by reference code (RC) and severity. The six-digit RC, which is composed of bytes 22, 23, and 13, identifies the possible error and determines the severity. The SIM type, located in byte 28, indicates which component experienced the error.

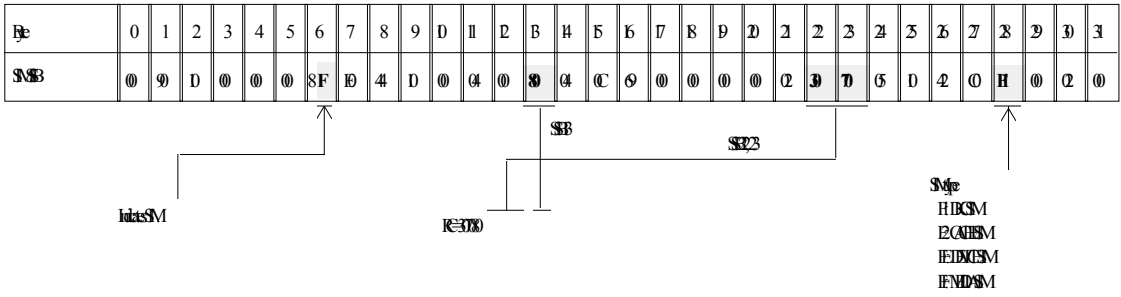


Figure 6.12 Typical SIM Showing Reference Code and SIM Type

Storage capacities for LDEVs on the SE 9985 are calculated based on the following values: 1 KB = 1,024 bytes, 1 MB = 1,024² bytes, 1 GB = 1,024³ bytes, 1 TB = 1,024⁴ bytes. Storage capacities for HDDs are calculated based on 1,000 (10³) instead of 1,024 (2¹⁰).

Table A.1 provides unit conversions for the standard (U.S.) and metric measurement systems.

Table A.1 Unit Conversions for Standard (U.S.) and Metric Measures

From	Multiply By:	To Get:
British thermal units (BTU)	0.251996	Kilocalories (kcal)
British thermal units (BTU)	0.000293018	Kilowatts (kW)
Inches (in)	2.54000508	Centimeters (cm)
Feet (ft)	0.3048006096	Meters (m)
Square feet (ft ²)	0.09290341	Square meters (m ²)
Cubic feet per minute (ft ³ /min)	0.028317016	Cubic meters per minute (m ³ /min)
Pound (lb)	0.4535924277	Kilogram (kg)
Kilocalories (kcal)	3.96832	British thermal units (BTU)
Kilocalories (kcal)	1.16279×10^{-3}	Kilowatts (kW)
Kilowatts (kW)	3412.08	British thermal units (BTU)
Kilowatts (kW)	859.828	Kilocalories (kcal)
Millimeters (mm)	0.03937	Inches (in)
Centimeters (cm)	0.3937	Inches (in)
Meters (m)	39.369996	Inches (in)
Meters (m)	3.280833	Feet (ft)
Square meters (m ²)	10.76387	Square feet (ft ²)
Cubic meters per minute (m ³ /min)	35.314445	Cubic feet per minute (ft ³ /min)
Kilograms (kg)	2.2046	Pounds (lb)
Ton (refrigerated)	12,000	BTUs per hour (BTU/hr)
Degrees Fahrenheit (°F)	subtract 32, then multiply result by 0.555556	Degrees centigrade (°C) °C = (°F - 32) × 0.555556
Degrees centigrade (°C)	multiply by 1.8, then add 32 to result	Degrees Fahrenheit (°F) °F = (°C × 1.8) + 32
Degrees Fahrenheit per hour (°F/hour)	0.555555	Degrees centigrade per hour (°C/hour)
Degrees centigrade per hour (°C/hour)	1.8	Degrees Fahrenheit per hour (°F/hour)

Glossary

Term	Definition
Array	Storage system consisting of trays and controller units. Storage system consisting of a minimum of one controller unit. Also includes one or more slots to house disks drives.
Array hot-spare	Disk that serves as a hot-spare within an array. A reserve disk that can be made available to all virtual disks within an array.
Asymmetric volume access	A storage access method that provides multiple data paths to the same volume, but allows only a subset of data paths at a time to be active.
Auto-sensing	Automatically determining the type of device connected (N-port, NL-port, F-port, FL-port, or Fabric) and adapting the port speed and interface protocol to match.
Back-End Director	A pair of array control processors (ACPs).
Block or block size	Amount of data sent or received by the host per I/O operation. Atomic read/write operation to/from a disk. Size of data unit that is striped across disks.
Cache	DRAM-based staging area used to provide higher performance to applications for reads and writes. During reads, the controller unit tries to keep the latest and most often accessed data in cache and also tries to pre-stage cache with future data during sequential accesses. For writes, cache is used to provide delayed writes to the disks. This delays the parity calculations and disk writes during RAID 5 operations. More optimization and advanced staging algorithms thus provide better performance.
Cache hit	Read or write request for data that is already in cache. Therefore, a request can be serviced without needing to go to disk.
Chunk	A quantity of information that is handled as a unit by the host and disk device.
Clean data	Any read data or write data that has been committed to disk. In other words, a copy of data that is safely on disk.
Concatenation	Sequentially mapping blocks on disks to a logical device. Two or more extents can be concatenated and accessed as a single logical device. Add extents to an existing volume.
Control path	The communications path used for system management information. Generally provided as an out-of-band connection over Ethernet.
Controller pair	Pair of controller units servicing a particular tray or group of trays.
Controller tray	A tray with one or more installed controller units.
Controller unit	The intelligence card that manages RAID functions and fail-over characteristics for an array or tray, or group of trays.
Copy-On-Write (COW)	The process that Sun StorEdge 9900 Copy-on-Write software uses to preserve point-in-time data when new data is written to disk. With each write, the system preserves the old data in snapshot reserve space, so that it can re-create the volume as it existed at the time of the snapshot.
CRC error checking	Checking for frames that have been corrupted (some of the 1 bits changed to 0 bits, and vice versa), due to noise or collision.
DAS	Direct attach storage. Storage directly attached to servers or hosts (as opposed to SAN storage where storage is attached to a network of storage devices).

Term	Definition
Data path	The path traveled by data packet — between the host processor and the disk.
Dedicated hot-spare	Disk that serves as a hot-spare to one, and only one, virtual disk in an array or tray.
Dirty data	Write data that is in cache and has been acknowledged to the application host, but which has not yet been committed to disk.
Disk	Physical entity that stores data (as compared to a virtual disk, which is a logical grouping of disks or storage extents).
Disk Slot	Slots on trays that house physical disks.
DMP	VERITAS dynamic multi-pathing.
Drive depopulation	Drive depopulation allows additional spindles to be added to drive trays that are not fully populated with 14 drives.
Duplexed cache	Cache mirroring with duplicate data paths to and from the cache. See <i>mirrored cache</i> .
ECC	Error correction code. Extra bits added to words, or double words, that correct all single-bit errors, and detect all double-bit errors. A superior technology to parity, which detects, but does not correct, single-bit errors, and cannot detect double-bit errors.
E-Port	An expansion port connecting two fabric switches.
ESCON	Enterprise System Connection. An IBM protocol used to link mainframes with peripherals and other mainframes at 10 to 17 Mbps over fiber optic cable.
Event	A change in the state of a managed object.
Expansion cabinet	An additional cabinet to expand the capacity of a storage system.
Expansion tray	A tray without an installed controller, used to expand the capacity of an array and/or storage system. Must be attached to a controller tray to function.
Extent	A set of contiguous blocks on a disk or disks with consecutive logical addresses. Extents can be smaller or larger than physical disks. On the Solaris OS, the format utility can subdivide a disk into several extents called slices (Windows and Linux have a similar concept called partitions). RAID arrays allow users to combine several disks together into a larger virtual disk. Although the underlying disks are separate extents, the resulting virtual disk is addressed from zero up to its new size — so this virtual disk is also an extent.
Fabric	A group of interconnections between ports that includes a fabric element. A collection of switches and the connections between them.
Fail-over	See <i>Path Fail-over and Recovery</i>
FC-AL	Fibre Channel arbitrated loop, a loop topology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled <i>fib</i> re in the context of Fibre Channel.
Fibre Channel	A set of standards for a serial I/O bus capable of transferring data between two ports up to 100 MB per second. Fibre Channel supports point-to-point, arbitrated loop, and switched topologies. Fibre Channel can be implemented with either optical fiber (note spelling) or copper.
Fiber-optic cable	Jacketed cable made from thin strands of glass, through which pulses of light transmit data. Used for high-speed transmission over medium to long distances.

Term	Definition
FICON	Short for <i>Fiber Connection</i> , or <i>Fiber Connectivity</i> , IBM's fiber optic channel technology that extends the capabilities of its previous fiber optic channel standard, ESCON. Unlike ESCON, FICON supports full duplex data transfers and enables greater throughput rates over longer distances. FICON uses a mapping layer that is based on technology developed for Fibre Channel and multiplexing technology, which allows small data transfers to be transmitted at the same time as larger ones.
Floating hot-spare	A drive that remains an active data drive after a RAID controller replaces a failed drive with it. A replacement drive now becomes the new hot-spare drive.
Front-end Director	A pair of channel host adapters (CHAs).
FRU	Field replaceable unit. A component that can be removed and replaced during service in the field.
F_Port	On a Fibre Channel switch, a port that supports an N_port.
GBIC	Gigabit interface converter. A standard form factor that provides a hot-plug connection into a Fibre Channel device.
G_Port	On a Fibre Channel switch, a port that supports either F_Port or E_Port functionality.
HBA	Host bus adapter.
Host ports	DSP ports attached to hosts or host-facing SAN ports. Any DSP port is capable of being either a host port or a storage port.
Hot-spare	Disk used by a controller unit to replace a failed disk.
Hot-swappable	A hot-swappable component can be installed or removed by simply pulling the component out and putting the new one in. The system either automatically recognizes the component change and configures itself as necessary or requires user interaction to configure the system. However, in neither case is a reboot required. All hot-swappable components are hot-pluggable, but not all hot-pluggable components are hot-swappable.
In-band	Using the data path between a host(s) and a storage device to transport system management traffic.
Initiator	On a Fibre Channel network, typically a server or workstation that requests transactions of disk or tape targets. Servers can have one or more initiators.
I/O	Input/output.
I/O rate	A measure of a device's capacity to transfer data to and from another device within a given time period, typically as I/O operations per second.
IOPS	Input/output operations per second. A measure of I/O performance, this is commonly used to quote random I/O performance.
IP	Internet protocol. A set of protocols developed by the United States Department of Defense to communicate between dissimilar computers across networks.
iSCSI	A protocol being ratified by the IETF for the transmission of SCSI commands and data blocks over TCP/IP networks .
LED	Light emitting diode.
LUN	Logical Unit as defined by SNIA. Defines a volume as it is mapped to particular host(s) or initiator(s). Distinguished from a volume in a sense that the same volume can represent a different LUN to different host(s) or initiator (s).

Term	Definition
LUN mapping	Assigning volume permissions (read-only, read/write, or none) to a host or initiator.
LUN masking	A technique that prevents all but certain initiators from gaining access to a volume.
Management path	The out-of-band path that connects components of the system to the storage service processor.
Mirror	The process of performing write operations to multiple physical media as part of each host-acknowledged write operation in order to maintain data availability. Provides data integrity by keeping multiple copies of identical volume data.
Mirrored cache	Redundant copies of data residing in cache — the (write) data residing in cache that has not yet been written to the hard disks is duplicated for fail-over operation.
Mirroring (RAID)	Redundant storage of data, achieved by duplicating files (so there is always a primary file and a copy of the primary file) onto separate disks.
Multi-pathing	Providing two or more physical paths to a given target or device.
NAS	Network Attached Storage. Network Attached Storage is a term for a conventional or proprietary server that provides file storage over a network using file access network protocols like NFS or CIFS.
Network terminal concentrator (NTC)	A modem connection point for the Sun StorEdgeRemote Response service. Helps facilitate a point-to-point connection from a remote support center.
Non-disruptive	Does not prevent system or data access at any time during operation. Data path access is not sacrificed, and the host does not see any I/O failure (unless dual points of failure). May no longer be an HA environment. Availability of management services not included.
Non-floating hot-spare	A drive that reverts back to hot-spare status after a failed drive has been replaced and the mirror re-silvered or the stripe rebuilt.
N_Port	A Fibre Channel port in a point-to-point or fabric topology.
NL_Port	A port attached to a node for use in all three topologies (point-to-point, arbitrated loop, or fabric).
NTC	Network terminal concentrator — see above.
NVRAM cache	A non-volatile (battery-backed) random access memory area used as an intermediate store for data between a host computer system and disk drives to achieve faster writes and, in some cases, faster reads.
OLTP	On-line transaction processing.
Optical fiber	Any filament of fiber, made of dielectric material, that guides light.
Out-of-band	Using a path other than the data path to transport system management information. Connecting to a management port using an IP network, for example.
Partner group (or partner pair)	Two controller units providing redundant data and management paths and mirrored cache duplexing (which provide controller fail-over and path fail-over capability).
Path failure	The loss of a data or management path.
Path fail-over and recovery	The process of automatically moving traffic to a different path when a path either fails, or is re-instated.
Point-in-time copy	A frozen copy of a volume's data, as created when taking a snapshot.

Term	Definition
Port	An access point on a device for attaching a link.
Primary volume	Used in the context of snapshots, the primary volume is the live data set from which the snapshot copy is made.
Profile	A set of attributes applied to a set of storage in a storage pool designed to help optimize that pool for a particular access pattern and/or level of data protection. Profiles are associated with storage pools to define the attributes of the pool.
Protocol	A convention for data transmission that defines timing, control, format, and data representation.
RAID	Redundant array of independent disks. A set of disk drives that appear to be a single logical disk drive to an application such as a database or file system. Different RAID levels provide different capacity, performance, availability, and cost characteristics.
RAID group	A set of disks running a RAID algorithm.
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 that is easily available elsewhere within the organization.
RAID 1+	RAID level 1 (1+0), or mirroring with striping. Data is stored at the file level. Files reside on separate disks, and two copies of the data are kept. Each data block in a RAID 1(1+0) volume is mirrored on two drives, and the blocks are striped across all the drives in a storage pool. If one of the mirrored pair fails, the data from the other drive is used.
RAID 5	RAID level 5, or striping with distributed parity. Both data and parity information are striped across the drives. Because of parity, if a single drive fails, data can be recovered from the remaining drives. Two drive failures cause all data to be lost. In other words, 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 6	RAID level 6, or striping with two sets of distributed parity for improved reliability and availability.
RAS	Reliability, availability, and serviceability. Reliability is a measure of the likelihood that problems will occur. A highly reliable system has few problems. Once a problem occurs, availability is the measure of how the system protects the user from being adversely affected by the problem. Serviceability is a measure of how easy it is to repair the problem.
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.
Reconstruction	The process of rebuilding lost data on a replacement disk after a disk failure.
Redundancy	Duplication for the purpose of achieving fault tolerance. Refers to duplication or addition of components, data, and functions within the array.
Rolling snapshot pattern	The creation of a series of snapshots in which the oldest snapshot is replaced each time a new snapshot is taken. For example, a weekly rolling snapshot pattern would cause this Tuesday's snapshot to replace last Tuesday's snapshot, this Wednesday's snapshot to replace last Wednesday's snapshot, etc.

Term	Definition
SAN	Storage area network. SAN architecture uses high-performance, high-capacity Fibre Channel switches to connect storage islands to servers. This approach provides physical connectivity, facilitating information sharing, or simplifying management across servers.
SCSI	Small computer systems interface. An ANSI standard for controlling peripheral devices by one or more host computers.
Serial transmission	Data communication mode where bits are sent in sequence in a single fiber.
SFC	See <i>Switch Fabric Cards</i> .
SFP	Small form pluggable.
SIO	See <i>Storage I/O Cards</i> .
Snapshot	A point-in-time copy of volume data, created using copy-on-write technology.
Snapshot reserve space	Disk space reserved for Copy-on-Write data.
Snapshot rollback	The process of applying saved changes from a snapshot copy to a primary volume. The most common application of this feature is to roll the primary volume back to the state it was in at the time the snapshot was taken.
(Snapshot) update	Modify an existing snapshot to contain data currently in the primary volume. This feature is typically used when updating the oldest snapshot to be the newest in a rolling snapshot pattern. Note (for developers): The DSP refers to this operation as a snapshot "reset".
SNMP	Simple network management protocol. A simple protocol designed to allow networked entities (for example, hosts, routers) to exchange monitoring information.
SRC	See <i>Storage Resource Card</i> .
SVP	See <i>Storage Service Processor</i> .
Storage domain	A logical domain with its own storage, and its own management environment.
Storage extent	See <i>Extent</i> .
Storage pool	A collection of disks, virtual disks or storage extents, generally with common configuration, availability, and performance characteristics, that can be carved into volumes.
Storage profile	See <i>Profile</i> .
Storage Resource Cards (SRC)	Processing cards in the DSP, which mate with SIO cards.
Storage Service Processor (SVP)	The management device integrated into storage systems that provide unified management access to system components and remote management functionality.
Striping	Laying data out over a series of disks or virtual disks, allows multiple disk controllers to simultaneously access data, thus improving performance.
Stripe size	Total amount of data in a disk stripe, that is, the block size multiplied by number of data disks in the stripe.
Stripe width	Total number of disks in a disk stripe.
Sun StorEdge Storage Pool Manager software	Uses virtualization capabilities of the Sun StorEdge 9985 system to simplify storage management, using storage pools and application-oriented storage profiles.

Term	Definition
Switch	The name of an implementation of the fabric topology. A fabric element that implements a fabric. The fabric element that allows each port of a switch to be connected to any other port on that switch. A collection of switches implement a fabric and provide the network through which any device can communicate with any other device.
Symmetric volume access	A storage access method that provides multiple live data paths to the same volume.
Syslog	The internal log file maintained by Sun StorEdge 9985 arrays to track events and alerts as well as informational and notice messages. This log file can be sent periodically to a host server for evaluation using the <code>syslogd(1M)</code> function.
System management	The set of features and functions that allow the user to control a storage system.
Target	The recipient of initiator commands. For example, volumes are presented to initiators as targets.
Telemetry stream	Stream of data generated by monitoring agents.
Throughput	A measure of sequential I/O performance, quoted as gigabytes per second (GB/sec.). See <i>IOPS and I/O rate</i> .
Topology	The components used to connect two or more ports together. Also, a specific way of connecting those components, as in point-to-point, fabric, or arbitrated loop.
Transfer rate	The rate at which data is transferred, usually measured in megabytes per second (MB/sec.).
Tray	An enclosure containing disks.
Tray depopulation	Trays delivered without the full compliment of disks installed. Allows additional disks to be added to trays that are not fully populated.
Virtual disk	Any abstraction or collection of disks that appears as a single disk to the device mounting it.
Volume	A logical disk carved from a storage pool. A virtual disk comprised of raw storage extents into which a file system, a DBMS, or an application can place data. Can be a single physical disk or a virtual disk mapped from one or more underlying extents.
Warm boot device	Bootable on all supported HBAs with storage booted before server booting.
Zone or zoning	Provided by fabric switches, a function that allows segmentation of node by physical port, name, or address.

COLLATERAL

Documents available on SunWin

SunWIN Token

Sun StorEdge 9985 System Just the Facts	445484
Sun StorEdge 9985 System Technical Presentation	445485
Sun StorEdge 9985 System Customer Presentation	445486

Sun StorEdge 9985 System Sales Guide	417591
Sun StorEdge 9985 System Datasheet	445487
Sun StorEdge 9900 System What Works With What	344150
(SE 9985 and SE 9990 will use the same WWW.Ignore 445672 as stated in the Sun Intro)	
Sun StorEdge 9985 System HW and SW Datasheet	445487
SE 9985 Field FAQ (Future)	445671

User Guides Available on the PTS Website

<http://pts-storage.west/products/T99x0/documentation.html>

While there are many user guides, the following is one of the most important. It provides a broad overview of the product rather than being a "point releases" about an individual feature. There might be a minor delay in getting it posted at Revenue Release July 12, 2005, so you may want to contact ken.ow-wing@sun.com directly if you need this document in order to maintain your sales momentum.

Sun StorEdge 9985 User Guide	MK-95RD279
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WEB INFORMATION:

Internal

<http://onestop/storage/9900/index.shtml?menu>

<http://mysalesstg.central/public/storage/products/highend/>

<http://mysalesstg.central/public/storage/products/highend/9985/>

<http://webhome.ebay/networkstorage/products/9900/index.html>

<http://pts-storage.west/products/T99x0/documentation.html>

<http://sejsc.ebay/> (easy place to the to the WWWs)

<http://webhome.ebay/networkstorage/products/datacenter/>

<http://webhome.ebay/networkstorage/solutions/consolidation.html>

<http://webhome.ebay/networkstorage/products/software>

<http://systems.corp/programs/datacenter/consolidation/>

<http://suncluster.eng/>

<https://channelone.hds.com/indexmain.cfm>

<http://sejsc.ebay/>

Partner:

<http://partner.sun.com/products/storage/9985.html>

<http://partner.sun.com/products/storage/highend.html>

<http://pts-storage.west/products/T99x0/documentation.html>

External

<http://www.sun.com/storage/highend/9985/index.xml>

<http://www.sun.com/storage/highend/>

<http://reseller.sun.com/products/storage/9960.html>

<http://reseller.sun.com/products/storage/9910.html>

<http://www.sun.com/storage/highend/>

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