Sun StorageTek™ 9990V

Storage System

Just the Facts

Sun Internal / Partner Version

July 10, 2007

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Copyrights

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Positioning

Figure 1: Sun StorageTek 9990V System

Introduction

The Sun StorageTek 9990V enterprise storage system is based on the fourth generation Hi-Star™ crossbar switch architecture delivering market leading performance, availability and scalability to meet even the most demanding data center storage, management and business continuity needs. The ST9990V redefines the storage industry with the world's first implementation of a large-scale, enterprise-class virtualization layer combined with thin provisioning software – representing the first time that customers can obtain the consolidation benefits of external storage virtualization with the efficiencies of thin provisioning in one integrated solution.

Now companies can benefit from the industry's highest-performing and most scalable storage solution, backed by a set of storage and data services that includes new thin provisioning with ST9900 Dynamic Provisioning™ software, application-centric storage management, and simplified, unified data replication across heterogeneous storage systems. The ST9990V provides as much as 332TB of internal storage and up to 247PB of external heterogeneous storage systems support. As an integral component of the portfolio of ST9900 Services Oriented Storage Solutions, the ST9990V provides an unequalled foundation for matching application requirements to the attributes of different classes of storage, while fully leveraging, and even adding value to, current investments.

New bundling of ST9900 software available on the ST9990V simplifies the purchase, installation and maintenance of ST9900 software for our customers, while streamlining the sales process and freeing up precious sales cycles for other productive activities. The new ST9900 Basic Operating System Software bundle combines ST9900 Device Manager Software, ST9900 Resource Manager Software and ST9900 Virtual Partition Manager software enabled for maximum of 4 partitions, in one cost-effective software bundle that is

easy to order. The number of license keys is dramatically reduced to simplify installation and maintenance. Other new software bundles (suites) were also announced and are discussed later in this document.

When complemented by services and solutions designed to realize its potential with best storage practices, the ST9990V assists customers in more closely aligning IT and business objectives. In summary, ST9990V unifies data and storage services across heterogeneous storage, supporting industrial-strength virtualization, replication, migration, and single pane-of-glass management. Customers can use just one platform to manage all of their storage systems.

Key Product Attributes:

- Industry leading performance, scalability, and availability for your most demanding enterprise storage and business continuity needs, in a fully integrated storage and data services platform.
- Thin Provisioning for improving storage utilization, simplifying storage provisioning, transparent capacity upgrades, and reducing TCO.
- Embedded Storage Virtualization for massive storage consolidation and management simplicity of up to unparalleled 247 PB.
- Virtual Partitioning of cache, disk, and I/O for helping organizations meet their security and service level agreements.
- Tiered Storage management for optimizing the alignment of storage costs with business needs and implementing data lifecycle management.
- Remote application with disk-based replication journaling for multi-data center disaster recovery.
- Market proven reliability
- Massive Scalability:
  - Up to 332TB internal, 247PB external
- Market Leading Performance
  - Industry leading 3.5M IOPS and 106 GB/s internal bandwidth)
  - Performance Scales with Capacity:
  - Crossbar architecture (4th generation) for max performance and availability
- Market–Proven Availability:
  - Optional 100% Data Availability Guarantee
- Comprehensive Management Suite:
  - Common across ST9900 product line
- Comprehensive Business Continuity Suite:
  - Common across ST9900 product line
- Enables Tiered Storage and Large Scale Consolidation:
  - Controller based virtualization
- Policy Driven Storage Management:
  - For data lifecycle management (DLM)
- Thin Provisioning (Dynamic Provisioning):
  - Improve storage utilization, provisioning and transparent capacity upgrades

Main Hardware Features

The ST9990V System provides an excellent combination of increased Performance, Scalability and Capacity.

The following features will be available at time of announcement:

* 106 GB Aggregate System Bandwidth
* 3.5M IOPS Maximum
* 332 TB (w/300 GB HDD) Internal raw capacity
* 1152 Disk drives
* 256 GB Data Cache Memory
* 32 GB Control Cache Memory
* 224 FC connections
* 112 FICON, 112 ESCON connections
* 32 Virtual Partitions (Virtual Storage Machines)
* 65,536 Logical devices (Open Systems and z/OS)
* 247 PB External Storage Support
* Dynamic Provisioning (Thin Provisioning)
* ST9900 Series Software Suite

Not all ST9990V features will be available at GA. The following will be available post GA(date TBD):

* External FICON support will be announced at introduction but not available until late 2007
* 300GB 15K drives (Date TBD - Approx. 3mths post GA)
* Continuous Data Protection (CDP)(TBD-Target for early CY2008)
* NAS and iSCSI (TBD)
* Higher capacity drives – Will support when available and meet the enterprise quality, reliability and performance requirements.
* Tuning Manager and GLAM (Target Q1FY08)(note version 5.7 is required to support ST9990V)

Main Software Features

- All ST9990V software is levergeable from the ST9990 and offered as suite bundles or as stand alone. (Although the same software is usuable on multiple generations of the ST9900 systems, each generation has a separate and distinct set of part numbers. The ST9990V has is owns set of part numbers. This means that you can not use a SW part number from the ST9990 on the ST9990V.)
- ST9900 Basic Operating System (BOS) Suite replaces Device & Resource Manager Suite
  - Includes Device Manager and Resource Manager Suite
  - Includes Virtual Partition Manager with support for up to 4 partitions
  - Includes Server Priority Manager
- ST9900 BOS Virtual Suite (BOS V)
  - Includes Universal Volume Manager

- Includes Virtual Partition Manager for up to 32 partitions

- ST9900 Disaster Recovery Suite to replace current TrueCopy
  - Includes TrueCopy Sync + HUR for both Open and Z/OS
- ST9900 Disaster Recovery Extended Suite to replace current HUR Suite
  - Include TrueCopy Sync + HUR with advanced function: 3DC for Open and z/OS and 4x4 for z/OS only
- ST9900 In-System Replication
  - Includes ShadowImage for Open and z/OS and CoW for Open
- ST9900 Compatible FlashCopy version 2
- ST9900 Dynamic Provisioning
- ST9900 Continuous Data Protection
- ST9900 Compatible PAV
- ST9900 Business Continuity Manager
- ST9900 CrossOS File Exchange (RapidXchange HMDE)
- ST9900 HiCommand Tuning Manager
- ST9900 Tiered Storage Manager
- ST9900 HiCommand Replication Monitor
- ST9900 HiCommand Protection Manager
- ST9900 Dynamic Link Manager

Sun StorageTek 9900 Basic Operating System (BOS)- This suite was created to deliver the storage return on investment, security, and quality of service to applications that your organization requires. And the Basic Operating System Virtualization software enables the ST9990Vs unique embedded virtualization capabilities and allows customers to take advantage of ST9900 storage management and data mobility capabilities—within a single system or across an entire heterogeneous storage pool. Using Basic Operating System, one administrator can manage an entire storage infrastructure from a single pane of glass or you can choose to designate multiple storage administrators who can optionally manage only a particular set of storage resources that is made accessible to them.

The primary Basic Operating System interface, Device Manager software, utilizes an easy-to-use and intuitive graphical user interface to centrally manage the ST9990V along with all other Sun ST/SE9900 storage systems. A complete command line interface is also included. Through Device Manager software Basic Operating System provides user, logical, physical, and host management views that enable provisioning and storage pooling for primary and secondary storage. It offers multiple levels of security for disks, ports, and administrators and its reporting capabilities enable capacity analysis based on server or application, or physical storage class usage.

In complex infrastructures where many servers are connected to a storage system, it's often essential that business-critical applications get their own required storage bandwidth. With Basic Operating System you can control bandwidth at the port level in addition to being able to create up to 4 individual virtual partitions (virtual private storage machines) to ensure that critical application servers have prioritized access to their required storage quality of service. And with Basic Operating System V you get the additional capability to create up to 32 secure virtual private storage machines.. This means shared storage can be securely compartmentalized where needed.

Operationally, Basic Operating System's Performance Monitor provides a fundamental view of the performance data provided by the storage system components, including physical disks, channel processors, and storage processors. The data helps you to make informed decisions regarding storage tuning and load balancing.

Sun StorageTek 9900 BOS Virtual (BOS V) - The BOS V is an upgrade to the BOS and adds Unique ability to virtualize externally attached storage subsystems to the ST9990V system creating a single heterogeneous pool of tiered storage. This enables simplified storage management, increases utilization, increases efficiency, improves service levels, simplifies data migration and helps meet compliance demands. With BOS V Virtual Partitions are expanded - up to 32 storage, cache and IO ports partitions.

Sun StorageTek 9900 HiCommand Tuning Manager and Sun StorageTek 9900 HiCommand Device Manager - Targeted for users managing multiple storage arrays including the ST9990, ST9985, ST9910, ST9960, ST9970 and ST9980 in open or shared environments. HiCommand quickly discovers the key configuration attributes of storage systems and allows users to begin proactively managing complex and heterogeneous storage environments quickly and effectively using an easy-to-use browser-based GUI. HiCommand enables remote storage management over secure IP connections and does not have to be direct-attached to the storage system. HiCommand is a suite of several management tools. Two of the most significant are HiCommand Tuning Manager and Device Manager. HiCommand Tuning Manager allows the customer monitor and manage various capacity, performance, service level parameters. HiCommand Device Manager allows the customer to manage disparate systems from the same graphical user interface.(part numbers for Tuning manager will be announced in August 2007) (The Device Manager base kit and trial license Part numbers for the ST9990/85/80/70/60/10 are also included in this announcement) (Device manager for the ST9990V is included in the BOS Suite)

Sun StorageTek 9900 Dynamic Link Manager (SDLM) software, is multi-pathing software which resides on the host server. It provides functions for distributing the load across multiple paths and switching to another path if there is a failure in a path in use. The load balancing and path failover capabilities of SDLM improve the overall performance and reliability of the system. (Part numbers for the ST9990V/90/85/80/70/60/10 are included in this announcement.)

Sun StorageTek 9900 ShadowImage In-System Replication – Includes ShadowImage for Open and z/OS and CoW for Open. Allows the user to create internal copies of volumes for a wide variety of purposes including offline backup and application testing.

Sun StorageTek 9900 Disaster Recovery Suite - Includes TrueCopy Sync+ HUR for both Open and Z/OS. Sun StorageTek 9900 TrueCopy Remote Replication provides data replication to other Sun StorageTek 9900 series subsystems over local or long distance connections. The added copies may be used to help enable disaster recovery, data mining, backup, testing, etc. It provides synchronous remote replication operations.

Sun StorageTek 9900 Disaster Recovery Extended Suite – Includes TrueCopy Sync + HUR with advanced function: 3DC for Open and z/OS and 4x4 for z/OS only.

Sun StorageTek 9900 Performance Monitor - Monitors disk subsystem and allows the user to obtain statistics about resources in the disk subsystem and statistics about workloads on disk and ports. (no orderable part numbers, this feature is embedded within the BOS Suite)

Sun StorageTek 9900 Server Priority Manager - Allows open-systems users to designate prioritized ports, or World Wide Names(WWN's), (e.g. for production servers) and non-prioritized ports (e.g. for development

servers) and set thresholds and upper limits for the I/O activity of these ports, or WWN's. (no orderable part numbers, this feature is embedded within the BOS Suite)

Sun StorageTek 9900 Data Retention Utility - The LDEV Security feature of the ST9990 subsystems allow the user to restrict host access to the logical devices (LDEVs) on the ST9990 subsystem. Key in retaining data intact for regulatory compliance requirements. (no orderable part numbers, this feature is embedded within the BOS Suite as it is within the Resource Manager Suite)

Sun StorageTek 9900 Data Retention Utility for IBM z/OS – LDEV Security: The LDEV Security feature of the SE9990 subsystems allow the user to restrict z/OS host access to the logical devices (LDEVs) on the SE9990 subsystem. (no orderable part numbers, this feature is embedded within the BOS Suite as it is within the Resource Manager Suite)

Sun StorageTek 9900 Compatible PAV - Enables the z/OS host system to issue multiple I/O requests in parallel to single logical devices (LDEV's) in the ST9990V subsystem to improve mainframe performance by eliminating IOSQ delays.

Sun StorageTek 9900 Multiplatform Backup - Allows the user to implement mainframe-based backup procedures and standards for the open system data stored on the multiplatform ST9990V, ST9990, ST9985, SE9980 and SE9970 subsystem.

Sun StorageTek 9900 Business Continuity Manager - Targeted for the z/OS host environment, this software provides a centralized infrastructure for managing copy operations.

Sun StorageTek 9900 Business Continuity Manager Extended CT Group - A consistent facility for managing mainframe copy operations.

Sun StorageTek 9900 Business Continuity Manager Extended Remote Control

Sun StorageTek 9900 Database Replication for IBM z/OS - DB2 replication facility.

Sun StorageTek 9900 Database Validator - Oracle database mapping tool. (no orderable part numbers, this feature is embedded within the BOS Suite as it is within the Resource Manager Suite)

Sun StorageTek 9900 Mainframe Connection - To connect a ST9990V to a mainframe.

Sun StorageTek 9900 Cross-OS File Exchange - Enables data stored on the ST9900 series products to be converted and transferred between z/OS and open-system platforms.

Sun StorageTek 9900 Cross-OS File Exchange Code Converter - Open to mainframe file transfer.

Sun StorageTek 9900 Dataset Replication for IBM z/OS - Provides split volume and copy operations. (no orderable part numbers, this feature is embedded within the BOS Suite as it is within the Resource Manager Suite)

Key Messages

1. Today's 24x7 global enterprises are not only confronted with escalating data growth but demand for the highest level of data availability, long-term data protection, and retention driven by numerous government and regulatory agency requirements. They are also challenged to improve application performance and availability, business continuity, data protection, and simplify the management of increasingly complex storage infrastructures. Sun StorageTek™ 9990V with its market proven crossbar switch architecture and embedded virtualization technology, extends the enterprise-class functionality and performance—virtualization of external storage, logical partitioning, and universal replication—introduced with its award winning predecessor, the Sun StorageTek 9990.With added Thin Provisioning functionality for optimizing storage utilization and reducing TCO, this massive-capacity system further assists storage managers in their mission to simplify storage administration, improve performance, and reduce overall costs.
2. 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.
3. The StorageTek 9990V is the evolutionary successor to the StorageTek 9990 system. It shares the same crossbar architecture, embedded virtualization, software, and connectivity protocols. The StorageTek 9990V is the right choice for customers who have an existing investment in StorageTek 9900 systems and software, and want a compatible system for new deployments.
4. The StorageTek 9990V is the follow on product for Sun StorageTek 9990.
5. The StorageTek 9990V provides mainframe virtualization capability with external FICON storage systems support (available post launch) just as it did successfully for years in Open Systems with Fibre Channel external storage systems support.

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 StorageTek 9990V is the evolutionary successor to the StorageTek 9990 system. It shares the same crossbar architecture, software, and connectivity protocols. The StorageTek 9990V is the right choice for customers who have an existing investment in StorageTek 9900 systems and software, and want a compatible system for new deployments.
   - The Sun StorageTek 9990V system provides all the enterprise class features and the market proven availability of the StorageTek 9900 family

- The Sun StorageTek 9990V system leverages customers existing StorageTek 9900 investments by utilizing the same storage management tools and the same replication software as the Sun StorageTek 9990 system.
- The Sun StorageTek 9990V provides storage virtualization. Customers can attach their existing storage systems from various vendors to the StorageTek 9990V 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 StorageTek 9900 Universal Volume Manager software)
- The Sun StorageTek 9990V 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 StorageTek 9900 Universal Volume Manager and StorageTek 9900 Tiered Storage Manager software)
- The Sun StorageTek 9990V helps customers meet service level agreements by logically partitioning system resources – disk, ports and cache. Up to 32 Virtual Private Storage Machines (VPSMs) can be created on a StorageTek 9990V, 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 recourses. (implemented by StorageTek 9900 Virtual Partitioning Manager)
- The Sun StorageTek 9990V 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 StorageTek 9900 Universal Replicator software)
- The Sun StorageTek 9990V system can also be a lower cost replication target for 3 data center disaster recovery plans based on StorageTek 9990 systems. The Sun StorageTek 9990V system provides a "Universal Replication Layer" with any-to-any replication. (implemented by StorageTek 9900 Universal Replicator and StorageTek 9900 ShadowImage software). Recently, this multi-hop replication capability has been enhanced with
- Delta Resync capability to maximize not only Recovery Time Objective (RCO), but Recovery Point Objective (RPO) as well.

3. The StorageTek 9990V can help lower the cost of storage for enterprises with investments in mainframe applications

- Native mainframe connectivity (FICON and ESCON) has been increased to 112 ports each.
- 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 ST9990V is positioned as the very high-end Data Center product within Sun's existing ST9900 enterprise product family delivering highest performance, scalability and thin provisioning. It will co-exist with the ST9990 throughout FY2008 and eventually replace the ST9990 in FY2009.

Key Messaging Statements with Respect to Competition

The Sun StorageTek 9990V will be targeted at the high-end enterprise market, and the data center in particular. It will represent the very high-end of Sun's StorageTek 9900 Series of products.

ST9990V will compete in the upper range of the enterprise storage market, dominated by Open Systems Fibre Channel SANs and the IBM z/OS FICON/ESCON mainframe environment. ST9990V's primary competitors remain the EMC Symmetrix DMX-3 Series and EMC InVista virtualization controller, IBM TotalStorage

DS8000 series, and IBM SAN Volume Controller for virtualization. Unlike the Sun ST9990V and (and the whole ST9900 family) that has embedded storage virtualization, both IBM and EMC have to rely on seperagte external appliances (IBM SVC) and switches (EMC InVista) for this capability.

All of the other enterprise storage vendors, including 3ParData, currently market their high-end arrays to compete directly with the current ST9990 and ST9985. Although IBM's SAN Volume Controller is not a storage array but rather a storage virtualization appliance, IBM is positioning it and equipping it with features and functionality that may place it in direct competition in some situations with the ST9990/85 and will likely continue to do so against ST9990V. Similarly, the EMC InVista is positioned as a storage virtualization solution leveraging the integration with various FC switch vendors and, in particular, integration with Cisco directors. Based on industry analysts' latest assessments of virtualization solutions, IBM SVC was proven to lack enterprise-level functionality and reliability and EMC's InVista downgraded to caution due to lack of customer acceptance. Sun's embedded ST9900 virtualization was recognized by these analysts as the most elegant, simple and scalable.

ST9990V Competitive Advantages

- Best Scalability, Availability and Performance
  - Up to **247**PB, 100% Data Availability Guarantee, Up to **3.5M** IOPS and **106**GB/s int. band-width
- Best Storage Virtualization
  - Embedded, Enterprise-proven (no appliances/switches)
  - Recognized as the most elegant, simple and scalable by leading analysts
- Best Replication
  - Only storage-based replication engine to use data journaling and pull technology for high per-formance, guaranteed data integrity and fast recovery
  - Only platform that can use the same replication, copy, and data movement software solutions across a heterogeneous storage pool
- Best Flexibility
  - Up to 32 dynamically re-configurable virtual storage systems (virtual partitions)
  - Flexible RAID configurations
  - Sophisticated cache management to minimize cost with active-active mirror protection
- Enterprise-level Thin Provisioning
  - For storage utilization and storage allocation efficiency

Competitive Comparisons

Current primary competitors are the IBM DS8300 Turbo and the EMC DMX3. Neither have embedded controller based storage virtualization and need to depend on a separate appliance based virtualization solution, such as IBM's San Volume Controller, or a separate switch based virtualization solution, such as EMC's InVista. Unlike the ST9900V, neither support mainframe (FICON) virtualization.

Sun StorageTek 9990V – Key Features

Customers are using the Sun ST9990V Sun ST9990 and ST9985 disk systems to support the largest and most critical data center environments. These systems provide performance, scalability and flexibility along with many powerful features that are not found in any other disk systems. These are some of the most valuable differentiating features.

Universal Volume Manager (UVM)

The Sun ST9900 Series, with UVM option, natively supports external disk virtualization. With UVM, customers can move their data to other disk systems without disrupting the application . UVM is vendor agnostic, so customers are not locked into Sun storage and choose the best fit for their requirements. Because UVM is embedded in the

microcode of every ST9900, customers can implement disk virtualization without adding any new devices to their environment. Only the license key need s to be purschased to make UVM operational. With UVM, a single 9990V can support up to 247 petabytes of external storage (32 petabytes for ST9990 and 16 petabytes for ST9985)

EMC's DMX-3 product does not support any external disk virtualization. EMC customers would have to buy an extra virtualization product including new hardware, new networking and new software. EMC has been selling the InVista SAN Virtualization product, but after a year on the market, only a small handful have been sold.

IBM's DS8000 does not support any external disk virtualization either. IBM sells the SAN Volume Controller (SVC) which is a virtualization appliance. The SVC is primarily aimed at midrange environments. IBM customers have to install the SVC in addition to the DS8000. Many SVC's would be required to support large data center requirements. In practice, the SVC is used primarily for data migrations.

Virtual Partition Manager (VPM)

Enterprise class disk systems are typically shared by dozens to hundreds of servers. The applications requirements and quality of service (QoS) vary tremendously, so customers must have control of the disk resources dedicated to each server. It is essential to fence off the resources required by the most critical applications, so disk administrators can guarantee their performance, and protect them from demand spikes from lower priority applications like large batch data transfers.

Sun ST9990/90V customers can use VPM to set up as many as 32 (8 for ST9985) separate Virtual Private Storage Machines or Virtual Partitions to manage complex mixes of application performance requirements. Instead of buying more disk systems, Sun customers have mature and sophisticated tools to maximize the systems they already own.

EMC has just announced their initial partitioning features, Dynamic Cache Partitioning and Symmetrix Priority Control. These new tools are relatively simple and lack the fine-grained, end to end QoS control available in VPM and unlike the ST9900 VPM that provides up to 32 full virtual partitions of not only cache, but disk and IO ports, EMC can only partition cache and is limited to only 8 partition at tbat. IBM DS8000's offer only 2 partitions that divide the array resources in half. Unlike the ST9900 where the virtual partitions are dynamic and can be configured and changed by the customer, IBM 2 partitions are factory preset and can not be changed by the customer, There is no flexibility to assign each application the resources and priority that it needs.

Universal Replicator (UR)

The ST9900 Family Universal Replicator feature leads the industry in robust remote replication. It delivers completely reliable and consistent replication over vast distances and overcoming instability in WAN connections. By using disk journaling and pull technologies, UR can survive link outages with complete consistency at the remote target, and without overloading the local system. Sun's Delta Resync feature allows three data center configurations to rapidly establish full redundancy following a failover from the primary site.

EMC's SRDF/A remote replication product was designed to store remote writes in local memory. When a link goes down, local cache can be consumed rapidly. EMC recently introduced disk journaling in a SRDF/A Delta Set extension, but still lacks pull technology to off-load the local system and maximize available data bandwidth. EMC does not support Delta Resync for 3 data center failovers.

IBM's Global Mirror replication product can maintain data consistency at the remote site, but requires local processing. It lacks Sun's Delta Resync capabilities and the sophisticated disk journaling with pull technologies available in Sun UR.

Flexible RAID Configuration

Sun ST9900 customers can adjust each RAID group on the entire 9990V/90/98 frame to meet their requirements. For example, although many applications can use a RAID-5 (7+1) configuration, others may need a smaller or larger set.

EMC's DMX-3 has a very rigid RAID configuration rules. Customers must select a single RAID-5 configuration for the entire system, so they cannot optimize configurations for each application.

IBM's DS8000 supports multiple RAID configurations.

Sophisticated Cache Management

Sun's ST9990 uses a sophisticated dynamic cache algorithms to maximize the use of expensive cache memory. It eliminates unnecessary read mirroring while still fully protecting every write with an active-active mirror.

EMC's DMX was originally designed without mirrored cache. In the DMX-3, EMC introduced mirrored cache, but used an simplistic and very wasteful model that mirrors all cache, both reads and writes, so no more than half the DMX cache can be used for data. The EMC mirroring is active-passive, so the mirrored cache cannot be used to increase write performance.

Dynamic Provisioning (Thin Provisioning)

ST9990V is the first and only enterprise storage to support thin provisioning. Dynamic Provisioning is not unique in the industry, but at this moment in time neither EMC, nor IBM has delivered a thin provisioning solution. Network Appliance is the only major storage vendor with thin provisioning. 3parDATA and some smaller niche players also have a thin provisioning offering.

Dynamic Provisioning software allows customers to allocate “virtual” disk storage based on their anticipated future needs, but with less physical disk initially required. Additional physical disks can be purchased later and installed transparently without an application service interruption. Dynamic Provisioning improves storage utilization, eliminates application service interruptions during physical disk capacity upgrades, simplifies administration and reduces TCO.

Enterprise Disk Comparision

	ST9990	ST999V	EMC DMX3	IBM DS8000
Architecture	Cross-Bar	Cross-Bar	Direct Matrix	Dual Controller
IOPs	2500	3500	?	?
Max # Disk Drives	1100	1100	2400	640
Internal Capacity FC (TB)	332	332	720	192
Max Internal Capacity (TB)	332	332	1200	320
Virtual Capacity (TB)	32000	247000	0	0
Internal Bandwidth (Gbs)	83	106	32	32
Max Usable Cache (GB)	256	256	256	256
Cache Mirroring	Active-Active	Active-Active	Active-Passive	Active-Passive
Partitions	32	32	8 (Cache Only)	2
Partition Size	Flexible	Flexible	Fixed	Fixed
Max # Backend loops	64	64	64	32
Backend loop speed (Gbs)	2	4	2	2
Front End Port Speed (Gbs)	4	4	2	4
FC	192	224	64	128
FICON	96	112	32	128
ESCON	96	112	64	128
ISCSI Support	Yes	TBD	Yes	No
Embedded NAS	Yes	TBD	No	No
FATA/LCFC/SATA support	No	No	Yes	Yes

General Availability

Hardware

This chart indicates, at a high level, what is available at GA (July 10, 2007) and what will be available post GA.

Hardware	GA	POST GA
Connectivity	Fibre Channel, FICON, ESCON	NAS
Min/Max ports	0-224 Fibre Channel, 0-112 FICON, 0-112 ESCON	
Minimum HDD	(3 Data + 1 Parity)+ 1 spare	
Maximim HDD	1152 HDD	
Drive Types	73GB, 146GB, 300GB	
Maximum External Capacity	247PB	
Minimum Cache	4GB	
Maximum Cache	256GB	
Max Control Memory	16GB	
Rack	Cabinet consists of a control frame and 4 array frames	Battery Rack

The following features will be available at GA:

- 106 GB Aggregate Internal System Bandwidth
- 3.5M IOPS Maximum (internal)
- 332 TB (w/300 GB HDD) Internal raw capacity
- 1152 Disk drives
- 256 GB Data Cache Memory
- 32 GB Control Cache Memory
- 224 FC connections
- 112 FICON, 112 ESCON connections
- 32 Virtual Partitions (Virtual Storage Machines)
- 65,536 Logical devices (Open Systems and z/OS)
- 247 PB External Storage Support
- Dynamic Provisioning (Thin Provisioning)for Open Systems

- ST9900 Series Software Suite

Not all ST9990V features will be available at GA. The following will be available post GA(date TBD):

- FICON functionality will be extended to supporting External Storage. While this feature will be announced at introduction, it will not be available until the end of the year.
- 300GB 15K drives (Date TBD - Approx. 3months post GA)
- Continuous Data Protection (CDP) (TBD-Target early CY2008)
- NAS and iSCSI (TBD)
- Higher capacity drives - Will be supported when they are available and meet our enterprise quality, reliability and performance requirements.
- Tuning Manager 5.7(July 16, 2007)
- Global Link Availability Manager(GLAM)5.7 (August 7, 2007)

Software

- All ST9990V software is levergeable from the ST 9990 and offered as suite bundles or as stand alone
- ST9900 Basic Operating System (BOS) Suite replaces Device & Resource Manager Suite
- - Includes Device Manager and Resource Manager Suite
- - Includes Virtual Partition Manager with support for up to 4
- partitions
- - Includes Server Priority Manager
- ST9900 BOS Virtual Suite (BOS V)
- - Includes Universal Volume Manager
- - Includes Virtual Partition Manager for more than 4 partitions
- ST9900 Disaster Recovery Suite to replace current TrueCopy
- - Includes TrueCopy Sync + HUR for both Open and Z/OS
- ST9900 Disaster Recovery Extended Suite to replace current HUR Suite
- - Include TrueCopy Sync + HUR with advanced function: 3DC for
- Open and z/OS and 4x4 for z/OS only
- ST9900 In-System Replication
- - Includes ShadowImage for Open and z/OS and CoW for Open
- ST9900 Compatible FlashCopy version 2
- ST9900 Dynamic Provisioning
- ST9900 Continuous Data Protection
- ST9900 Compatible PAV
- ST9900 Business Continuity Manager
- ST9900 CrossOS File Exchange (RapidXchange HMDE)
- ST9900 HiCommand Tuning Manager
- ST9900 Tiered Storage Manager

- ST9900 HiCommand Replication Monitor
- ST9900 HiCommand Protection Manager
- ST9900 Dynamic Link Manager

Service / Warranty

Hardware	GA
Warranty	3 years
Service Level	3 years coverage, 7x24 Same Day 4-hour* on-site response, 7x24 Phone Support. *average response times.
Install Service	Yes
Third party install	Yes

FEATURE, FUNCTION, AND BENEFIT MATRIX

ST9990V will provide the industry's most **extensive array of integrated features and functionality** upon which to build enterprise storage solutions. The features and functions that customers have enjoyed on the ST9990 are enhanced and extended on ST9990V.

FEATURE	FUNCTION	BENEFIT

HiStar 4th generation Cross Bar Architecture	• New faster processors, increased SMP (Symmetric Multi Processor) design • Up to 3,500,000 IOPS • 106 GB/s internal bandwidth • Up to 256GB Cache • 4Gbps FC Front-end and Back-end loops • Scalability beyond current ST9990 product • Performance to manage larger capacity of internal and externally attached storage	• The industry's *highest performance* architecture allows customers to achieve the transaction rates and performance required by their most demanding applications
Multi-platform connectivity	• Heterogeneous multi protocol connectivity • FC, ESCON, FICON, NAS • Satisfies need for increased numbers and types of connectivity • Better per port performance using faster processors	Choice of connectivity enables • FC for high performance and mission critical applications • ESCON and FICON for mainframe • NAS for plug and play file sharing (post GA) • iSCSI may offer lower cost connection alternative (post GA)
Multi-platform storage pooling	External Capacity • Manages up to 247 PB of external storage Internal Capacity • Up to 332TB internal • Support for 1152 HDDs	Virtualizes multiple tiers of storage to enable: • Simplified Configuration • Aggregated connectivity • Virtual Private Storage • Common path management • Enhanced security • Performance QoS • Universal replication • Lifecycle management

Universal Storage Services	Device Management ● Host Storage Domains ● Logical Boot Device (LUN 0) ● Logical Partitioning (Storage LPAR) Performance Management ● Performance Monitor ● Volume Migrator ● Server Priority Manager ● Tuning Manager Resource Management ● HiCommand Device Manager Storage Area Management ● ST9900 Storage Services Manager HiCommand Tiered Storage Manager	Reduce TCO by simplifying storage management
Dynamic Provisioning	Dynamic Provisioning software allows customers to allocate "virtual" disk storage based on their anticipated future needs, but with less physical disk initially required (over-allocation). Additional physical disks can be purchased later and installed transparently without an application service interruption.	● Improves Storage Utilization by reducing the need for unused disk storage for provisioning. ● Elimination of application service interruptions that are normally required to install new disk capacity. ● Reduced TCO by deferring some portion of storage acquisitions to a later date to exploit the continuing price decline. ● Simplified Administration by reducing the impact of volume creation and volume formatting associated with the installation of physical disk capacity. ● Reduced Power & Cooling requirements due to fewer physical disks required.

Product Positioning with Sun's ST9900 Product Family

The will be positioned as the very high-end Data Center product within Sun's existing ST9900 enterprise product family delivering higher performance, scalability and thin provisioning. It will co-exist with the ST9990 throughout FY2008 and eventually replace the ST9990V.

GA Product Feature Comparisons

	ST9990	ST9990V
Technology / Virtualization	3rd Generation Cross-Bar Switch Embedded Virtualization	4th Generation Cross-Bar Switch Embedded Virtualization
Maximum IOPS	2,500k	3,500k
External Storage Bandwidth IOPS	2000	10000
Maximum supported Internal Capacity	332TB's	332TB's
Maximum supported Total Capacity	32PB's	247 PB's
Internal Bandwidth	83 GB/second	106 GB/second
Maximum cache	256GB	256GB today, 512GB in future
Maximum Back-end loops(paths)	64 x 2Gb/second	64 x 4Gb/second
Front End Fibre Channel Ports	192 x 4Gb/second	224 x 4Gb/second
Maximum Internal Disks	1152 x 2Gb/second	1152 x 4Gb/second
HDD Types	FC 73GB 15K RPM	FC 73GB 15K RPM
	FC 146GB 10K RPM	N/A
	FC 146GB 15K RPM	FC 146GB 15K RPM
	FC 300GB 10K RPM	FC 300GB 10K RPM
Maximum LDEV's	64k (MF) 16k (OS)	64k MF & OS today (128k in 4Q 2007)
External Storage Connection	FC	FC, FICON in 4Q 2007
Maximum ESCON PORTS	96	112
Maximum FICON PORTS	96	112
Maximum iSCSI PORTS	32	TBD
Maximum iSCSI PORTS	32	TBD
Size Single LDEV	2TB	2TB

Future enhancements are as follows:

- **Cache going to 512GB**
- **External FICON support Q1CY08**
- **300GB 15K drives (on both 90 & 90V) Q4CY08**

- **Performance** – Target of 3.5M IOPS vs. current ST9990 2.5M IOPS + performance improvements to local and remote replication, and external storage bandwidth.
- **Scalability** – Up to 247 Petabytes (PBs) of virtualized storage vs. 32 PBs on the ST9990 + more ports, volumes, disk capacity, local and remote replication volume copies and additional scalability enhancements

- **Dynamic Provisioning** software, known generically as thin provisioning, allows customers to allocate "virtual" disk capacity based on their anticipated future needs, but with less physical disk initially required. Additional physical disks can be purchased later and installed transparently without an application service interruption. The primary benefits of Dynamic Provisioning are Elimination of application service interruptions, reduced TCO (including lower power & cooling due to fewer disks) and simplified administration.

- **NAS –** The current ST9990/ST9985 NAS blade will be replaced with a more scalable, higher performance NAS solution at a later time (TBD).

- **Full 4Gb/second Fibre Channel front and back** (Channel adapters, disks, and back-end storage adapters. Unlike current ST9990 that has 4Gb/s front-end (adapters), but only 2Gb/s back-end (to disks).

- **Tiered Storage**- New support for FICON-attached external storage available in late 2007. HDS will announce a statement of intent to deliver FICON attached external storage, but no delivery date will be announced.

- **Statement of Intent to deliver additional features** – There are several other planned enhancements that might be announced in advance via a "statement of intent" to deliver. The following are potential items that may be disclosed via a statement of intent to deliver:

  1. FICON attachment of external storage to enhance our mainframe solution portfolio
  2. Increased number of ShadowImage pairs to reinforce the scalability message
  3. Increased number of COW (Copy-On-Write) Snapshots
  4. Increased number of HUR pairs
  5. NAS
  6. iSCSI
  7. 300 GB 15K RPM

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

- The Sun StorageTek 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 StorageTek 9990V, Sun's StorageTek 9900 family now consists of the ST9985, the ST9990 and ST9990V addressing mid-range enterprise to the highest end of the data center market needs for both open systems and mainframe.
  - ST9985 - Mid-Enterprise and Remote DR
    - Most affordable
  - ST9990 - Data Center
    - High availability, scalability and functionality
  - ST9990V - High-End Data Center
    - Highest performance, scalability and functionality

- The Sun StorageTek 6000 product family mostly consist of modular storage for open system environments delivers the most cost-effective combination of data availability, performance, scalability, and features.
- The Sun StorageTek 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. StorageTek 3000 products maximize performance and availability for workgroup applications and offer a flexible, cost-effective approach for growing storage demands.

Market Value Proposition

The Sun StorageTek 9990V provides our customers with a fully integrated enterprise storage solution delivering market leading performance, availability, scalability, and manageability for meeting the most demanding data center needs with the added benefit of integrated storage virtualization and thin provisioning to reduce the Total Cost of Ownership. Embedded Virtualization enables massive storage consolidation and management simplicity for reducing cost, Thin Provisioning capability for optimizing storage utilization and capacity planning, Virtual Partitioning for assuring QOS and Tiered Storage Management for implementing Data Life Cycle Management.
Universal Replicator provides enhance business continuity and disaster recovery protection across heterogeneous environments.

Target Markets:

Customers Who:

- Have the highest availability, connectivity and performance requirements and existing storage doesn't scale due to performance, capacity, and security limitations.
- Planning to consolidate multiple storage systems and need to maintain application isolation and Quality of Service
- Have difficulty managing storage complexity and cost from multiple heterogeneous storage systems. Have aging legacy disk systems
- Want to transparently migrate aging data to lower-cost storage technologies (DLM)
- Require remote replication to one or more recovery sites
- Need to share storage resources across multiple business groups with disparate application requirements
- Difficulty managing storage growth while keeping costs down due to low storage utilization, unplanned interruptions for capacity upgrades.

Customer Benefits

The ST9900 Family, of which the ST9990V is the flagship, provides the following: "Provide our customers with end to end, best of breed, data center class solutions that deliver unbeatable availability, scalability and manageability - while delivering compelling value and Total Cost of Ownership.

When a customer buys a ST9990V array, they get simplified storage management and a lower TCO because the virtualization features simplify the connectivity of their network allowing them to save on environmental costs, licensing fees, and maintenance costs.

For customers who need to optimize their corporate assets, increase their productivity, and require their IT departments to meet Service Level Agreements, the ST9990V provides a critical piece in a complete end-to-end solution that simplifies storage management, and enables hyper-consolidation through enhanced virtualization features on an architecture that has proven itself reliable, resilient and unrivaled in performance - unlike point-product solutions based on an old architecture.

For enterprises facing rapid data growth and multiple, disparate applications, the Sun StorageTek 9990V system helps reduce costs and improve service levels through better management of new and existing storage resources.

- **Simplified Management** — The Sun StorageTek 9990V system's application oriented storage-management utility abstracts storage complexity, enabling users to simplify management by pooling storage resources. 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 StorageTek 9990V

System, however, the boundaries of physical storage devices are abstracted to a *virtual inventory* 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.

- **Extreme Scalability —** The Sun StorageTek 9990V system can also improve performance and service levels with an architecture that enables predictable, seamless scalability of performance and capacity to meet changing application needs, increasing agility and improving service levels. In contrast to typical modular storage arrays — which scale for capacity only, causing applications to compete for storage resources — the Sun StorageTek 9990V system's extreme scalability scales capacity, performance, connectivity, and data services as required by application or business needs.
- **Extreme Availability** — All Sun StorageTek 9990V systems have been designed to ensure that the entire system has no single point of failure. Further, should a component in a StorageTek 9990V 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 StorageTek 9990V storage solution for complete protection of their digital assets.
- **Extreme Performance** — The Sun StorageTek 9990V is the industry leading storage platform in terms of performance. This system easily has twice the performance over any competitor's storage system. With the next generation non-blocking crossbar switch at the heart of all Sun StorageTek 9990V systems, the resulting throughput of the entire system provides outstanding performance to even the highest I/O intensive transactional applications. Additionally, the Sun StorageTek 9990V is the only storage system in the industry to offer the ability to partition resources to further ensure application quality of service objectives are maintained.
- **Extreme Configurability** — Each Sun StorageTek 9990V system can be tailored to fit the most demanding customer environment. The front-end connectivity to servers is supported through Fibre Channel, Ethernet, ESCON, and FICON directors, permitting concurrent attachment to open system servers and mainframe systems. In fact, the Sun StorageTek 9990V supports up to 224 Fibre Channel connections, three times Back-end disk drive connectivity is provided through advanced back-end directors supporting up to 64 4Gpbs Fibre Channel Arbitrated Loops, all active-active, twice as many as the nearest competitor.
- **Ensured Business Continuity —** Complimenting the Sun StorageTek 9990V system is a suite of business continuity software, ensuring that all essential data managed by a 9990 is fully protected. The Sun StorageTek 9990V provides two point-in-time local copy protection packages – Sun StorageTek 9990V ShadowImage In-System Replication and Sun StorageTek 9990V Copy-on-Write Snapshot. To support remote replication of data, the Sun StorageTek 9990V offers the StorageTek 9900 True Copy Remote Replication software that permits both synchronous and asynchronous data replication across Sun StorageTek 9990V systems.
- **Centralized Data Services** — The Sun StorageTek 9990V 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 StorageTek 9990V system, data services are system-wide and have dedicated compute resources existing outside of the data path and independent of the host, enabling virtually unparalleled application performance.

Offering simplified, application-oriented management, vast scalability in terms of performance and capacity, outstanding availability, tailored configurability, and robust business continuity, the Sun StorageTek 9990V system can help to:

- Reduce costs through consolidated management

- Reduce TCO by extending the life of storage resources
- Improve service levels through predictable application and data growth.

- **Supports Implementation of "Service Provider" Business Models**

By Complementing Dynamic System Domains (DSD) provided by Sun Servers and Solaris Containers, ST9990 Virtual Private Storage Machines (VPSM) support customer's initiative's to implement "Service Provider" Business Models. DSDs are a form of server partitioning. Solaris Containers are a form of software partitioning provided by the Solaris Operating System.

Partner Business Proposition

The Sun StorageTek 9990V system enables channel sales partners to quickly and easily deploy enterprise storage resources with predictable business and application results.

- **Easy, Predictable Deployment** —The Sun StorageTek 9990V system comes with a wide range of management support tools to allow partners the ability to setup and configure the system.
- **No Hidden Costs** — The Sun StorageTek 9990V system includes a wide breadth of standard features of any system in its class. With Sun StorageTek Enterprise Storage Manager, Sun StorageTek 9990V Availability Suite, and Sun-server based load balancing, this system comes pre-tested with the complete set of functions required to host today's business-critical application environments.
- **Predictable Scaling and Performance** — The Sun StorageTek 9990V system is one of the first products in its class that enables enterprises to dedicate and scale storage resources to meet changing application needs.
- **Feature Support —**The Sun StorageTek 9990V provides for a complete set of connectivity and upgrade features to respond to changing customer environments. This provides partners the ability to manage customer expectations through deployment of non-disruptive upgrades to the system.
- **Software Support —**The wide range of Sun StorageTek 9990V software allows partners to respond to customer requirements through acquisition of complimentary software solutions for storage resource management, business continuity, quality of service specification, and the like.
- **Increase Business Annuity** — The Sun StorageTek 9990V system provides partners with a best-of-breed system for enterprise IT environments.

Target Applications

The highly flexible architecture of the Sun StorageTek 9990V 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 StorageTek 9990V system provides high application performance through 4-gigabit per second, full-fabric Fibre Channel ports and 256 GB of data cache. With more than 332 TBs of internal capacity, the Sun StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V 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. Eight minutes of battery power is available for destaging cache.

The Sun StorageTek 9990V system's *no single point of failure* architecture (through embedded dual fabrics and total redundancy) offers ease of deployment while maintaining a high level of data protection.

In addition, the Sun StorageTek 9990V 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 StorageTek 9990V 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 Sun StorageTek 9990V 's unique ability to manage other heterogeneous storage systems through aggregation of these resources under one “umbrella”(Sun refers to this as Multi-Vendor Storage Pooling), the Sun StorageTek 9990V 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 StorageTek 9990V system is the ideal storage platform for implementing data warehousing and business intelligence solutions. A Sun StorageTek 9990V provides heterogeneous connectivity and offers extreme levels of availability, performance and security for the largest data warehouse / business intelligence environments. The Sun StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V is an ideal storage system from a data / information lifecycle management perspective. With the Sun StorageTek 9990V 's future ability to support other heterogeneous systems through aggregation or pooling storage resources under a single 9990V system. Critical digital assets can be maintained on the Sun StorageTek 9990V and less critical digital assets can be migrated to lower-cost storage systems managed by the Sun StorageTek 9990V. Adding to this software support for hierarchical storage management, such as Sun's Storagetek SAM-FS and StorageTek QFS , and the ZFS File System products, the Sun StorageTek 9990V becomes the answer to an enterprise's information lifecycle management needs.

Business Continuity

- With outstanding reliability and availability characteristics, the Sun StorageTek 9990V is an enterprise's answer to providing complete data protection for their critical data assets. The Sun StorageTek 9990V system compliments its data availability through a suite of business continuity software, ensuring that all essential data managed by a Sun StorageTek 9990V is fully protected. The Sun StorageTek 9990V provides two point-in-time local copy protection packages – ST9900 In-System Replication Suite: ST9900 ShadowImage In-System Replication and ST9900 Copy-on-Write Snapshot. To support remote replication of data, the Sun StorageTek 9990V offers a StorageTek 9900 Disaster Recovery Suite Software that includes TrueCopy Sync and Universal Replicator that permits data replication across Sun StorageTek 9990V systems.

Product Specifications

Product Overview

Sun StorageTek 9990V is a comprehensive and fully integrated enterprise storage services platform that enables customers to achieve the highest levels of availability and performance in the industry with the lowest TCO. It is an evolution of the ST9990 with refinements to existing technology and additional new functionality, with higher system performance to further differentiate it from the competition. Building on the proven technical superiority and industry thought leadership established by the ST9990 with its unique embedded virtualization, 100% Data Availability Guarantee, Logical Partitioning, Universal Replicator, Dynamic Provisioning, and a proven massively scalable crossbar switch architecture; Sun StorageTek 9990V is an evolution of those capabilities with greater performance, scalability and new functionality. New integrated capabilities for thin provisioning, FICON attachment for external storage, and enhancements to its embedded virtualization will further demonstrate how Sun StorageTek 9990V is the most comprehensive and fully integrated enterprise storage platform on the market. When contrasted with IBM and EMC's piece-meal approach of separate switch-appliance based virtualization appliances and additional layers of software to manage, move and copy data, Sun StorageTek 9990V provides the industry's most fully integrated combination of enterprise-proven hardware and software technologies that unify and simplify the delivery of universal data and storage services across heterogeneous storage platforms. Key features and benefits:

- **Provides the Tiered Storage foundation that enables Data Lifecycle Management -** The ST9990V Universal Storage Platform is ideal for customers who wish to deploy a Data Lifecycle Management solution across multiple differentiated tiers of storage to reduce costs and improve efficiency by enabling them to match the value of their data to the type of storage it is kept on. The ST9990V enables the customer to manage a pool of heterogeneous tiered storage from a single console and move data non-disruptively between storage tiers as the value of the data or the usage model changes over time to maximize resource utilization and reduce costs. Customers can exploit all of ST9990V's benefits to build a tiered storage infrastructure internally or in combination with externally attached storage. New with ST9990V is the ability to attach external storage via FICON to enable a simpler and smoother migration path or tiered storage infrastructure for mainframe customers. With embedded virtualization and dynamic application data mobility solutions like HiCommand Tiered Storage Manager, customers can continually adjust their storage infrastructure to their changing business needs. HiCommand Tuning Manager and HiCommand Device Manager enable customers to continually monitor and forecast their storage infrastructure needs. ShadowImage In-System Replication and Universal Replication provide scalable data protection solutions that have proven to meet the most stringent business continuance and compliance requirements of the world's largest financial institutions.
- **Simplifies Storage Management** – Customers with multiple storage systems who wish to reduce their storage management complexity and cost can aggregate or consolidate all of their storage into a single storage pool with ST9990V's embedded virtualization, and exploit the benefits of common software for data movement, replication, partitioning, and storage management across the entire heterogeneous tiered storage pool. A rich portfolio of software solutions, coupled with the highest performing and most reliable storage platform in the industry provide the best platform for consolidating and simplifying storage management. Customers can manage their entire infrastructure from a single pane of glass, or they can choose to designate multiple storage administrators who can optionally manage only a particular set of storage resources that is accessible to them. ST9990V's unique embedded virtualization capabilities enable customers to use ST9900 storage management and data mobility software across an entire heterogeneous storage pool, thus dramatically simplifying the process while reducing software and maintenance costs. New integrated **Dynamic Provisioning** software greatly improves storage utilization and simplifies storage management to reduce TCO costs and eliminating many of the service interruptions that are normally required to install and format new disk capacity.

- **Provides investment protection** – ST9990V customers who seek a storage technology refresh but wish to protect the investment in their current storage systems that may or may not yet be fully depreciated, can attach their legacy storage to ST9990V externally and exploit the unique virtualization, storage partitioning, universal replication, and other new software tools with their legacy storage. At a later date when it is more financially beneficial to retire the legacy storage, the customer can migrate the data to ST9990V or any other platform within ST9990V's external storage pool. **New with ST9990V** is the ability to externally attach storage via FICON ports thus enabling a much simpler migration and tiered storage management for z/OS mainframe customers.(future)

- **Massive Multi-Protocol Consolidation –** ST9990V provides customers an integrated platform for consolidating and centralizing their data while providing access to hundreds of or even thousands of servers with differing requirements for connectivity. ST9990V support for Fibre Channel, ESCON, FICON, and NAS and iSCSI not available at GA, but planned for later) coupled with logical partitioning, virtual storage ports and centralized management with HiCommand Software provides the most comprehensive and flexible platform for massive consolidation of storage systems with multi-protocol requirements, while also providing the software tools to monitor, manage and optimize the environment to ensure application quality of service. The fourth generation of the Universal Star Network switched network architecture provides the industry's highest performing and most scalable storage system with even more host connectivity than the previous generation to meet the needs of the largest consolidation projects.

- **Dynamic Provisioning Reduces Total Cost of Ownership while improving Data Availability –** Dynamic Provisioning, the new thin provisioning software feature available with ST9990V will allow customers to greatly improve their storage utilization and reduce their storage TCO by deferring a portion of their disk purchases to a later date when disk prices are usually lower. The reduction in physical disk requirement for provisioning also can provide a significant savings in power and cooling requirements. Today many customers purchase and allocate significantly more disk storage than they currently need, in anticipation of future growth and to avoid possible application service interruptions that may be needed to install additional disk drives. Dynamic Provisioning software allows customers to allocate "virtual" disk storage based on their anticipated future needs, but with less physical disk initially required. Additional physical disks can be purchased later and installed transparently without an application service interruption. This feature is not available for mainframes (z/OS), but Open Systems only.
- **Enhanced Business Continuance –** ST9990V provides heterogeneous data replication and copy services between any platform and at any distance, with higher performance, increased data protection and more efficient use of network bandwidth than previously available. The result is reduced costs, simplified management and improved data protection and disaster recovery capability. With ST9990V, Universal Replication (HUR) and ShadowImage (SI) software have improved performance and increased scalability. Both HUR and SI on ST9990V can support more volumes and more replication pairs then previously available. Performance has also been improved for both HUR and SI, and HUR has added new support for more consistency groups spread across up to 4 ST9990V systems that reside at each site within a 2 datacenter or a 3 datacenter configuration.
- **Increased ROI** – ST9990V, like its predecessor, the ST9990 will increase ROI by providing investment protection and longer life for legacy storage, improved storage and server utilization, improved application quality of service, lower software licenses/costs and simplified and centralized storage management.
- **Improved Service Level Management** – ST9990V ensures application-specific Quality of Service and security within private virtual storage machines. For customers who wish to charge end-users for differentiated levels of service, or charge for the amount of storage resources consumed, ST9990V's virtual private storage machines can also ensure that end-users are allocated only what they are charged for. Logical partitioning for mainframe-attached has been simplified by eliminating some of the restrictions on the ST9990 and ST9985.

- **Reduced Storage Costs for Mainframe Customers** – For mainframe customers ST9990V provides an opportunity to exploit SATA storage to improve data protection, or to more cost-effectively store larger amounts DFSMS Migration Level 1 data and offload costly DFSMS mainframe processing cycles, or deploy a long term and secure data archive solution for regulatory compliance. ST9990V's virtual private storage machines are the perfect compliment to mainframe LPARs and together they provide workload isolation and optimum quality of service. This will be enhanced in the near future when FICON qualified to support external storage, along with Universal Volume Manager. This is not a statement that the ST 9990 V comes with internal SATA storage.

Key Application Areas and Opportunities:

- Customers with multiple heterogeneous storage systems who **wish to reduce their storage management complexity and cost** by aggregating all of their storage as a common pool of ST9990V external storage and exploit the benefits of common software capabilities across the storage pool
- Customers seeking the performance or capacity of a "high-end" enterprise storage system with **very high reliability and availability characteristics** for mission-critical applications.
- Existing ST9990 customers **who wish to deploy an additional system at their Disaster Recovery site** can deploy either a ST9990V with only internal storage, or a ST9990V with externally attached lower cost or legacy storage for a more cost-effective disaster recovery solution
- Enterprise storage customers who seek a storage technology refresh but wish **to protect the investment in their current storage systems that are not yet fully depreciated,** can attach their legacy storage to ST9990V externally, and exploit the unique virtualization, storage partitioning, universal replication, and other common software tools with their older storage technology
- For customers who are replacing their existing storage systems that are nearing the end of life, ST9990V provides them with an easier and less disruptive data migration and transition to newer technology.
- Customers who wish to implement a storage chargeback system based on the amount of storage resources allocated to each application or dept. can utilize ST9990V's virtual private storage machines to dedicate and charge for a fixed amount of storage for each application or department, with the flexibility to change that allocation as needed.
- Customers who wish to offer their end-users a service level agreement that includes the option for differentiated classes of storage to match the level of service they wish to pay for, can deploy ST9990V with internal storage and one or more differentiated types of external storage
- Customers who wish to deploy a data life cycle management solution across multiple differentiated tiers of storage can exploit HiCommand Tiered Storage Manager and other ST9900 Family copy software to non-disruptively move data between storage tiers as the value or usage model for that data changes over time. The result is optimum storage utilization and performance, and a lower overall TCO.
- Customers who wish to store a large amount of secure, online data due to regulatory compliance or other long term data retention requirements can externally attach Sun SATA storage archive capability, or other archive capable storage products from Sun's extensive storage portfolio.
- Customers who wish to physically consolidate multiple storage systems into one ST9990V storage system, but wish to continue to maintain workload isolation that was previously afforded by separate and distinct storage systems, can do so with private virtual storage machines within a single ST9990V system.
- Mainframe LPAR customers who wish to extend their server workload isolation and QOS to include data isolation and QOS can configure and dedicate a ST9990V virtual private storage machine to each mainframe LPAR that requires it.
- Open Systems customers who wish to isolate storage resource-intensive applications like data replication and data back-up and Online Transaction Processing (OLTP) can dedicate one or more ST9990V virtual private storage machines to the resource-intensive applications to improve the quality of service of it, and the other storage applications.

Sun StorageTek 9990V Packaging

The ST9990V High Availability Architecture:

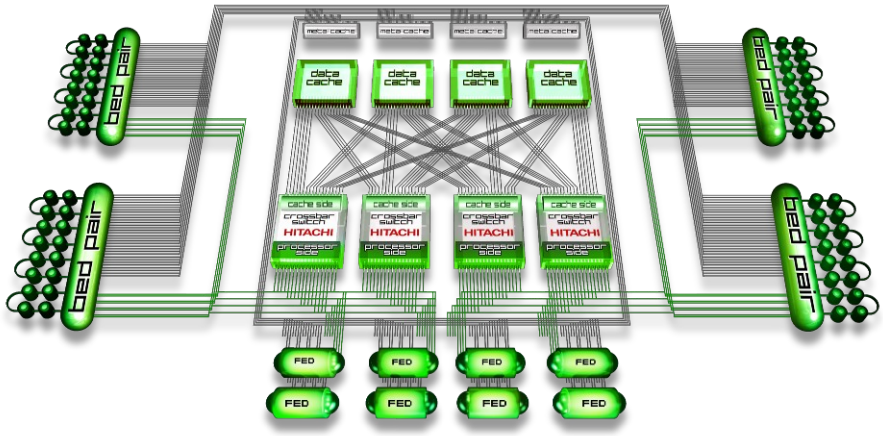


Figure 2: Sun StorageTek 9990V Architecture Diagram

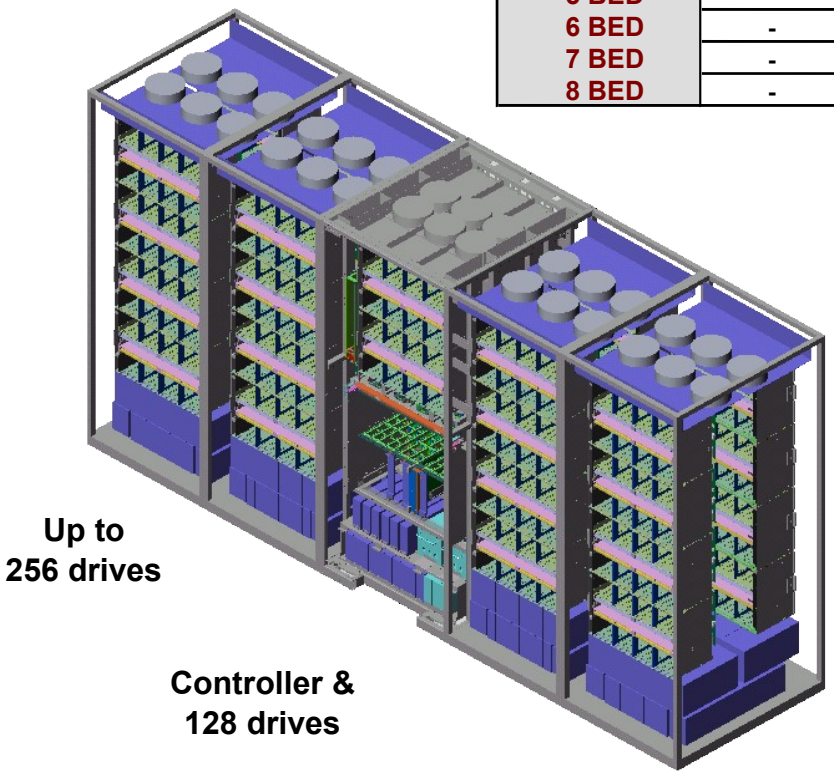
- The Sun StorageTek 9990V is not a single server that needs to be clustered for availability
    - It is a cluster of 128 processors within a physical frame sharing a global cache
- The first enterprise storage system with a switched back-end. Please note that this is really a hybrid architecture which represents both switching capabilities but Fibre-Channel Arbitrated Loops are still used the back end.
- No single point of failure and can be maintained disruptively
- RAID6
- Dynamic Sparing
- HiTrack® “call-home” service/remote maintenance tool
- 100% Data Availability guarantee

ST9990V Form Factor and Packaging:

- Base controller frame and 1 to 4 optional disk array frames
- Controller boards are reduced to half previous size, fewer resources affected by a service action
- Improved Availability, Configurability and Serviceability

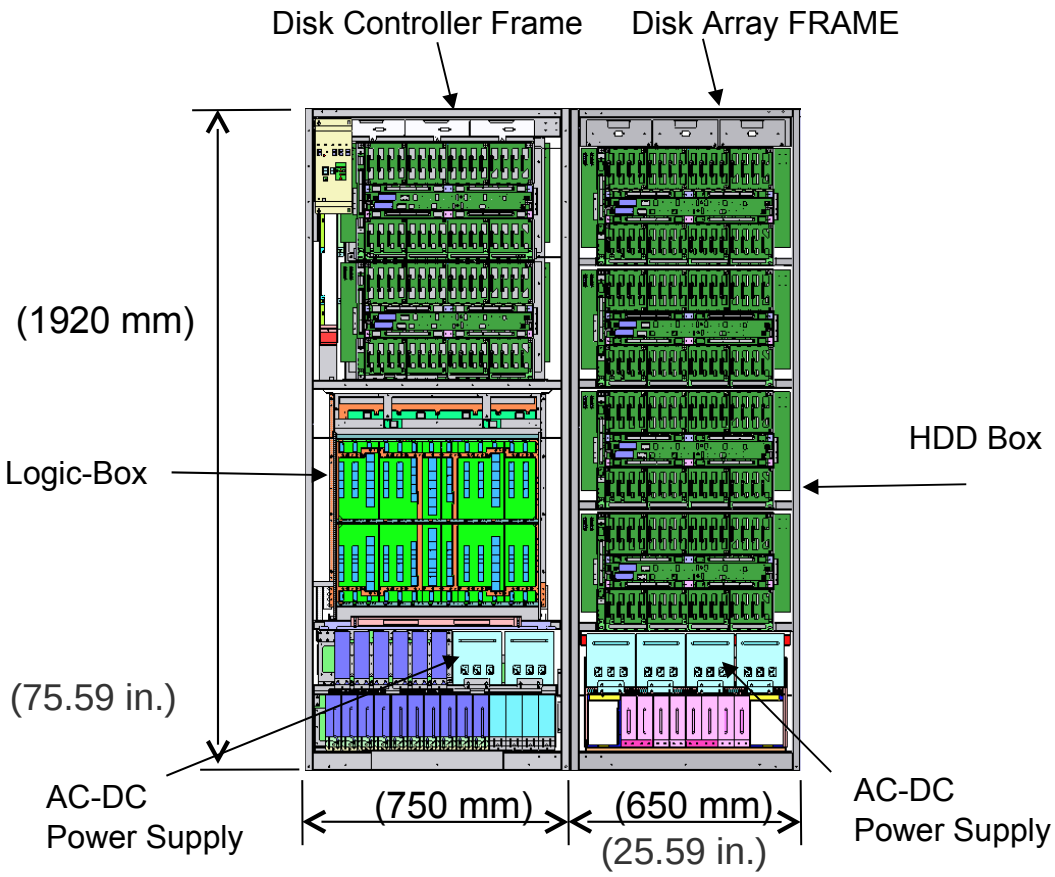
CHA Type	FED Packages		Ports / Package	
	USP	USP-V	USP	USP-V
Open Fibre	4	8	16,32	8,16
ESCON	4	8	16	8
FICON	4	8	8,16	8

	Back-end Loops		Max Disks	
	USP	USP-V	USP	USP-V
1 BED	16	8	384	192
2 BED	32	16	640	384
3 BED	48	24	896	512
4 BED	64	32	1152	640
5 BED	-	40	-	768
6 BED	-	48	-	896
7 BED	-	56	-	1024
8 BED	-	64	-	1152



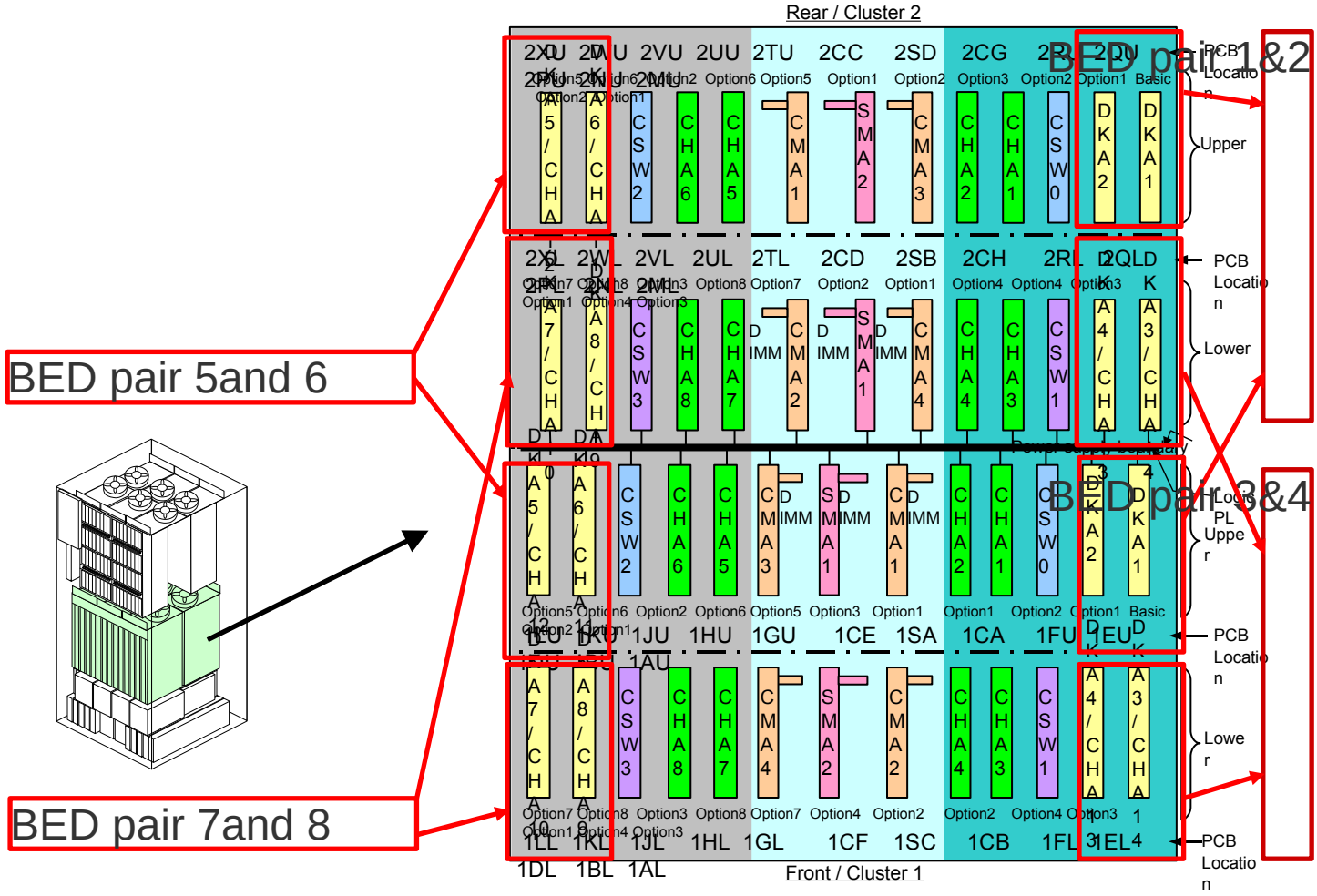
ST9990V Frame Types:

- Disk Controller (DKC) Frame
- Disk Unit (DKU) or Disk Array Frame



ST9990V Disk Controller Frame's New Logic Box Design:

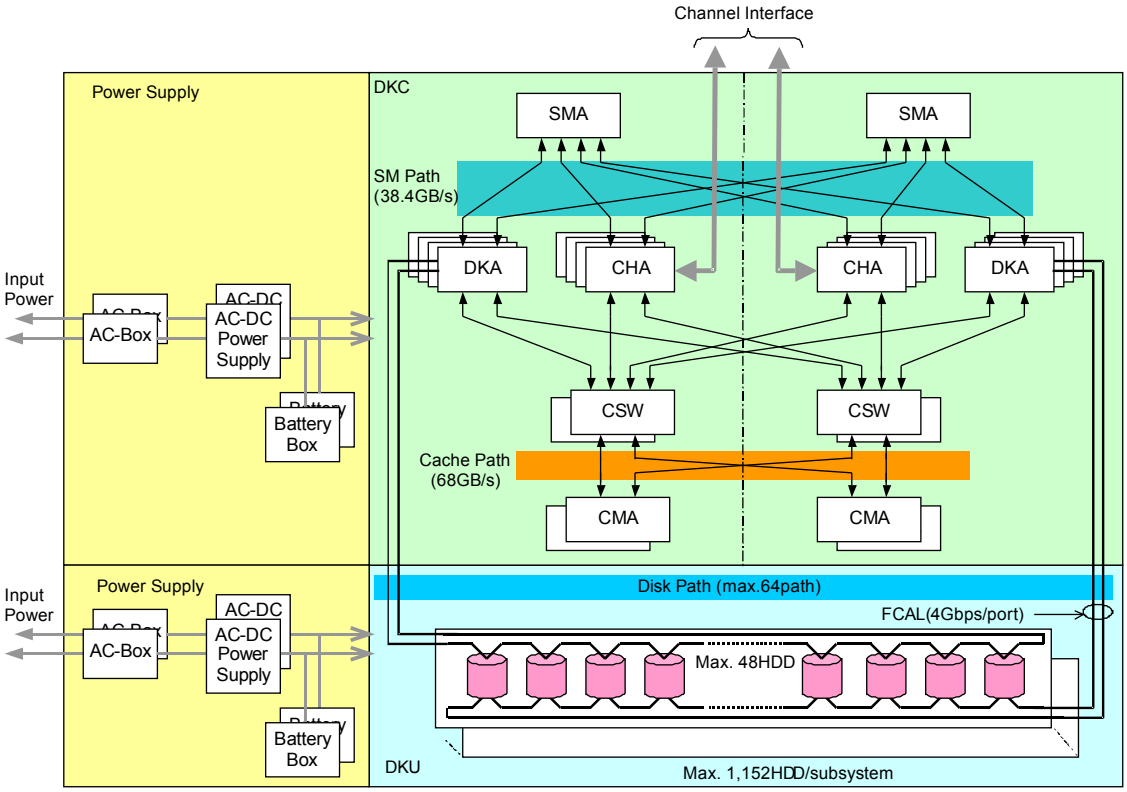
- The Logic Box is divided into CLuster1 a CLuster2 with a lower and upper layer.
- All PCBs are half size than on the Universal Storage Platform.



Hardware Architecture

The ST9990V hardware is divided into the power supply section, controller section, and disk drive section in which disk drives are installed. The power supply section consists of the AC-boxes, AC-DC power supplies, and battery boxes. The controller section consists of the channel adapters (CHAs), disk adapters (DKAs), cache memory boards (CACHEs), shared memory boards (SMs), and disk units (DKUs). Each component is connected over the cache paths, SM paths, and/or disk paths. The batteries installed in the ST9990V are nickel metal hydride batteries.

Note: The shared memory for the ST9990V is now mounted on separate PCBs (was mounted on the cache boards for previous RAID subsystems). This new design eliminates the performance degradation (caused by write-through mode) previously experienced during shared memory replacement.



Components of the Controller Frame

The ST9990V controller frame contains the control and operational components of the subsystem and one hard disk unit (HDU) box. The ST9990V controller is fully redundant and has no active single point of failure. All controller frame components can be repaired or replaced without interrupting access to user data. The key features and components of the controller frame are:

- Storage clusters
- Nonvolatile duplex shared memory
- Nonvolatile duplex cache memory
- Multiple data and control paths
- Redundant power supplies
- Front-end directors
- Channels

- Back-end directors

Storage Clusters

Each controller frame consists of two redundant controller halves called storage clusters. Each storage cluster contains all physical and logical elements (for example, power supplies, channel adapters, disk adapters, cache, control storage) needed to sustain processing within the subsystem. Both storage clusters should be connected to each host using an alternate path scheme, so that if one storage cluster fails, the other storage cluster can continue processing for the entire subsystem.

The front-end and back-end directors are split between clusters to provide full backup. Each storage cluster also contains a separate, duplicate copy of cache and shared memory contents. In addition to the high-level redundancy that this type of storage clustering provides, many of the individual components within each storage cluster contain redundant circuits, paths, and/or processors to allow the storage cluster to remain operational even with multiple component failures. Each storage cluster is powered by its own set of power supplies, which can provide power for the entire storage subsystem in the unlikely event of power supply failure. Because of this redundancy, the ST9990V can sustain the loss of multiple power supplies and still continue operation.

Note: The redundancy and backup features of the ST9990V eliminate all active single points of failure, no matter how unlikely, to provide an additional level of reliability and data availability.

Nonvolatile Shared Memory

The nonvolatile shared memory contains the cache directory and configuration information for the ST9990V. The path group arrays (for example, for dynamic path selection) also reside in the shared memory. The shared memory is duplexed, and each side of the duplex resides on the first two SM cards, which are in clusters 1 and 2. The shared memory has separate power supplies and is protected by separate seven-day battery backup.

For the ST9990V model, shared memory is now mounted on separate boards (previously on the cache boards). This new design eliminates the performance degradation (caused by write-through mode) that was previously experienced during shared memory replacement.

The ST9990V can be configured with up to 16 GB of shared memory. The size of the shared memory is determined by several factors, including total cache size, number of logical devices (LDEVs), and replication function(s) in use. The replication functions affecting shared memory include TrueCopy, ShadowImage, Universal Replicator, Copy-on-Write Snapshot, FlashCopy V2, Volume Migration, and Copy Manager for TPF. Any required increase beyond the base size is automatically shipped and configured during the upgrade process.

Nonvolatile Cache Memory

The ST9990V can be configured with a maximum of 256 GB of cache (increments of 4 or 8 GB). All cache memory in the ST9990V is nonvolatile and is protected by 36-hour battery backup (without de-stage option, cache 132 GB or more) or 48-hour battery backup (without de-stage option, cache 128 GB or less).

The cache in the ST9990V is divided into two equal areas (called cache A and cache B) on separate cards. Cache A is in cluster 1, and cache B is in cluster 2. The ST9990V places all read and write data in cache. Write data is normally written to both cache A and B with one channel write operation, so that the data is always duplicated (duplexed) across logic and power boundaries. If one copy of write data is defective or lost, the other copy is immediately de-staged to disk. This “duplex cache” design ensures full data integrity in the unlikely event of a cache memory or power-related failure.

Note: Mainframe hosts can specify special attributes (for example, cache fast write (CFW) command) to write data (typically sort work data) without write duplexing. This data is not duplexed and is usually given a discard command at the end of the sort, so that the data will not be de-staged to the disk drives.

Multiple Data and Control Paths

The ST9990V introduces the 4th generation of the revolutionary Hi-Star™ crossbar switch architecture which uses multiple point-to-point data and command paths to provide redundancy and improve performance. Each data and command path is independent. The individual paths between the channel or disk adapters and cache are steered by high-speed cache switch cards (CSWs). The ST9990V does not have any common buses, thus eliminating the performance degradation and contention that can occur in bus architecture. All data stored on the ST9990V is moved into and out of cache over the redundant high-speed paths.

Redundant Power Supplies

Each storage cluster is powered by its own set of redundant power supplies, and each power supply is able to provide power for the entire system, if necessary. Because of this redundancy, the ST9990V can sustain the loss of multiple power supplies and still continue to operate. To make use of this capability, the ST9990V should be connected either to dual power sources or to different power panels, so if there is a failure on one of the power sources, the ST9990V can continue full operations using power from the alternate source.

Channel Adapters and Front-End Directors

The channel adapter boards (CHAs) contain the front-end directors (microprocessors) that process the channel commands from the host(s) and manage host access to cache. In the mainframe environment, the front-end directors perform CKD-to-FBA and FBA-to-CKD conversion for the data in cache. Channel adapter boards are installed in pairs. The channel interfaces on each board can all transfer data at once, independently. Each channel adapter board pair is composed of one type of channel interface (for example, FICON or NAS). Fibre-channel adapters and FICON-channel adapters are available in both shortwave (multimode) and longwave (single-mode) versions. The ST9990V can be configured with multiple channel adapter pairs to support various interface configurations.

lists the channel adapter specifications and configurations and the number of channel connections for each configuration.

Note: Hitachi Performance Monitor allows users to collect and view usage statistics for the front-end directors in the ST9990V.

Host Channels

The ST9990V supports all-mainframe, all-open system, and multiplatform operations and offers the following types of host channel connections:

- **FICON.** The ST9990V supports up to 112 FICON ports capable of data transfer speeds of up to 400 MB/sec (4 Gbps). FICON features, available in shortwave (multimode) and longwave (single mode) versions, can have either 8 or 16 FICON host interfaces per pair of channel adapter boards. When configured with shortwave FICON channel adapters, the ST9990V can be located up to 500 meters (2750 feet) from the host(s). When configured with longwave FICON channel adapters, the ST9990V can be located up to ten kilometers from the host(s). If you need further FICON-related information, please contact your Hitachi Data Systems representative.

  Note: FICON data transmission rates vary according to configuration. Please note:

  - S/390 Parallel Enterprise Servers - Generation 5 (G5) and Generation 6 (G6) only support FICON at 1 Gbps.
  - z800 and z900 series hosts have the following possible configurations:

    FICON channel will operate at 1 Gbps ONLY.

    FICON EXPRESS channel transmission rates will vary according to microcode release. If microcode is 3G or later, the channel will auto-negotiate to set a 1-Gbps or 2-Gbps or 4Gbps transmission rate. If microcode is previous to 3G, the channel will operate at 1 Gbps ONLY.

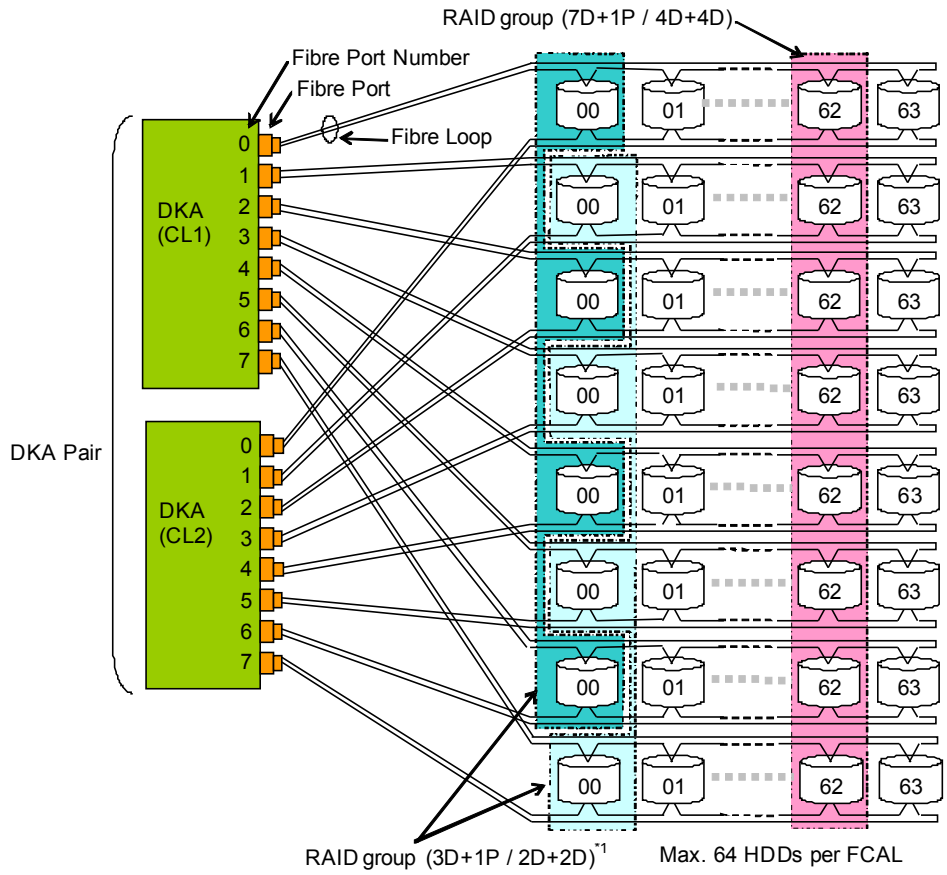
- Extended Serial Adapter (ExSA) (compatible with ESCON protocol). The ST9990V supports a maximum of ExSA serial channel interfaces. The ExSA channel interface cards provide data transfer speeds of up to 17 MB/sec and have 16 ports per pair of channel adapter boards. Each ExSA channel can be directly connected to a CHPID or a serial channel director. Shared serial channels can be used for dynamic path switching. The ST9990V also supports the ExSA Extended Distance Feature (XDF).
- Fibre-Channel. The ST9990V supports up to 224 fibre-channel ports. The fibre ports are capable of data transfer speeds of 400 MB/sec (4 Gbps). Fibre-channel features can have either 8 or 16 ports per pair of channel adapter boards. The ST9990V supports shortwave (multimode) and longwave (single-mode) versions of fibre-channel ports on the same adapter card. When configured with shortwave fibre-channel adapters, the ST9990V can be located up to 500 meters (2750 feet) from the open-system host(s). When configured with longwave fibre-channel adapters, the ST9990V can be located up to 10 kilometers from the open-system host(s).
- NAS. Support on the ST9990V is TBD, but with the ST9990 it supports a maximum of 32 NAS channel interfaces (8 ports per pair of channel adapter boards). The NAS channel interface boards provide data transfer speeds of up to 100 MB/sec. The ST9990V supports shortwave (multimode) NAS channel adapters and can be located up to 500 meters (2750 feet) from the NAS-attached host(s).
- iSCSI. Support on the ST9990V is TBD, but with the ST9990 it supports a maximum of 48 iSCSI interfaces. The iSCSI channel interface boards provide data transfer speeds of up to 100 MB/sec. The ST9990V supports shortwave (multimode) iSCSI channel adapters and can be located up to 500 meters (2750 feet) from the host(s). In an iSCSI environment, the ST9990V provides user authentication between hosts and ports mutually by using CHAP (challenge handshake authentication protocol).(iSCSI is a future)

Disk Adapters and Back-End Directors

The disk adapters (DKAs) contain the back-end directors (microprocessors) that control the transfer of data between the disk drives and cache. The disk adapters are installed in pairs for redundancy and performance. illustrates a conceptual DKA pair domain. The ST9990V can be configured with up to four DKA pairs. All functions, paths, and disk drives controlled by one DKA pair are called an “array domain.” An array domain can contain a variety of LVI and/or LU configurations.

The disk drives are connected to the DKA pairs by fibre cables using an arbitrated-loop (FC-AL) topology. Each DKA has eight independent fibre backend paths controlled by eight back-end directors (microprocessors). Each dual-ported fibre-channel disk drive is connected through its two ports to each DKA in a pair over separate physical paths for improved performance as well as redundancy.

 lists the DKA specifications. Each DKA pair can support a maximum of 256 HDDs (in two array frames), including dynamic spare drives (384 HDDs for the first DKA pair). Each DKA pair contains eight buffers (one per fibre path) that support data transfer to and from cache. Each dual-ported disk drive can transfer data over either port. Each of the two paths shared by the disk drive is connected to a separate DKA in the pair to provide alternate path capability. Each DKA pair is capable of 16 simultaneous data transfers to or from the HDDs.



*1: A RAID group (3D+1P/2D+2D) consists offibre port number 0, 2, 4, and 6, or 1, 3, 5 and 7.

Figure 2.1 Conceptual Array Domain for the ST9990V

Service Processor (SVP)

The ST9990V includes a built-in custom PC called the service processor (SVP). The SVP is integrated into the controller frame and can only be used by authorized Hitachi Data Systems personnel. The SVP enables the Hitachi Data Systems representative to configure, maintain, and upgrade the ST9990V. The SVP also collects performance data for all key components of the ST9990V to enable diagnostic testing and analysis. In addition, the ST9990V Storage Navigator functionality is provided by the SVP. Connecting the SVP with a service center enables remote maintenance of the subsystem.

Note: The ST9990V can be equipped with an optional duplicate SVP for additional reliability.

Important: The SVP does not have access to any user data stored on the ST9990V.

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 issue 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://ST9990/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.

Disk Drives

- The Control Frame can contain up to 128 disk drives. Each of the 4 array frames contain up to 256 disk drives each. The total amound of disk drives is 1,152. At initial product release, these disk drives are available:
- 73GB / 15Krpm disk drive
- 146GB / 10Krpm disk drives
- 146GB / 15Krpm disk drives
- 300 GB/ 10K disk drives

- (300 GB/ 15K disk drives planned for GA plus 2 months)
- 750 GB / 7200rpm disk drives (Low Cost Fibre Channel disk - a SATA disk with a FC interface to it)

RAID Support

Recently ST9900 introduced concept of RAID concatenation. The benefit is to achieve the better performance in the backend. It allows striping the data across more disks. The disadvantage could be chances of more LDEV blockade if two or more HDDs are blocked (depends on RAID level used)

With "RAID5 concatenation"on V06 code and higher, you can stripe across either two or four RAID5 7+1 parity groups (i.e. up to 32 drives).
For the J3 the following RAID is supported:

- RAID1 (2D + 2M)
- RAID5 (3D + 1P)
- RAID6 (6D +2P)
- RAID5 (7D+1P)
- RAID1 (4D+4M)

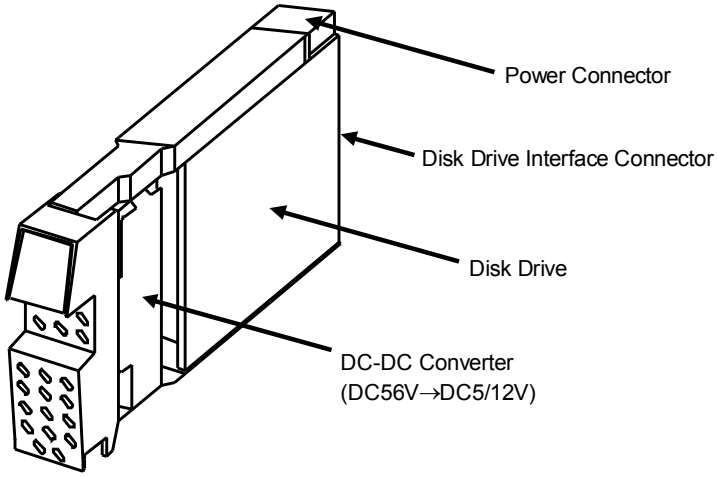
There is a maximum of 40 Global Spares.

Table 2-1 Disk Drive Specifications

Parameter		72 GB (15 krpm) DKS2C-K72FC	146 GB (10 krpm) DKS2D-J146FC	146 GB (10 krpm) DKR2E-J146FC	146 GB (15 krpm) DKS2D-K146FC
Formatted capacity (GB)		71.50	143.76	143.76	143.76
Revolution speed (rpm)		15,000	10,000	10,000	15,000
Platter diameter		2.5 inches	3.3 inches	3 inches	2.5 inches
Physical tracks per physical cylinder (user area) (number of heads)		8	4	10	8
Physical disk platters (user area) (numbers of disks)		4	2	5	4
Sector length (byte)		520 (512)	520 (512)	520 (512)	520 (512)
Seek time (ms) (read/write)	MIN	0.4 / 0.6	0.65 / 0.85	0.5 / 0.7	0.4 / 0.6
	MAX	6.7 / 7.1	9.8 / 10.4	10.0 / 11.0	6.7 / 7.1
	AVE	3.8 / 4.2	4.9 / 5.5	4.9 / 5.4	3.8 / 4.1
Average latency time (ms)		2.01	2.99	2.99	2.01
Internal data transfer rate (MB/sec)		74.5 to 111.4	58.75 to 111.88	57.3 to 99.9	76.13 to 113.78
Max. interface data transfer rate (MB/sec)		200	200	200	200

Parameter	300 GB (10 krpm) DKS2D-J300FC	300 GB (10 krpm) DKR2F-J300FC
Formatted capacity (GB)	288.20	288.20
Revolution speed (rpm)	10,000	10,000
Platter diameter	3.3 inches	3.3 inches
Physical tracks per physical cylinder (user area) (number of heads)	8	10
Physical disk platters (user area) (numbers of disks)	4	5

Sector length (byte)		520 (512)	520 (512)
Seek time (ms) (read/write)	MIN	0.65 / 0.85	0.4 / 0.45
	MAX	9.8 / 10.4	10.0 / 11.0
	AVE	4.9 / 5.5	4.7 / 5.1
Average latency time (ms)		2.99	2.99
Internal data transfer rate (MB/sec)		58.75 to 114.13	72.73 to 134.4
Max. interface data transfer rate (MB/sec)		200	200



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 1152 disk drives total, the total internal system raw capacity of a single StorageTek 9990V system is 332 TBs.

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 a recommended option. When the ST 9990 was first released, RAID 6 was an was required. That requirement has since been relaxed, and RAID 6 now has the status of a recommended option.
- 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 ST9990V maintenance manual, which is available only to authorized support personnel.

The reason why RAID 6 is a recommeded option 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 StorageTek 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 ST9990. This drive is also used in the ST9985 and ST9990V. This disk drive extends the maximum internal storage capacity of the ST9990V to 332TB (un-formatted, raw).

* **750 GB / 7200 rpm High capacity low-cost Fibre Channel Low-cost FC (SATA II) HDD**

- Please see token #**525106** for 3 technical documents which can help you architect,install, and characterize the behavior of these disk drives.
- Low cost/GB (less than 50% $/GB of existing 300GB 15K HDD)
- Supports in-box tiered storage management solutions
- More than double maximum internal ST9985/90V capacity to 180TB and 830TB respectively.

* The applicability of the 750GB 7200rpm Low-cost FC (SATA II) HDD include:

- General Purpose File Systems
- Tier Three with Tiered Storage Management.
- Messaging/Email for Performance, Availability, Capacity
- Decision Support Systems for Capacity, and Density
- Web Server for Capacity
- Backup and Archive

The Key technical specifications and functionality (for 750 GB / 7200 rpm LCFC-SATA-II) are as follows:

Capacity/HDD	738.62	(GB)		
Number of heads		8		
Number of disks		4		
Seek Time (Read/Write)				
Minimum	0.8/1.0	(ms)		
Average	8.5/10.0	(ms)		
Maximum	11.0/12.0	(ms)		
Average latency time	4.17	(ms)		
Rotational speed	7200	(min-1)		
FC Interface data transfer rate			Maximum	400 (MB/s)
SATA II Interface data transfer rate			Maximum	300 (MB/s)
Media transfer rate			Maximum	128.75 (MB/s)

Low-Cost/GB disk storage for Tier 2 and Tier 3 enterprise applications such as fixed content, archive and data protection. The new 750GB 7200rpm Low-cost FC (SATA II) HDD may be optimized within the storage system for its high capacity for applications that require capacity and optimized reads for large files.

QUESTIONS AND ANSWERS

Q. Can the 750 GB 7200 RPM drive be used in a ST 9990 and ST 9985?

A. The 750 GB 7200 RPM HDD can only be used in the ST 9990V and ST 9985V

Q. Does this 750GB low-cost SATA II HDD have the same performance and duty cycle characteristics as the other FC drives ?

A. No, the 750GB low-cost FC SATA II HDD has lower performance and duty cycle characteristics and should not be positioned for Tier-1 applications such as OLTP, but only for Tier-2/Tier-3 applications such as archive, data protection and reference data applications.

Application Source (P-Vol)		SUN ST9990V and ST9985V Internal SATA Destination (S-Vol)	External SATA Destination (S-Vol)
Archival Storage		**OK** CAVEAT - Recommended that a full copy backup of archive located elsewhere in data center or at a remote site.	**OK**
Short Term Staging of backups targeted for Tape		**OK**	**OK**
Medium/Long Term VTL Backup Storage		**Caution2** Not Recommended to keep primary data and backup data in same array.	**OK3**
Copy-on-Write	15k FC-base RAID Group	**Not Recommended1**	**Not Recommended1**
	10k FC-base RAID Group	**OK1**	**OK1**
	7.2K SATA-based RAID Group	**OK2**	**OK**
ShadowImage	15k FC-base RAID Group	**Not Recommended1**	**Not Recommended1**
	10k FC-base RAID Group	**OK1**	**OK1**
	7.2K SATA-based RAID Group	**OK**	**OK**
TrueCopy Synchronous	15k FC-base RAID Group	**Not Recommended1**	**Not Recommended1**
	10k FC-base RAID Group	**OK1**	**OK1**
	7.2K SATA-based RAID Group	**OK2**	**OK**
SUN ST9900 Universal Replication	15k FC-base RAID Group	**Not Recommended1**	**Not Recommended1**
	10k FC-base RAID Group	**OK1**	**OK1**
	7.2K SATA-based RAID Group	**OK**	**OK**

•1 - SATA performance even in large RAID group will be much slower than 10K FC (39%) or 15K FC (60%)
•2- Not considered 'Best Practice'.
•3 – Externally attached non-ST9900 SATA HDD 'Power Down' feature NOT supported with UVM at this time.

Capacity	**750GB**
RAID Levels	**MAX LBA : 55FC7400(750GB Type 520byte Format)** **RAID6(6D+2P)** **RAID5(7D+1P,3D+1P)** **RAID1(2D+2D)**
Emulation	**OPEN-V**

More notes for 750GB/7200rpm LCFC-SATA-II disk drives
•FC Bridge in canister will attach to 4Gbps BED
•Disk transfers at 3Gbps
•FC/SATA intermix allowed in same FIBRE loop
•FC/SATA intermix not allowed in same ECC group
•Subsequent larger SATA drives can be added to same loop
•"Write & Verify with compare"
•Actually only compare CRC data, but still significant overhead

ST9990V (750GB LCF-SATA-II) disk drives:

RAID LEVEL		3D+1P	7D+1P	2D+2D	6D+2P
Number of volumes per RAID group		1	2	1	2
Max number of RAID groups per subsystem		287	143	287	143
Max number of volumes per subsystem		287	286	287	286
Subsystem capacity (Min/Max) GB	Min	2216	5170	1477	4432
	Max	635935	739353	423956	633719

RAID-6 (6D+2P)is required with 300 GB disk drives. This disk drive, part number TV9DKC-F605I-300JS, is a high speed, large capacity disk drive. The disk drives are manufactured by ST9900 Global Storage Technologies, the worldwide leader in the 10K RPM disk drive market and they are fully compatible with all models of the ST9990V. This 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 332TBs. 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.

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

The ST9990V supports RAID-1, RAID-5, and RAID-6 array groups.

RAID-1. illustrates a sample RAID-1 (2D+2D) layout. A RAID-1 (2D+2D) array group consists of two pair of disk drives in a mirrored configuration, regardless of disk drive capacity. A RAID-1 (4D+4D) group* combines two RAID-1 (2D+2D) groups. Data is striped to two drives and mirrored to the other two drives. The stripe consists of two data chunks. The primary and secondary stripes are toggled back and forth across the physical disk drives for high performance. Each data chunk consists of either eight logical tracks (mainframe) or 768 logical blocks (open systems). A failure in a drive causes the corresponding mirrored drive to take over for the failed drive. Although the RAID-5 implementation is appropriate for many applications, the RAID-1 option on the ST9990V is ideal for workloads with low cache-hit ratios.

***Note for RAID-1(4D+4D):** It is recommended that both RAID-1 (2D+2D) groups within a RAID-1 (4D+4D) group be configured under the same DKA pair.

RAID-5. A RAID-5 array group consists of four (3D+1P) or eight (7D+1P) disk drives. The data is written across the four (or eight) disk drives in a stripe that has three (or seven) data chunks and one parity chunk. Each chunk contains either eight logical tracks (mainframe) or 768 logical blocks (open). The enhanced RAID-5+ implementation in the ST9990V minimizes the write penalty incurred by standard RAID-5 implementations by keeping write data in cache until an entire stripe can be built and then writing the entire data stripe to the disk drives. The 7D+1P RAID-5 increases usable capacity and improves performance.

illustrates RAID-5 data stripes mapped over four physical drives. Data and parity are striped across each of the disk drives in the array group (hence the term "parity group"). The logical devices (LDEVs) are evenly dispersed in the array group, so that the performance of each LDEV within the array group is the same. also shows the parity chunks that are the "Exclusive OR" (EOR) of the data chunks. The parity and data chunks rotate after each stripe. The total data in each stripe is either 24 logical tracks (eight tracks per chunk) for mainframe data, or 2304 blocks (768 blocks per chunk) for open-systems data. Each of these array groups can be configured as either 3390-*x* or OPEN-*x* logical devices. All LDEVs in the array group must be the same format (3390-*x* or OPEN-*x*). For open systems, each LDEV is mapped to a SCSI address, so that it has a TID and logical unit number (LUN).

RAID-6. A RAID-6 array group consists of eight (6D+2P) disk drives. The data is written across the eight disk drives in a stripe that has six data chunks and two parity chunks. Each chunk contains either eight logical tracks (mainframe) or 768 logical blocks (open).

In the case of RAID-6, data can be assured when up to two drives in an array group fail. Therefore, RAID-6 is the most reliable of the RAID levels.

Sequential Data Striping

The ST9990V's enhanced RAID-5+ implementation attempts to keep write data in cache until parity can be generated without referencing old parity or data. This capability to write entire data stripes, which is usually achieved only in sequential processing environments, minimizes the write penalty incurred by standard RAID-5 implementations. The device data and parity tracks are mapped to specific physical disk drive locations within each array group. Therefore, each track of an LDEV occupies the same relative physical location within each array group in the subsystem.

LDEV Striping Across Array Groups

In addition to the conventional concatenation of RAID-1 array groups (4D+4D), the ST9990V supports LDEV striping across multiple RAID-5 array groups for improved LU performance in open-system environments. The advantages of LDEV striping are:

- Improved performance, especially of an individual LU, due to an increase in the number of HDDs that constitute an array group.
- Better workload distribution: in the case where the workload of one array group is higher than another array group, you can distribute the workload by combining the array groups, thereby reducing the total workload concentrated on each specific array group.

Note: The LDEV striping feature should only be used to resolve a performance problem (disk drive bottleneck) due to heavy I/O activity to an individual LDEV.

The supported LDEV striping configurations are:

- LDEV striping across two RAID-5 (7D+1P) array groups (see). The maximum number of LDEVs in this configuration is 1000.
- LDEV striping across four RAID-5 (7D+1P) array groups (see). The maximum number of LDEVs in this configuration is 2000.

All disk drives and device emulation types are supported for LDEV striping. LDEV striping can be used in combination with all ST9990V data management functions, with the following restriction in Volume Migration:

In Volume Migration operations (optimizing LDEV allocation), you cannot migrate an array group within a combined/striped group to another group. Volume Migration migrates all LDEVs in an array group to another array group.

RAID 28+4 - Vertical Striping

Raid 28+4 or Raid 14+2 - vertical striping is also known as Raid 5 concatenation in which two or four RAID5 (7D+1) parity groups are concatenated. The data and parity is distributed and arranged in 16 or 32 drives. The V05 code has two parity group concatenation and V06 code has full four Raid5 (7+1) concatenation. The main advantage of this type of concatenation is that in case of major parity group bottleneck you can increase size of parity group and spread load by increasing twice or four times number of drives. More spindles better the performance. The only caveat you need to consider is in case of two drives blocked/failure as large numbers of Ldev are arranged in comparison to RAID5 (7+1) and formating time.

RAID-Level Intermix

RAID technology provides full fault-tolerance capability for the disk drives of the ST9990V. The cache management algorithms enable the ST9990V 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 ST9990V supports RAID-1, RAID-5, RAID-6, and intermixed RAID-level configurations, including intermixed array groups within an array domain. illustrates an intermix of RAID levels. All types of array groups (RAID-5 3D+1P, 7D+1P; RAID-1 2D+2D, 4D+4D; RAID-6 6D+2P) can be intermixed under one DKA pair.

Hard Disk Drive Intermix

All hard disk drives (HDDs) in one array group (parity group) must be of the same capacity and type. Different HDD types can be attached to the same DKA pair.
Note: For the latest information on available HDD types and intermix requirements, please contact your Hitachi Data Systems account team.

Device Emulation Intermix

illustrates an intermix of device emulation types. The ST9990V supports an intermix of all device emulations on the same DKA pair, with the restriction that the devices in each array group have the same type of track geometry or format.

The Virtual LVI/LUN (also called CVS) function enables different logical volume types to coexist. When Virtual LVI/LUN is not being used, an array group can be configured with only one device type (for example, 3390-3 *or* 3390-9, not 3390-3 and 3390-9). When Virtual LVI/LUN is being used, you can intermix 3390 device types, and you can intermix OPEN-*x* device types, but you cannot intermix 3390 and OPEN device types.

Note: For the latest information on supported LU types and intermix requirements, please contact your Hitachi Data Systems account team.

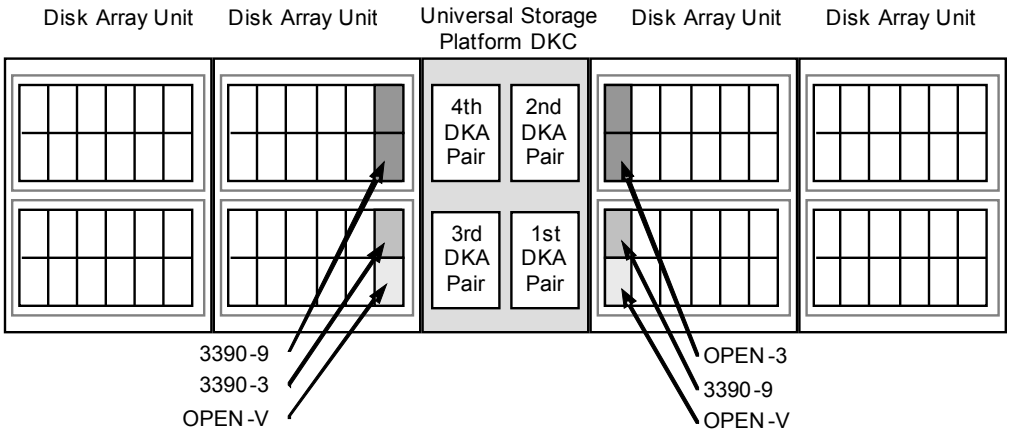


Figure 2.2 Sample Device Emulation Intermix

Comparing RAID levels

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

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%	

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 ST9990V supports the following power specifications:

Single Phase 50 AMP is available in Europe and Rest of World (ROW)

Three phase 30 amp is available in Europe and Rest of World (ROW)

Single Phase 30 amps is available in Japan only.

Please note: The term ROW excludes Japan

The following are supported.

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

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

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

Specific plug and receptacle configurations and part numbers are specified in the StorageTek 9990V 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/9990/user/rd2310.pdf

Page 110 (doc) Page 126 (Acrobat viewer)

Battery Backup

The ST9990V can be configured with a maximum of 256 GB of cache (increments of 4 or 8 GB). All cache memory in the ST9990V is nonvolatile and is protected by 36-hour battery backup (without de-stage option, cache 132 GB or more) or 48-hour battery backup (without de-stage option, cache 128 GB or less).

Software Solutions

All current Sun StorageTek 9900 software products are supported on the new StorageTek 9990V providing a complete suite of storage management, data/information lifecycle management, and business continuity solutions.

Complimenting the Sun StorageTek 99990V system is a set of specific software offerings providing storage resource management, performance tuning, and business continuity solutions.

StorageTek 9900 Basic Operating System (BOS) Suite

- Includes Device Manager, Resource Manager Suite and Server Priority Manager

- Also includes Virtual Partition Manager with support for up to 4 partitions

This suite was created to deliver the storage return on investment, security, and quality of service to applications that your organization requires. And the Basic Operating System Virtualization software enables the ST9990V's embedded virtualization capabilities and allows customers to take advantage of storage management and data mobility capabilities within a single system or across an entire heterogeneous storage pool. Using Basic Operating System, one administrator can manage an entire storage infrastructure from a single pane of glass or you can choose to designate multiple storage administrators who can optionally manage only a particular set of storage resources that is made accessible to them.

- ### StorageTek 9900 Resource Management Suite

The Sun StorageTek software and hardware solutions are managed through the powerful StorageTek 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.

- ### StorageTek 9900 HiCommand Device Manager

The StorageTek 9900 HiCommand Device Manager software provides a single platform for centrally managing, configuring, and monitoring Sun StorageTek 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 StorageTek 9900 HiCommand Tuning Manager and StorageTek 9900 HiCommand Storage Services Manager modules, Device Manager software helps automate entire storage environments.

- **StorageTek 9900 Virtual Partition Manager**

The StorageTek 9990V Virtual Partition Manager enables the logical partitioning of ports, cache, and disk capacity (parity groups) on Sun StorageTek 9990V 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.

- **StorageTek 9900 Server Priority Manager**

The StorageTek 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 StorageTek 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.

StorageTek 9900 BOS Virtual Suite (BOS V)

- Includes Universal Volume Manager and Virtual Partition Manager for more than 4 partitions

The BOS V is an upgrade to the BOS and adds Unique ability to virtualize externally attached storage subsystems to the ST9990V system creating a single heterogeneous pool of tiered storage. This enables simplified storage management, increases utilization, increases efficiency, improves service levels, simplifies data migration and helps meet compliance demands. The with the BOS V Virtual Partitions are expanded - up to 32 storage and 32 cache partitions.

- **Sun StorageTek 9990 Universal Volume Manager**

Simplified management is a key component of large-scale data storage consolidation. The Sun StorageTek 9990 Universal VolumeManager software allows you to manage multiple storage systems connected to the Sun StorageTek 9990 system under a single point of control. Using Universal VolumeManager, you can virtualize and manage up to 247 PB of mixed storage systems from Sun and other vendors as if they were all one system. External storage volumes form a shared storage pool that can be used by multiple servers and multiple applications.

StorageTek 9900 Disaster Recovery Suite(Bundle) (replaces TrueCopy)

- Includes TrueCopy Sync and Universal Replicator for both Open and Z/OS.

Sun StorageTek 9900 TrueCopy Remote Replication provides data replication to other Sun StorageTek 9900 series subsystems over local or long distance connections. The added copies may be used to help enable disaster recovery, data mining, backup, testing, etc. Performs synchronous remote replication operations.

Sun StorageTek 9900 Disaster Recovery Extended Suite – Includes TrueCopy Sync and Universal Replicator with advanced function: 3DC for Open and z/OS and 4x4 for z/OS only.

- **StorageTek 9900 True Copy Remote Replication**

The StorageTek 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 StorageTek 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 StorageTek 9900 ShadowImage™ in-system replication software to enable robust business continuity solutions.

- **StorageTek 9900 Universal Replicator**

The StorageTek 9900 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 StorageTek 9900 series environment. When used in conjunction with the StorageTek 9990V 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 StorageTek 9900 True Copy Remote Replication software by leveraging their existing investment in the StorageTek 9900 Series storage systems. It provides an unmatched business continuity framework that enables local, remote, and multi-site data replication among 9990Vsystems including between and among hosted storage systems.

Sun StorageTek 9990V Dynamic Provisioning

The Sun StorageTek 9990V Dynamic Provisioning software improves storage utilization, simplifies storage provisioning, and enables an easy, transparent way of adding additional storage when needed without disruptions to applications. Also known as thin provisioning, Dynamic Provisioning allows certain Open Systems customers the ability to overallocate storage to an application without it actually being physically installed until needed. This minimizes the cost associated with overallocating and underutiliziation of storage resources. It also helps simplify performance optimization by transparently spreading many hosts' individual IO patterns across many physical disks, thereby reducing performance management concerns and optimizing performance/throughput. Dynamic provisioning reduces costs, power and cooling, improves performance, simplifies management, and minimizes application service interruptions.

StorageTek 9900 HiCommand Tuning Manager

The StorageTek 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.

StorageTek 9900 HiCommand Data Link Manager

The capabilities of the StorageTek 9900 HiCommand Data Link Manager software (formerly known as StorageTek 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.

StorageTek 9900 HiCommand Storage Services Manager

The StorageTek 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.

StorageTek 9900 Volume Migration

The StorageTek 9900 Volume Migration software helps simplify the way users manage performance levels in the Sun StorageTek 9900 series. Sun StorageTek 9900 Volume Migration 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; StorageTek 9900 Volume Migration 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.

StorageTek 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, StorageTek 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.

StorageTek 9900 In-System Replication Suite

The StorageTek 9900 In-System Replication includes both ShadowImage and Copy on Write. In-System Replication Suite along with the Sun StorageTek 9900 series, allows information to be protected and accessible 24x7. StorageTek 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 StorageTek 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.

The high-speed, non-disruptive, copy-on-write technology of Sun's StorageTek 9900 Copy-on-Write Snapshot software rapidly creates up to 14 point-in-time copies of any data volume within a StorageTek 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.

Dynamic Provisioning Software

Support

Dynamic Provisioning only support Open Systems (Open – V emulation). Currently it only supports internal storage, but will be expanded to support external storage under UVM in phase 2 post GA (TBD)

Best Fit

- Best Fit on larger systems where the usage aggregation of a storage pool across many spindles will demonstrate largest performance optimization.
    - Each user gets access to a larger number of spindles
- Best Fit for stable environments and large consistently growing files or volumes. It's best used for applications such as enterprise databases and archival applications where capacity growth rates are understood.
    - Oracle and other databases that can grow and automatically expand
- Deferred storage purchase benefits will be limited with applications or file systems that rapidly write in a sparse fashion over all their volume's allocation.

- Some Open Systems applications and file systems do just that, so the benefits can be application-dependent.

File System Dependency – Benefits Quick Summary

Benefit	Contents
(1) Simplify Volume Creation and Configuration	Quick volume creation w/o formatting or physical installation Freedom from volume expansion w/o physical configuration changes Freedom of drives additions w/o logical configuration changes
(2) Easier Performance Optimization	Automatic workload leveling across Pool.
(3) Optimize Capacity Usage	Allow huge logical volume size with minimum physical capacity usage. Dependent upon OS, filesystem, and/or DB platform.

OS	FS	Benefit (1)	Benefit (2)	Benefit (3)	Note
HP_UX	JFS	X	X	X	
Windows Server2003	NTFS	X	X	X	
Linux	XFS	X	X	X	Need to set specific parameter
	ext2	X	X	Partial	
	ext3	X	X	Partial	
Solaris	UFS	X	X		
	VxFS	X	X	X	
AIX	JFS	X	X		
	VxFS	X	X	X	

Field Issues

Cluster Support

Please refer to the following URL for Cluster Support of the ST9900 Family of Storage Systems.

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

Open V

The ST9990V 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. ST9900 Data Systems (the sales and marketing arm of ST9900 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 ST9990V.

Note that a FAQ regarding Open V is now available at Token #428905. Originally published for the ST9990, this FAQ also applies to the ST9990V.

WWWW (What Works With What)

There are several WWWW documents associated with the ST9900 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.
  - ST9990V, ST9990, ST9985, ST9980, ST9970, ST9960, ST9910
  - 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 Support Matrix for the ST9900 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.

Microcode

ST9990V = 60-01-32-00/00

This is the microcode that the ST 9990V will GA with.

RAID 10

ST9900 Data Systems promotes “RAID 1+”. In reality, striping is included with this, and therefore ST9990V and ST9990V RAID 1 is equivelent to RAID 10.

Features and Capabilities of the Sun StorageTek 9990V

	ST9990	ST9990V
Technology / Virtualization	3rd Generation Cross-Bar Switch Embedded Virtualization	4th Generation Cross-Bar Switch Embedded Virtualization
Maximum IOPS	2,500k	3,500k
External Storage Bandwidth IOPS	2,000	10,000
Maximum supported Internal Capacity	332TB's	332TB's
Maximum supported Total Capacity	32PB's	247 PB's
Internal Bandwidth	83 GB/second	106 GB/second
Maximum cache	256GB	256GB today, 512GB in future
Back-end loops	64 x 2Gb/second	64 x 4Gb/second
Front End Fibre Channel Ports	192 x 4Gb/second	224 x 4Gb/second
Maximum Internal Disks	1152 x 2Gb/second	1152 x 4Gb/second
Maximum LDEV's	64k (MF) 16k (OS)	64k MF & OS today (128k in 4Q 2007)
External Storage Connection	FC	FC, FICON in 4Q 2007
Maximum ESCON PORTS	96	112
Maximum FICON PORTS	96	112
Size Single LDEV	2TB	2TB
NAS and iSCSI support	High Performance NAS platform	NAS and iSCSI options not available at GA

ST9990V Business Continuity Enhancements

	ST9990	ST9990V
TrueCopy Sync PAIRS	16k	32k
TrueCopy Async PAIRS	16k	32k
TrueCopy Async CTG's	128	128
TrueCopy Async PAIRS per CTG	4096	4096
Universal Replicator PAIRS	16k	32k
Universal Replicator CTG's	256	256
Universal Replicator PAIRS per CTG	4096	4096
ShadowImage PAIRS	8k	16k
ShadowImage CTG's	128	128
ShadowImage PAIRS per CTG	4096	8192

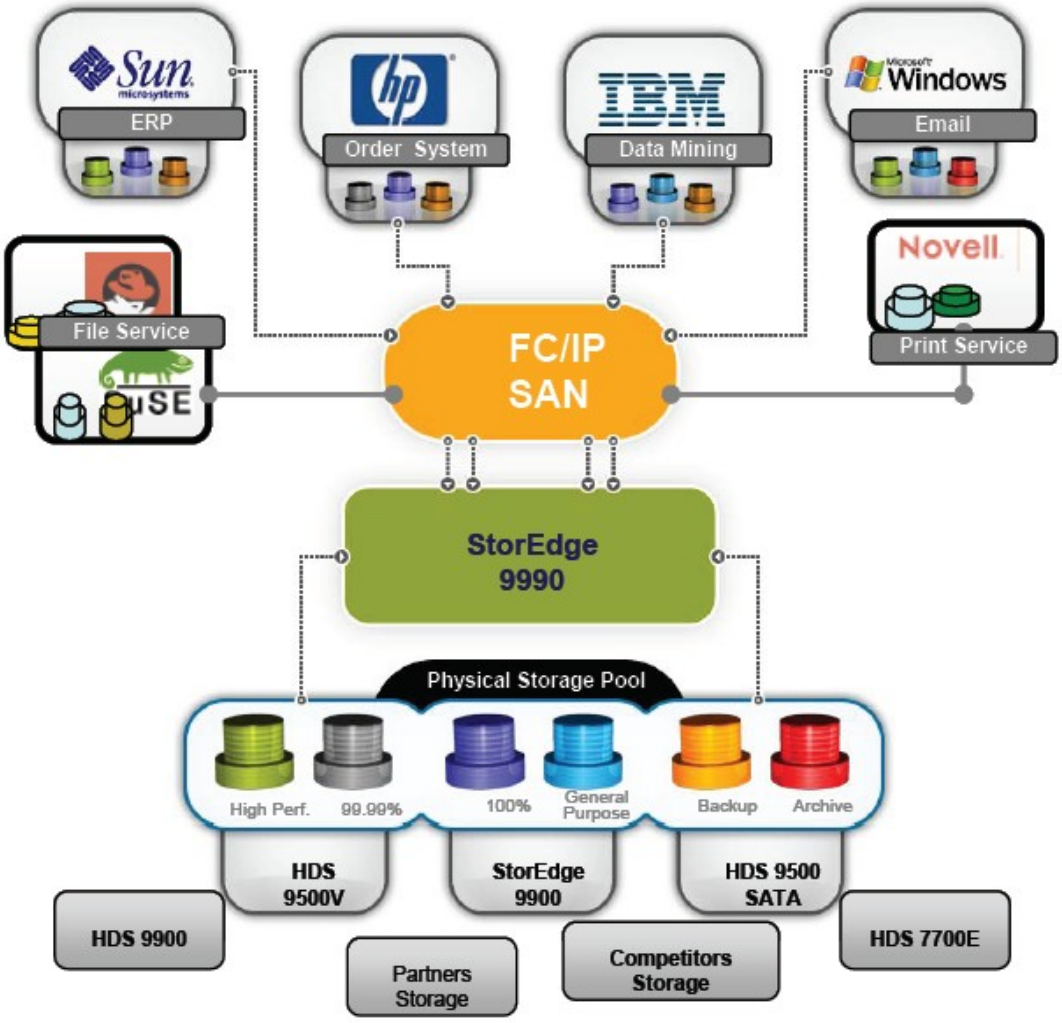


Figure 1

Sun StorageTek 9990V Multi-Vendor Host Platform Storage Pooling

The method by which the StorageTek 9990V implements multi-vendor host platform storage pooling is through mapping an external LUN (ELUN) to a LUN within the StorageTek 9990Vsystem. An external LUN (ELUN) requires no physical disk storage on the StorageTek 9990V. This LUN mapping is illustrated in Figure 2.

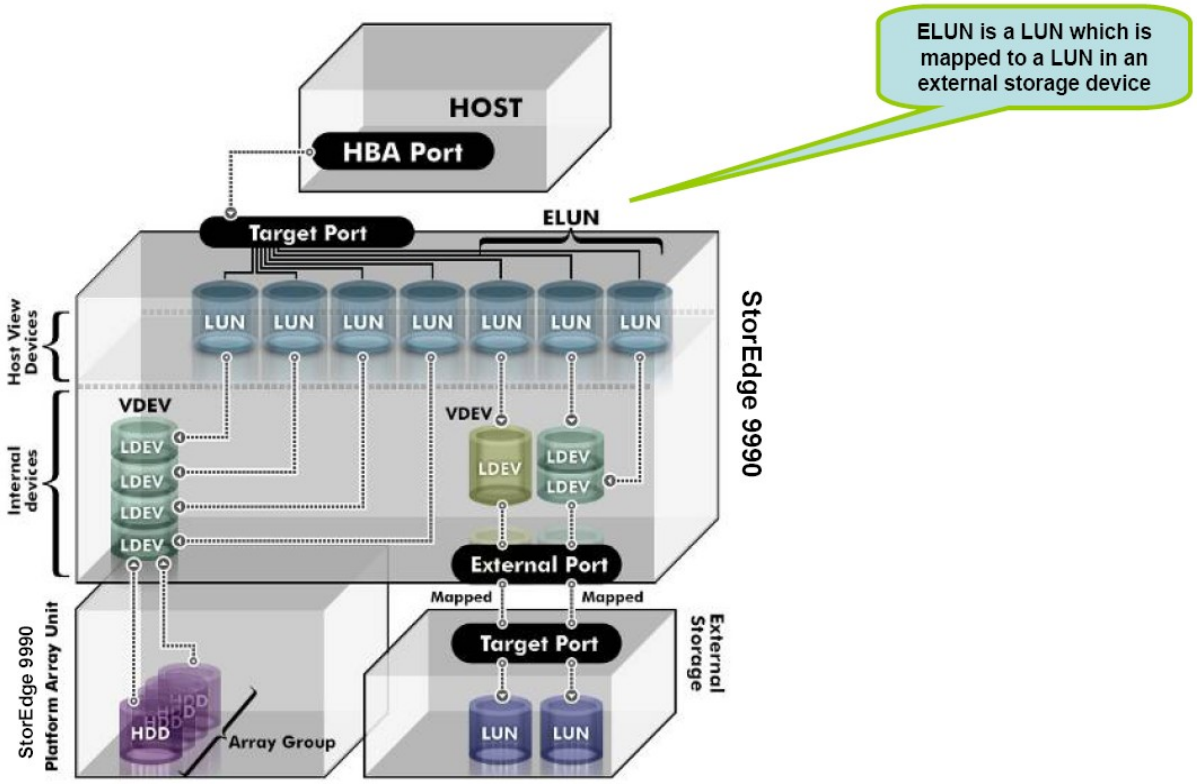


Figure 2

Multi-Vendor Host Platform Storage Pooling External LUN Mapping

As illustrated in Figure 1, an external heterogeneous storage system can be connected to a StorageTek 9990V system (1) through a direct connection, (2) through a switch, or, remotely, through extenders.

Currently, the following heterogeneous storage systems are supported by the StorageTek 9990V multi-vendor host platform storage pooling:

- Sun StorageTek 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.

Virtual Private Storage Machines (VPSM)

Another unique feature of the StorageTek 9990V system is the ability to create Virtual Private Storage Machines within the system. Through the StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V virtual partitioning functionality.

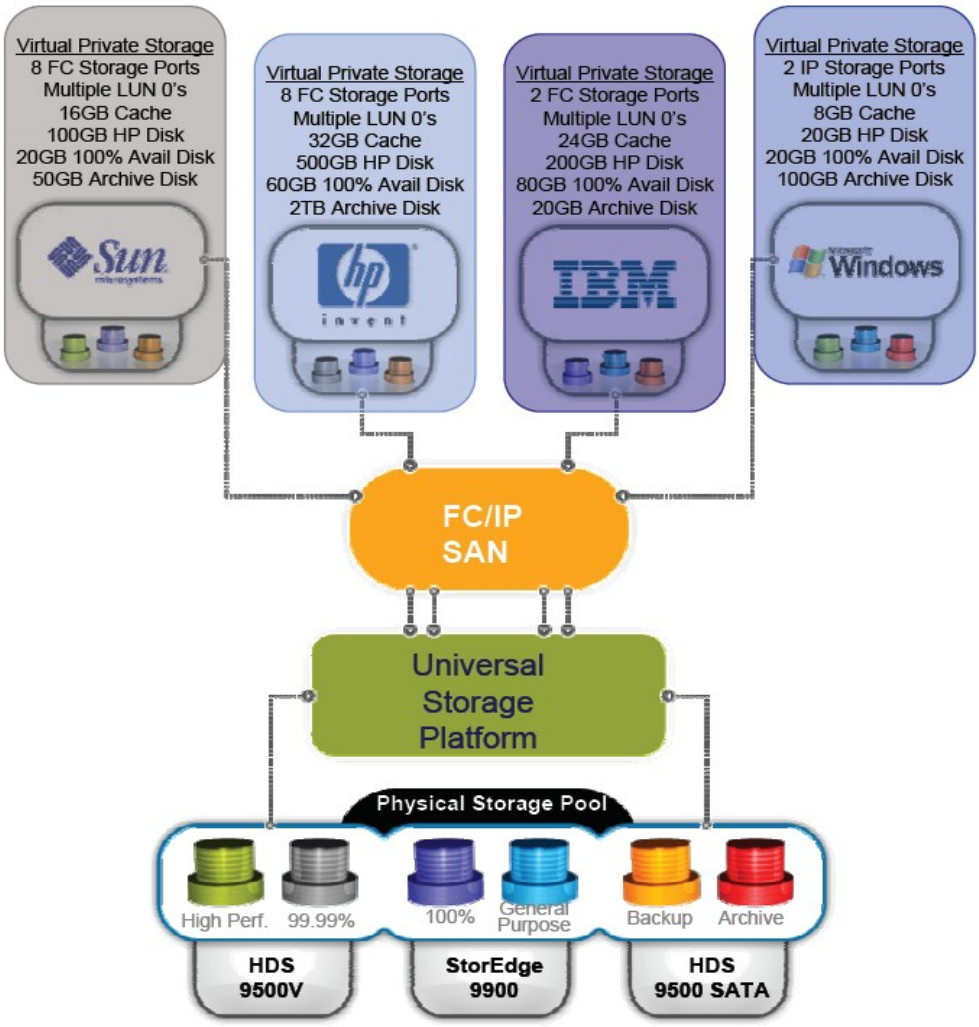


Figure 3

StorageTek 9990V Virtual Partitioning

Virtual partitions are configured via ST9900 Virtual Partition Manager, which is the software tool use to set up Storage Logical Partitions (SLPR) and a 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 4.

The StorageTek 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 StorageTek 9990V system is fully secure.

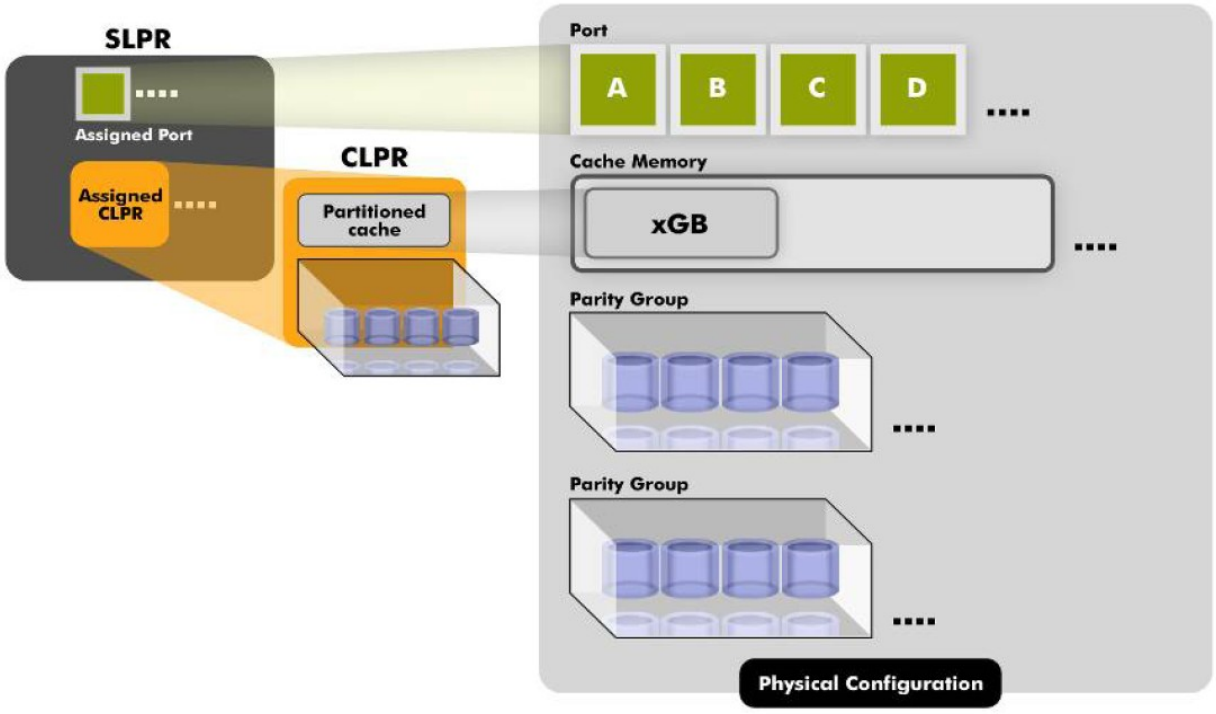


Figure 4

StorageTek 9990V Virtual Private Storage Machine Basic Concepts

Operating System Support

The following operating systems are supported at the initial release of the Sun StorageTek 9990V:

- 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

Security

Monitoring and Diagnostics Software (StorageTek 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

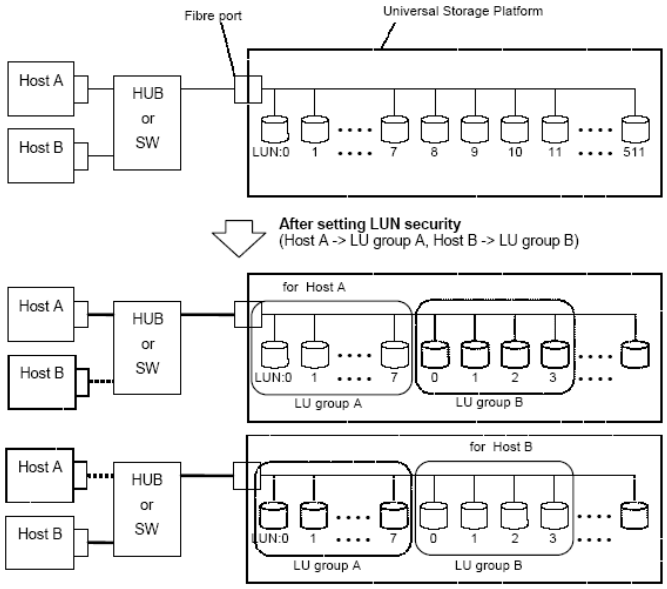
LUN mapping is the task of assigning a LUN number to a volume. This helps ensure that the storage administrator can tightly control access to particular volumes.

Storage Domains

This feature lets the user carve the Sun StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V 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 StorageTek 9990V system is fully secure from outside access.

Command Line Interface (CLI)

The CLI uses encryption and authentication.

Encrypted Communications

Only encrypted services are provided on the Sun StorageTek 9990V 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)

The ST9990V is not expected to fail in any way that would interrupt user access to data. The ST9990V can sustain multiple component failures and still continue to provide full access to all stored user data.

Note: While access to user data is never compromised, the failure of a key component can degrade performance.

The reliability, availability, and serviceability features of the ST9990V include:

- **Highly Available.** The ST9990V provides highly available architecture for all critical components. The subsystem is protected against disk drive error and failure by enhanced RAID technologies and dynamic scrubbing and sparing. The ST9990V uses component and function redundancy to provide high availability for all other subsystem components (microprocessors, control storage, power supplies, etc.). The ST9990V has no active single point of component failure and is designed to provide continuous access to all user data.
- **Separate power supply systems.** Each storage cluster is powered by a separate set of power supplies. Each set can provide power for the entire subsystem in the unlikely event of power supply failure. The power supplies of each set can be connected across power boundaries, so that each set can continue to provide power if a power outage occurs. The ST9990V can sustain the loss of multiple power supplies and still continue operation.
- **New – battery backup and de-stage option for HDDs.** A new feature of the ST9990V provides separate battery backup for the hard disk drives (HDDs) with an optional setting to de-stage data from cache to the (internal) HDDs during a power outage.
- ***Note:*** The de-stage option is not supported when external storage is connected and/or when Cache Residency Manager BIND mode is applied.
- **Dynamic scrubbing and sparing for disk drives.** The ST9990V uses special diagnostic techniques and dynamic scrubbing to detect and correct disk errors. Dynamic sparing is invoked automatically if needed. The ST9990V can be configured with up to 40 spare disk drives (4 + 36 optional), and any spare disk can back up any other disk of the same speed (RPMs) and the same or less capacity, even if the failed disk and spare disk are in different array domains (attached to different back-end directors).
- **Dynamic duplex cache.** The ST9990V cache is divided into two equal segments on separate power boundaries. The ST9990V places all write data in both cache segments with one internal write operation, so the data is always duplicated (duplexed) across power boundaries. If one copy of write data is defective or lost, the other copy is immediately de-staged to disk. This duplex design ensures full data integrity in the event of a cache or power failure.
- **Remote copy features.** The ST9900 Universal Replicator, ST9900 TrueCopy, and Compatible Replication for IBM XRC data movement features enable users to set up and maintain duplicate copies of mainframe and open-system data over extended distances. In the event of a system failure or site disaster, the secondary copy of data can be invoked rapidly, allowing applications to be recovered with guaranteed data integrity.
- **Hi-Track.** The Hi-Track maintenance support tool monitors the operation of the ST9990V at all times, collects hardware status and error data, and transmits this data to the ST9900 Data Systems Support Center. The Support Center analyzes the data and implements corrective action as needed. In the unlikely event of a component failure, Hi-Track contacts the ST9900 Data Systems Support Center immediately to report the failure without requiring any action on the part of the user. Hi-Track enables most problems to be identified and fixed prior to actual failure, and the advanced redundancy features enable the subsystem to remain operational even if one or more components fail.
- ***Note:*** Hi-Track does not have access to any user data stored on the ST9990V.

- **Non-disruptive service and upgrades.** All hardware upgrades can be performed non-disruptively during normal system operation. All hardware sub-assemblies can be removed, serviced, repaired, and/or replaced non-disruptively during normal system operation. Shared memory for the ST9990V is installed on separate PCBs, and the fibre-channel PCBs for the ST9990V are equipped with hot-swappable fibre SFP transceivers (GBICs). All microcode upgrades can be performed during normal operations using the service processor (SVP) and the alternate path facilities of the host. Online microcode upgrades can be performed without interrupting open-system host operations.
- **Error Reporting.** The ST9990V reports service information messages (SIMs) to notify users of errors and service requirements. SIMs can also report normal operational changes, such as remote copy pair status change. The SIMs are logged on the ST9990V SVP, reported directly to the mainframe and open-system hosts, and reported to ST9900 Data Systems over Hi-Track.

System Administration

Please refer to the following web page for the latest User Guides and maintenance manuals:

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

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 "ST9900 WWWW"

Please refer to the documents described below,.

- What Works With What (WWWW) (Issued by ST9900 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 ST9900 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 StorageTek 9990V system.

Sun Software

- StorageTek Enterprise Backup Software (EBS) 7.,1
- StorageTek QFS software 4.0, or later
- StorageTek SAM-FS software 4.0, or later
- Sun StorageTek Enterprise Storage Manager 2.1 software, or higher
- Sun StorageTek 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 StorageTek 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

NEW PARTS NOW AVAILABLE FOR SALE:

Order Number	List Price	Discount Category	SunSpectrum(SM) Price*	Note
Options and Spares				
TV9DKC-F605I-146K1	$3,245.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 146GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 15000RPM, FC; contained in a canister for installation as a spare drive in an ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant				
TV9DKC-F605I-146KS	$3,245.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 146GB Hard Disk Drive (HDD); 1 * hard disk drive, 146GB, 15000RPM, FC; contained in a canister for installation in an ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant				
TV9DKC-F605I-18	$33,795.00	M	N/A	
Description: Sun StorageTek(TM) 9990V Disk Array Frame Unit with doors; factory-configured; contains 8 hard disk unit boxes (each box accommodates 32 hard disk drives), installed as the standard and capable of containing a maximum of 256 hard disk drives; conforms to both 3-phase AC power and single-phase AC power specifications; Dimensions of frame: Height: 1860, Width: 650mm and Depth: 925mm; (AC power supply and AC power cable not included). RoHS-5 compliant				
TV9DKC-F605I-300J1	$3,245.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 300GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installationas a spare drive in an ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant				
TV9DKC-F605I-300JS	$3,245.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 300GB Hard Disk Drive (HDD); 1 * hard disk drive, 300GB, 10000RPM, FC; contained in a canister for installation in an ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant				
TV9DKC-F605I-72K1	$2,075.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 73GB Spare Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installationas a spare drive in an ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant				
TV9DKC-F605I-72KS	$2,075.00	M	$7.0	1
Description: Sun StorageTek(TM) 9990V 73GB Hard Disk Drive (HDD); 1 * hard disk drive, 73GB, 15000RPM, FC; contained in a canister for installation in an ST9990V integrated disk controller and array frame unit (DKC610I)				

and/or disk array frame unit (DKU610I); (for the ST9900V). RoHS-5 compliant

TV9DKC-F605I-AKT $17,295.00 M N/A

Description:

Sun StorageTek(TM) 9990V DKU Expansion Kit; consists of FSW/SVR/DKU PS; option is required when installing upper hard disk unit-BOX (connecting 3rd/4th DKA and 7th/8th DKA) on HDD. 1 set of this option can be installed on the DKU frame; (for the ST9990V). RoHS-5 compliant

TV9DKC-F605I-EXC $635.00 M N/A

Description:

Sun StorageTek(TM) 9990V Device Interface Cable Kit; 1 * cable unit assembly; required when connecting DKU-R1 and DKU-R2 or DKU-L1 and DKU-L2. One set of this option is required for the upper hard disk unit-BOX and the lower hard disk unit-BOX each; (for the ST9990V).RoHS-5 compliant

TV9DKC-F610I-16FS $33,595.00 M N/A

Description:

Sun StorageTek(TM) 9990V Fibre Channel 16-Port Front End Director for Short Wave 1-4Gbps; 2 *channel adapter PCBs each w/ 8 FC ports;All 16 FC ports come w/ Fibre SFPs for Shortwave;may be replaced w/ DKC-F610I-1FL for longwave; short /longwave SFPs may be installed on the same channel adapter; 8sets(128 ports)can be installed in CHA slots ;max of 8sets can be installed in DKA slots, making 16 sets(256 ports) installed; for ST9990V controller &array frame unit.RoHS-5 compliant

TV9DKC-F610I-1FL $715.00 M N/A

Description:

Sun StorageTek(TM) 9990V Fibre Small Form Factor Pluggable (SFP) Transceiver for Long Wavelength 1-4Gbps 10km; 1 * fibre optical channel adapter conforming to the long wavelength (single mode). RoHS-5 compliant

TV9DKC-F610I-1FS $235.00 M N/A

Description:

Sun StorageTek(TM) 9990V Fibre Small Form Factor Pluggable (SFP) Transceiver for Short Wavelength 1-4Gbps; 1 * fibre optical channel adapter conforming to the short wavelength (multi-mode). RoHS-5 compliant

TV9DKC-F610I-3EC $1,295.00 M N/A

Description:

Sun StorageTek(TM) 9990V Power Cable Kit; for 3 Phase 30 Amp AC 200V/50Hz installations; 1 * power cable unit; (required when a 3 phase ST9990 integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I) is shipped to Europe; one kit per unit).(for the ST9990V) RoHS-5 compliant

TV9DKC-F610I-3PS $1,565.00 M N/A

Description:

Sun StorageTek(TM) 9990V AC Power Supply Box Kit; for three phase/200V 30 Amp installations; 2 * AC power supply distribution boxes ; (2 are required per ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I) when units are connected to three phase input).(for the ST9990V) RoHS-5 compliant

TV9DKC-F610I-3UC $1,005.00 M N/A

Description:

Sun StorageTek(TM) 9990V Power Cable Kit; for 3 Phase 30 Amp AC 200V/60Hz installations; 1 * power cable unit; (required when a 3 phase ST9990V integrated disk controller and array frame unit (DKC610I) and/or disk array frame unit (DKU610I) is shipped to USA; one kit per unit).(for the ST9990V) RoHS-5 compliant

TV9DKC-F610I-8FS $24,955.00 M N/A

Description:

Sun StorageTek(TM) 9990V Fibre Channel 8-Port Front End Director for Short Wavelength 1-4Gbps;2 *channel adapter PCBs each w/4 fibre channel ports;All 8 FC ports w/ Fibre SFPs for Short wave;may be replaced w/DKC-F610I-1FL for longwave; short/long wave SFPs may be installed on same channel adapter. 8sets (64ports) can be installed in CHA slots;max of 8sets can be installed in DKAslots, making 16sets(128ports)total installed;for ST9990V controller &array frame. RoHS-5 compliant

TV9DKC-F610I-8MFL $27,595.00 M N/A

Description:

Sun StorageTek(TM) 9990V FICON 8-Port Front End Director for Long Wavelength 1-4Gbps; 2 * 4 port channel adapter printed circuit

boards(PCB) w/ LC type optical connectors; mainframe fibre channel ports conform to the long Wavelength (multi- mode); 8 sets (64 ports) can be installed in the CHA exclusive use slot. A maximum of 7 sets can be installed in the DKA slot, making 15 sets (120ports) total can be installed;for the ST9990Vdisk controller and array frame unit(DKC610I).RoHS-5compliant

TV9DKC-F610I-8MFS $24,995.00 M N/A

Description:

Sun StorageTek(TM) 9990V FICON 8-Port Front End Director for Short Wavelength 1-4Gbps; 2 * 4 port channel adapter printed circuit boards(PCB) w/ LC type optical connectors; mainframe fibre channel ports conform to the short Wavelength (multi- mode); 8 sets (64 ports) can be installed in the CHA exclusive use slot. A maximum of 7 sets can be installed in the DKA slot, making 15 sets (120ports) total can be installed;for the ST9990V disk controller and array frame unit(DKC610I).RoHS-5compliant

TV9DKC-F610I-8S $8,595.00 M N/A

Description:

Sun StorageTek(TM) 9990V Serial 8-port Adapter;a channel adapter consisting of 8*serial channel ports; composed of two-channel adapter PCBs in each of which 4 serial ports are equipped. 8 sets (64 ports) can be installed in the CHA exclusive use slot; A maximum of 7 sets can be installed in the DKA slot, making 15 sets (120 ports) total can be installed; for the ST9990V integrated disk controller and array frame unit. .RoHS-5 compliant

TV9DKC-F610I-AB $4,095.00 M N/A

Description:

Sun StorageTek(TM) 9990V Additional Battery; 12V battery for DKC; 2 * battery boxes, 2* battery control printed circuit boards. Add 1 set when the following occurs: * Cache Memory Capacity is 56GB or more * Shared Memory Capacity is 14GB or more * When the 1st set of DKC-F610I-APC is installed. Add 2nd set when the following occurs: * CM Capacity is 72GB or more * When the 2nd set of the DKC-F610I-APC is installed. Add 3rd set when the following occurs: * CM Capacity is 104GB or more. RoHS-5 compliant

TV9DKC-F610I-ABX $8,295.00 M N/A

Description:

Sun StorageTek(TM) 9990V Additional Battery; 56V battery for DKC; 2 * battery boxes, 2* battery control printed circuit boards. This option is required when one of following occurs: * Maximum of 1 set is installable in the DKC Frame when De-stage mode is selected * Cache Memory Capacity is 136GB; Maximum of 2 set is installable in the DKU Frame when de-stage mode selected: Install 1 set when without DKC-F605I-AKT or Install 2 sets of this option if DKC-F605I-AKT is installed. RoHS-5 compliant

TV9DKC-F610I-APC $5,025.00 M N/A

Description:

Sun StorageTek(TM) 9990V Additional Power Supply; extended 12V AC-DC power supply for DKC. Maximum of 2 options can be installed on DKC frame; (Required to Add 1 set when one of the following: * Install 5 to 10 sets of DKA+CHA options * Install 2 sets of DKC-F610I-CX * Install 2 sets of DKC-F610I-SX)(Required to Add 2 sets when one of the following: * Install 11 or more sets of DKA+CHA options * Install 3 to 4 sets of DKC-F610I-CX): (For ST9990V) RoHS-5 compliant

TV9DKC-F610I-C4G $10,795.00 M N/A

Description:

Sun StorageTek(TM) 9990V Additional Cache Memory Module - 4GB; 8 * DIMM boards each installed with 512Mbit DRAM; for the ST9990V integrated disk controller and array frame unit. (for the ST9990V) RoHS-5 Compliant.

TV9DKC-F610I-C8G $32,600.00 M N/A

Description:

Sun StorageTek(TM) 9990 Additional 8GB Cache Memory Module; consists of 4 DIMM boards on which 1Gbit DRAM is mounted. Max number of installable options is: * 16 sets (Cache capacity: 128GB) when the DKC-F510I-CX1GR is not installed, or * 32 sets (Cache capacity: 256GB) when the DKC-F510I-CX1GR is installed. Required number of the options is determined based on the disk capacity of the subsystem. (ST9990) RoHS Compliant.

TV9DKC-F610I-CSW $26,795.00 M N/A
Description:
Sun StorageTek(TM) 9990V Data Path Expansion Kit; 2 * printed circuit boards for data path expansion; A maximum of three sets of this option can be installed based on the installation position of CHA/DKA (1 set is pre-installed on DKC610I-5); for the ST9990V integrated disk controller and array frame unit (DKC610I). RoHS-5 compliant
TV9DKC-F610I-CX $2,795.00 M N/A
Description:
Sun StorageTek(TM) 9990V Cache Data Path Expansion Kit; 2 * printed circuit boards(PCBs) for installing cache memory; Up to 4 sets of this option can be installed in one subsystem; Maximum of 64GB (C8Gx8 set) cache memory can be installed in one option; for the ST9990V integrated disk controller and array frame unit (DKC610I). RoHS-5 compliant
TV9DKC-F610I-DKA $43,995.00 M N/A
Description:
Sun StorageTek(TM) 9990V Back End Director; consists of 2 * disk adapter printed circuit boards (1 disk adapter pair - 2 PCBs), that control 4 * 4Gbps fibre channel ports per PCB, using 4 * 400 MHz Microprocessors per PCB; Up to 8 sets of DKAs can be installed in a subsystem and they can control up to 1,152 HDDs; for the ST9990V integrated disk controller and array frame unit (DKC610I); (Note: a maximum of four of this feature can be installed per DKC). RoHS-5 compliant
TV9DKC-F610I-L1DC $715.00 M N/A
Description:
Sun StorageTek(TM) 9990V Device Interface Cable Kit; 1 * cable unit assembly; required when connecting the 5th/6th ST9990V Back End Director (DKA) pair and DKU-L1 in case of the 6 DKA pairs model within the ST9990V integrated disk controller and array frame unit (DKC610I) to the ST9990V disk array frame unit (DKU610I) in the L1 position; (connects DKC to DKU-L1). This option is required when installing DKU-L1. RoHS-5 compliant
TV9DKC-F610I-L1UC $715.00 M N/A
Description:
Sun StorageTek(TM) 9990V Device Interface Cable Kit; 1 * cable unit assembly; required when connecting the 7th/8th Back End Director (DKA) pair and DKU-L1 in case of the 8 DKA pairs model within the ST9990V integrated disk controller and array frame unit (DKC610I) to the ST9990V disk array frame unit in the L2 position; (connects DKC to DKU-L2). In case of the 8 DKA pairs model, DKC-F610I-L1DC is necessary in addition to this option. RoHS-5 compliant
TV9DKC-F610I-PCI $975.00 M N/A
Description:
Sun StorageTek(TM) 9990V Power Control Interface Kit for Mainframe; 1 *remote power control device; (this option performs the remote power control via the PCI interface with the IBM mainframe host).This option has 4 end connections, and can control the remote power from maximum of 4 sets of IBM mainframes. RoHS-5 compliant
TV9DKC-F610I-R1DC $715.00 M N/A
Description:
Sun StorageTek(TM) 9990V Device Interface Cable Kit; 1 * cable unit assembly; required when connecting the DKU-R0 (ST9990V Back End Director) within the ST9990V integrated disk controller and array frame unit (DKC610I) to the ST9990V disk array frame unit (DKU505I) in the R1 position; (connects DKU-R0 to DKU-R1). This option is required when installing DKU-R1. RoHS-5 compliant
TV9DKC-F610I-R1UC $715.00 M N/A
Description:
Sun StorageTek(TM) 9990V Device Interface Cable Kit; 1 * cable unit assembly; required when connecting the 3rd/4th ST9990V Back End Director (DKA) pair and DKU-R1 in case of the 4 DKA pairs model within the ST9990V integrated disk controller and array frame unit (DKC610I) to the ST9990V disk array frame unit (DKU610I) in the R1 position; (connects DKC to DKU-R1). In case of the 4DKA pair model, DKC-F610I-R1DC is necessary in addition to this option. RoHS-5 compliant
TV9DKC-F610I-S2GQ $8,495.00 M N/A
Description:

Sun StorageTek(TM) 9990V Additional 2GB Shared Memory Module; consists of 4 DIMM boards on which 512Mbit DRAM is mounted. Required number of the shared memories is determined based on the cache capacity of the subsystem, disk capacity, the number of LDEVs, and program products to be installed. When 1 DKC-F610I-SX is installed: Maximum of 4 sets (Capacity of 8GB); When 2 DKC-F610I-SX are installed: Maximum of 8 sets (Capacity of 16GB); (for the ST9990V) RoHS-5 compliant

TV9DKC-F610I-S4GQ $25,495.00 M N/A

Description:

Sun StorageTek(TM) 9990V Additional 4GB Shared Memory Module; consists of 4 DIMM boards on which 1Gbit DRAM is mounted. Required number of the shared memories is determined based on the cache capacity of the subsystem, disk capacity, the number of LDEVs, and program products to be installed. When 1 DKC-F610I-SX is installed: Maximum of 4 sets (Capacity of 16GB); When 2 DKC-F610I-SX are installed: Maximum of 8 sets (Capacity of 32GB); (for the ST9990V) RoHS-5 compliant

TV9DKC-F610I-SVP $4,995.00 M N/A

Description:

Sun StorageTek(TM) 9990V SVP High Reliability Support Kit; 1 * service processor (for use as a failover device); for installation in an ST9990V integrated disk controller and array frame unit (DKC610I). SVP does not have CD-ROM drive and FD drive. RoHS-5 compliant

TV9DKC-F610I-SX $2,995.00 M N/A

Description:

Sun StorageTek(TM) 9990V Shared Memory Adapter; 2 * printed circuit boards(PCBs) for mounting shared memory; Up to2 sets of this option can be installed per a subsystem. Maximum of 16GB (S4GQ x 4 set) of Shared Memory can be installable with a set of this option; for the ST9990V integrated disk controller and array frame unit (DKC610I). RoHS-5 compliant

TV9DKC610I-5 $55,000.00 M $969.0 1

Description:

Sun StorageTek (TM) 9990V Integrated Disk Controller and Disk Array Frame Unit with doors, factory-configured, supports RAID1/5/6 configurations, contains up to 128 hard disk drives; Frame dimensions: Height:1860mm, Width:782mm, Depth:925mm, 4 * 3.3V/12V redundant power supplies, 20 * redundant fans, 1 * service processor (SVP), 1 * 14ft LAN Cable, 1 * 12ft phone cable, microcode kit, HiTrack, modem card; installation included.RoHS-5 compliant

W9D-T12-1DSK-1P $84.00 S N/A

Description:

Sun StorageTek 9990V System Disk Drive Upgrade to 1 Year of Platinum Support.

W9D-T12-1DSK-2P $168.00 S N/A

Description:

Sun StorageTek 9990V System Disk Drive Upgrade to 2 Years of Platinum Support.

W9D-T12-1DSK-3P $252.00 S N/A

Description:

Sun StorageTek 9990V System Disk Drive Upgrade to 3 Years of Platinum Support.

W9D-T12-990V-1P $11,628.00 S N/A

Description:

Sun StorageTek 9990V System Upgrade to 1 Year of Platinum Support.

W9D-T12-990V-2P $23,256.00 S N/A

Description:

Sun StoreTek 9990V System Upgrade to 2 Years of Platinum Support.

W9D-T12-990V-3P $34,884.00 S N/A

Description:

Sun StorageTek 9990V System Upgrade to 3 Years of Platinum Support.

WW-PS-ED90VBOS-C $999,999.00 C N/A

Description:

ST9990V Basic Operating System (BOS) Custom configuration Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions. >120 Tbs, >1024 LUNs, >80 dual host connections.

WW-PS-ED90VBOS-L $110,000.00 E N/A

Description:

ST9990V Basic Operating System (BOS) configuration Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions. Large Configuration- Up to 120 TB of Disk, Up to 1024 LUNs included, Up to 80 dual host connections.

WW-PS-ED90VBOS-M $80,000.00 E N/A

Description:

ST9990V Basic Operating System (BOS) configuration Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions. Medium Configuration- Up to 70 TB of Disk, Up to 512 LUNs included, Up to 64 dual host connections.

WW-PS-ED90VBOS-S $60,000.00 E N/A

Description:

ST9990V Basic Operating System (BOS) configuration Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions. Small Configuration- Up to 35 TB of Disk, Up to 256 LUNs included, Up to 32 dual host connections.

WW-PS-ED90VDP-C $999,999.00 C N/A

Description:

Dynamic Provisioning (DP) for ST9990V can be included as an additional feature of the Base (BOS) configuration with additional Dynamic Provisioning Licensed TB's.

WW-PS-ED90VDR-C $999,999.00 C N/A

Description:

Disaster Recovery for ST9990V can be included as an addition to the Base (BOS) configuration, includes TrueCopy Sync support for the appropriate TC Licensed TB's service can be combined with TrueCopy Sync as an addition to the Base (BOS) configuration with additional Universal Replicator support for UR Licensed TB's.

WW-PS-ED90VDRX-C $999,999.00 C N/A

Description:

Disaster Recovery Extended for ST9990V can be included as an addition to the Base (BOS) configuration with additional support for Universal Replicator 3 Data Center solution for Open Systems and Universal Replicator 4X4 for Mainframe, Network Assessment services should be included as well.

WW-PS-ED90VIS-C $999,999.00 C N/A

Description:

In-System Replication (IS) for ST9990V can be included as an addition to the Base (BOS) configuration with additional ShadowImage Replication support for SI Licensed TB's Open Systems Copy on Write (CoW) can be included as an addition to the Base (BOS) configuration with additional In-System Replication support for IS (CoW) Licensed TB's.

WW-PS-ED90VMF-C $999,999.00 C N/A

Description:

Custom Mainframe (MF) services for ST9990V can be included as an addition to the Base (BOS) configuration depending on the Licensed MF software components ordered.

WW-PS-EDBOSV-C $999,999.00 C N/A

Description:

BOS Virtual for ST9990V can be included as an addition to the Base (BOS) configuration with additional Virtual Partition Manager support for more than 4 Virtual Partitions, service also includes support for Universal Volume Manager based on UVM Licensed TB's.

P-WW-PS-ED90BOSV-C $999,999.00 C N/A

Description:

BOS Virtual for ST9990V can be included as an addition to the Base (BOS) configuration with additional Virtual Partition Manager support for more than 4 Virtual Partitions, service also includes support for Universal Volume Manager based on UVM Licensed TB's.

P-WW-PS-ED90VBOS-C $999,999.00 C N/A

Description:

FOR RESELL/CO-DELIVER, IDO PARTNER PURCHASE ONLY: Sun Professional Services High End Disk Integration Service for ST9990V Basic Operating System (BOS) Custom configuration, Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions. >120 Tbs, >1024 LUNs, >80 dual host

connections.
P-WW-PS-ED90VBOS-L $49,500.00 E N/A
Description:
FOR RESELL/CO-DELIVER, IDO PARTNER PURCHASE ONLY: Sun Professional Services High End Disk Integration Service for ST9990V Basic Operating System (BOS) configuration, Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions Large Configuration- Up to 120 TB of Disk, Up to 1024 LUNs included, Up to 80 dual host connections.
P-WW-PS-ED90VBOS-M $36,000.00 E N/A
Description:
FOR RESELL/CO-DELIVER, IDO PARTNER PURCHASE ONLY: Sun Professional Services High End Disk Integration Service for ST9990V Basic Operating System (BOS) configuration, Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions Medium Configuration- Up to 70 TB of Disk, Up to 512 LUNs included, Up to 64 dual host connections.
P-WW-PS-ED90VBOS-S $27,000.00 E N/A
Description:
FOR RESELL/CO-DELIVER, IDO PARTNER PURCHASE ONLY: Sun Professional Services High End Disk Integration Service for ST9990V Basic Operating System (BOS) configuration, Includes Device Manager, Resource Manager, Server Priority Manager and Virtual Partition Manager support for up to 4 virtual Partitions Small Configuration- Up to 35 TB of Disk, Up to 256 LUNs included, Up to 32 dual host connections.
P-WW-PS-ED90VDP-C $999,999.00 C N/A
Description:
Dynamic Provisioning (DP) for ST9990V can be included as an additional feature of the Base (BOS) configuration with additional Dynamic Provisioning Licensed TB's.
P-WW-PS-ED90VDR-C $999,999.00 C N/A
Description:
Disaster Recovery for ST9990V can be included as an addition to the Base (BOS) configuration, includes TrueCopy Sync support for the appropriate TC Licensed TB's service can be combined with TrueCopy Sync as an addition to the Base (BOS) configuration with additional Universal Replicator support for UR Licensed TB's.
P-WW-PS-ED90VDRX-C $999,999.00 C N/A
Description:
Disaster Recovery Extended for ST9990V can be included as an addition to the Base (BOS) configuration with additional support for Universal Replicator 3 Data Center solution for Open Systems and Universal Replicator 4X4 for Mainframe, Network Assessment services should be included as well.
P-WW-PS-ED90VIS-C $999,999.00 C N/A
Description:
In-System Replication (IS) for ST9990V can be included as an addition to the Base (BOS) configuration with additional ShadowImage Replication support for SI Licensed TB's Open Systems Copy on Write (CoW) can be included as an addition to the Base (BOS) configuration with additional In-System Replication support for IS (CoW) Licensed TB's.
P-WW-PS-ED90VMF-C $999,999.00 C N/A
Description:
Custom Mainframe (MF) services for ST9990V can be included as an addition to the Base (BOS) configuration depending on the Licensed MF software components ordered.

Ordering Notes:
1

SunSpectrum Instant Upgrade 3yr, platinum service level recommended.

E. INTEGRATED STACK CONTENTS
N/A

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

Q4FY2005-162I June 17, 2005

SUN HARDWARE PRODUCT INTRO: Announcing Sun StorageTek(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 ST9985 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 ST9990 that is compatible in hardware, firmware and software where the full scalability of the ST9990 is not required.

13. AVAILABILITY TO ALL PARTNERS

The ST9985 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 ST9990

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

15. ORDERING PROCESS

The ordering process remains the same with these new ST9900 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 ST9900 products are not in Webdesk, they are in Partner Express.
Partner WebDesk?	N	The ST9900 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 ST9985s?

A. A partner should be qualified at the "Data Center" level before before committing to sell the ST9985. Please refer to the following URL:

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

Licensing Guidelines

This section covers licensing for a broad set of features associated with the ST9990V.

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 ST9990.

Section 1. How products are licensed on the ST9990V.

Note 1: Presented Capacity is effectively the Total Usable Capacity.

= [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 ST9990V or on an external device.

1. Features which are licensed based on ST9990V by Internal Capacity Only.

   1.1. Basic Operating System (BOS) Suite - pricing based on Internal Raw capacity for each 1TB increments

   1.2. HiCommand Tuning Manager – pricing based on internal raw capacity for each 1TB increments

   1.3. HiCommand Replication Monitor– pricing based on internal raw capacity for each 1TB increments

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

   2.1. Basic Operating System Virtualization(BOS-V) - pricing based on total external usable capacity attached to the ST9990V system for each 4TB increments

3. Features which are licensed based on ST9990 Internal and External Capacities.

   3.1. Use this guidance if this product is Raw Capacity based on a stand alone ST9990V.

   a) If No External Storage, then the capacity to be licensed equals the amount of ST9990 Internal Raw Only.

   b) If there is External Storage then the amount to be licensed equals ST9990V Internal Raw Capacity plus the Usable Presented Capacity from external devices.

   c) The list of products in this category are:

   - HiCommand Tiered Storage Manager – Internal: pricing based on internal raw capacity for each 1TB increments; External : pricing based on external usable capacity for each 4TB increments

4. Features which are licensed based on Usable Capacity

   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 ST9990V or on the external device.)

   b) The list of products in this category are:

   - Disaster Recovery Suite – pricing based on usable capacity for each 1TB increments
   - Disaster Recovery Suite Extended - pricing based on usable capacity for each 1TB increments
   - In-System Replication Suite - pricing based on usable capacity for each 1TB increments
   - Compatible FlashCopy version 2 - pricing based on usable capacity for each 1TB increments
   - Compatible PAV - pricing based on usable capacity for each 1TB increments

- Dynamic Provisioning - pricing and License capacity based on total usable capacity of volumes in the HDP pool, TB Qty ordered in 10TB, 20TB, 50TB and 100TB increments.
- Business Continuity Manager - pricing based on usable capacity for each 1TB increments
- Business Continuity Manager Extended - pricing based on usable capacity for each 1TB increments

4. Features which are licensed based on P-VOLs

- Protection Manager - pricing based on Total managed Primary Volumes (P-VOLs) and secondary volumes being protected by the Protection Manager Server for each 1TB increments up to 63TBs and in 4 increments up to unlimited capacity.

5. Features which are server based

- Dynamic Link Manager(SDLM) pricing per individual server up to a unlimited number of servers
- HiCommand Global Link Availability Manager(GLAM) - pricing based on 10 server Blocks

Section 2. Licensing in context of ST9990V vs the ST9990

First, here is what is new and different from the ST9990:

The BOS, BOS V, Disaster Recovery and Disaster Recovery Extended Suites are all new to the ST9990V.

Here is what is different about licensing on the ST9990V:

All the ST9990V Software is licensed in new licensing bands. Here is how the licensing tiers/bands work:

Trial License
Media Kit (formerly Base Kit)
Base license (Base charge for Software)
1) 1-5TB Band
2) 6-10TB Band
3) 11-25TB Band
4) 26-50TB Band
5) 51-100TB Band
6) 101-500TB Band
7) 501-2000TB Band
Instead of ordering Software in Incremental tiers at 1TB increments up to 63TBs and 4TB increments up to unlimited capacity, you now order ST9990V software within bands in increments of 1TB up to unlimited capacity.
.
For example:
Customer wants 15TBs
Customer purchases the base license price plus the cost per TB within band 3 above (11TB-25TBs).

Upgrade example:
Customer wants to acquire an additional 15TBs

The next 15TBs places customer in band 4 pricing (26TB-50TB)
Customer acquires the next 15TB at the cost per TB within Band 4

This benefits the customer and gives them a price break when ordering more TB's up front. When ordering SW for the ST9990 you paid more for the first TB tiers and as you moved through the tiers the price per TB decreased. Now with these licensing bands your customer sees the price break per TB as they move up the bands, so they save more money the higher the band they fall into.

II. Software Transfer Program (Technology Upgrades) between ST9990V and other ST9900 Family products such as the ST9990, ST9985, ST9980, ST9970, ST9960, ST9910.*

There is currently *NO* Software Transfer Program to the ST9990V from other members of the ST9900 Family such as the **ST9990, ST9985, ST9980, ST9970, ST9960, ST9910 at this time**.

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

Competitive Comparison

For competitive information, please visit the following URL:

http://wikihome.sfbay.sun.com/Storage-Intelligence/Wiki.jsp?page=Disk#section-Disk-DatacenterDiskCompetition

Frequently Asked Questions

Q.

How many models of the ST9990V are there? Are there separate "Pricing Reference Points" like there was on the ST9990?

A.

There is only one model of the ST9990V

Unlike the ST9990, the ST9990V is available in one model only and there are no "Pricing Reference Points". This, along with the packaging and configuration enhancements offered, allows our customers to better tailor the system to their specific business needs. The ST9990V has more granular configuration options than its predecessor. For example, more Front End Directors and Back End Directors are available in smaller increments, allowing the customer to purchase only what they need. It also greatly improves serviceability since smaller increments of system resources are affected by any service action. Some of the other architecture enhancements include:

- Aggregate internal bandwidth increased from 81GB/sec to 106GB/sec
- Performance increased from 2.5M IOPS to 3.5M IOPS
- Replication IOPS increased 2X
- External Storage IOPS increased 6X

- Replication Products support more pairs, more volumes etc.
- The number of LDEVs per system increased to 64K for both Open systems and mainframes
- 4GB/sec end-to-end (Front End Directors, Disks, and Back End Directors)
- FICON External Storage attachment is planned for late 2007
- Fibre Channel Front End Directors in increments of either 8 or 16 instead of 16 or 32
- ESCON Front End Directors in increments of 8 rather than 16
- FICON directors available in increments of 8, rather than 8 or 16
- Number of FC ports have been instreased from 192 to 224
- Number of FICON and ESCON ports has been increased from 96 to 112 for both

Q.

How is the Service Processor (SVP) configured in the ST9990V?

A.

The ST9990V does not come equipped with a laptop, which in the past has been referred to as a Service Processor or SVP. Instead, service personnel will be expected to provide their own PC type of device to interface to the ST9990V for maintenance purposes.

A ST9990V will come initially with a SVP blade embedded in a control frame. It has similar capabilities to the SVP used in the ST9990. A second SVP blade may be embedded for redundancy purposes. It is recommended that customers take advantage of SVP redundancy by purchasing a second SVP.

Q.

What are Back End Directors and Front End Directors?

A.

The same nomenclature used with the ST9990 with respect to Channel Host Adapters (CHA) and Array Control Processors (ACPs)/Disk Adapters (DKAs) is still used on the ST9990V. Redundant pairs of CHA are referred to as "Front End Directors" (FED) and Redundant Pairs of ACP/DKA are referred to as "Back End Directors" (BED). Note: For clarification, the terms "ACP" and "DKA" are synonymous.

Q.

Will the 100% Data Availability Guarantee be available the ST9990V?

A.

Yes, the 100% Data Availability Guarantee will again be available for the ST9900V as it has been for the last 3 generations of ST9900 product.

Q.

Can I attach the new disk array frames and disks for the ST9990V to my existing ST9990, ST9985, ST9960, ST9970, ST9980 control frame?

A.

No. The new disk array frames are only supported on the ST9990V control frame. The new ST9990V are not backward compatible with ST9990, ST9985, ST9960, ST9970, ST9980. However, you can virtualize existing ST99X0 Systems behind the ST9990V system.

Q.

How are storage system trade-in values determined?

A.

Sun works with customers on a case-by-case basis to understand a customer's current book value coupled with market values for older systems. Sun's upgrade sales reps then determine the appropriate value for the storage devices being traded for the ST9900. This amount can be used to purchase additional migration services or more storage capacity thereby extending the purchase budget.

Q.

How can Sun help me with the migration and ongoing support of the ST9990V?

A.

Sun Professional Services can assist the customer in optimizing storage investments and improving your operating efficiencies in the data center. Sun storage consultants can help the customer implement a comprehensive data migration plan that mitigates risk and ensures a smooth, prompt and uninterrupted transition to new storage equipment. Sun can also help implement TrueCopy and ShadowImage software for specific customer environments. Other relevant Storage Services include:

The following optional technical services are available:

-SAN Architecture and Implementation
-Data Migration and Replication
-Storage Assessment
-Capacity Planning
-Performance Tuning

The following optional business services are available:

-Storage Total Cost of Ownership (TCO)
-Enterprise Continuity

Q.

Are the hard disk drives used in the ST9960, ST9910, ST9980, ST9970, ST9985 and ST9990 the same as those used in the ST9990V?

A.

No. Hard disk drives from ST9960, ST9910, ST9980, ST9970, ST9985 and ST9990 cannot be used in a ST9990V.

Q.

What is the maximum of hard disk drives (HDDs) and Spares in a ST9990V?

A.

	HDDs	Spares
ST9990V	1152	16

Q.

How many Logical Devices(LUNS) does a ST9990V support?

A.

65,536 Logical Devices for both OPEN and z/OS.

Q.

What is "Control Cache"?

A.

"Shared memory" is now known as "Control Cache".

Q.

How many ports are dedicated to internal storage?

A.

32 ports are dedicated to internal storage.

Q.

How many ports are available in the Sun StorageTek 9990V Fibre Channel 8-Port and Sun StorageTek 9990V Fibre Channel 16-Port Front End Directors?

A.

The reason this question is asked is that the high availability architecture and nomenclature of this system can be confusing.

There are two front end directors available, one 8-port and one 16-port.

The Fibre Channel 8-Port Front End Director for Short Wavelength 1-4Gbps includes 2 channel adapter PCBs each with 4 fibre channel ports. All 8 FC ports with Fibre SFPs for Short wave, may be replaced with DKC-F610I-1FL for longwave. Short or long wave SFPs may be installed on same channel adapter. 8 sets(64ports) can be installed in CHA slot, a maximum of 8 sets can be installed in DKA slot, making 16sets(128ports) total installed.

The Fibre Channel 16-Port Front End Director for Short Wave 1-4Gbps includes 2 channel adapter PCBs each with 8 FC ports. All 16 FC ports come with Fibre SFPs for Shortwave, may be replaced with DKC-F610I-1FL for long wave. Short or long wave SFPs may be installed on the same channel adapter. 8 sets(128 ports) can be installed in CHA slot, a maximum of 8 sets can be installed in DKA slot, making 16 sets(256 ports) installed.

Q.

How many hard disk drives can be contained in an ST9990V Integrated Disk Controller Unit?

A.

128 hard disk drives.

Q.

How many hard disk drives can be contained in an ST9990V Disk Array Frame Unit?

A.

256 hard disk drives.

Q.

What software is included within the ST9900 BOS and BOS V Suite Software? Does it replace these products?

A.

* ST9900 Basic Operating System (BOS) Suite replaces Device & Resource Manager Suite
  - Includes Device Manager and Resource Manager Suite
  - Includes Virtual Partition Manager with support for up to 4 partitions
  - Includes Server Priority Manager
* ST9900 BOS Virtual Suite (BOS V)
  - Includes Universal Volume Manager
  - Includes Virtual Partition Manager for more than 4 partitions

Sun StorageTek 9900 Basic Operating System (BOS)- This suite was created to deliver the storage return on investment, security, and quality of service to applications that your organization requires. And the Basic Operating System Virtualization software enables the ST9990V's embedded virtualization capabilities and allows customers to take advantage of storage management and data mobility capabilities within a single system or across an entire heterogeneous storage pool. Using Basic Operating System, one administrator can manage an entire storage infrastructure from a single pane of glass or you can choose to designate multiple storage administrators who can optionally manage only a particular set of storage resources that is made accessible to them.

Sun StorageTek 9900 BOS Virtual (BOS V) - The BOS V is an upgrade to the BOS and adds Unique ability to virtualize externally attached storage subsystems to the ST9990V system creating a single heterogeneous pool of tiered storage. This enables simplified storage management, increases utilization, increases efficiency, improves service levels, simplifies data migration and helps meet compliance demands. The with the BOS V Virtual Partitions are expanded - up to 32 storage and 32 cache partitions.

Q.

Is installation included in the price of Sun StorageTek 9990V System?

A.

ST9990V product purchase includes Sun StorageTek(SM) 9990V Installation Service, (9990V 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/

StorageTek 9990V product purchases sold for installation into existing ST9990V 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.

ST9990V Installation does not include the installation of optional third-party SAN components. Installation of optional third-party SAN components may involve additional charges.

ST9990V 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 StorageTek 9900 Series for implementation services that go beyond the basic installation provided by 9900 Installation.

*If installation is performed outside of normal business hours, for customers in all geographies, the customer should be charged a separate line item charge for the following part: EIS-9900-E-AH . The extra charge for after-hours installations applies to initial controller base charge only, and must be ordered in conjunction with each 4 disk after hours installation service (EIS-9900-4DISKE-AH).

Q.

What languages will the ST9900 series software products in this announcement support?

A.

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

Q.

What level of software warranty/support comes standard with the purchase of ST9900 Series software?

A.

A Standard software warranty comes with the purchase of the ST9900 series software. This warranty covers 90 day defective media replacement only. To take advantage of ST9900 series software free updates and upgrades, customers must purchase the appropriate Sun S4 Maintenance contract. The recommended level of support for this product is Premium.

For more information regarding Sun Software support, please visit the following URL:

http://www.sun.com/service/support/software/index.html

Q.

Are there standard and high performance Back End Directors?

A.

No. There is only one type of Back End Director, and it has one microprocessor per Fibre Channel Loop.

Q.

Is Dynamic Provisioning and Optional Feature and does a customer have to implement it on the whole ST9990V system?

A.

Yes, Dynamic Provisioning is an Optional Feature. Customer can configure it as needed. It supports:
* 1 to 32 Dynamic Pools per ST9990V
* 1 to 4096 Thin Provisioned LUNs (volumes) per pool
* 8GB to 2.0TB per Pool LDEV
* 8GB to 286TB maximum aggregate Pool size

Q.

Will the ST9990V support the same external storage devices as the previous ST9990?

A.

Yes, all external storage currently supported on the ST9990 will be supported at General Availability of the ST9990V. At the end of 2007 (CY), External FICON support will be added to provide FICON based storage mainframe virtualization

Q.

What new software was announced for ST9990V?

A.

Sun StorageTek 9900 Dynamic Provisioning software allows customers to allocate "virtual" disk storage based on their anticipated future needs, but with less physical disk initially required. Additional physical disks can be purchased later and installed transparently without an application service interruption. The primary benefits of Dynamic Provisioning are:

1. Elimination of application service interruptions that are normally required to install new disk capacity. Because the application only sees the amount of ?virtual capacity? that is allocated to it, additional physical disk capacity can be installed when needed, without interruption.

2. Simplified administration by reducing the impact of volume creation and volume formatting associated with the installation of physical disk capacity

3. Improved performance and virtually automatic tuning and avoidance of performance ?hot spots? because I/O activity is spread across a large number of disk devices in the Dynamic Provisioning software?s shared pool of disks.

4. Reduced Total Cost of Ownership (TCO) by deferring some portion of storage acquisitions to a later date. Over an extended period of time the storage acquisition costs will be reduced by the use of Dynamic Provisioning and improved storage utilization.

5. Reduced Power and Cooling requirements due to fewer physical disks required.

The Sun StorageTek 9900V is the first and only enterprise storage to support both virtualization and thin provisioning. ST9900 Dynamic Provisioning software is not unique in the industry, but at this moment in time neither EMC, nor IBM has delivered a thin provisioning solution. Network Appliance is the only major storage vendor with thin provisioning. 3parDATA and some smaller niche players also have a thin provisioning offering.

The other existing ST9900 software products that customers already know and trust have also been scaled beyond the limits of the prior generation ST9990 system. Many of the replication products now support more pairs per system, more consistency groups, and higher performance. This allows them to extend the value across the entire ST9900 product line and other vendors' products when virtualized and all centrally managed from a single pane of glass with ST9990V's embedded virtualization.

Q.

Does ST9900 Dynamic Provisioning software inter-operate with all other ST9900 software?

A.

Like any other new software, features and enhancements will be delivered in a phased release over time. The initial release of Dynamic Provisioning software contains the basic function required to allow customers to begin using and testing it so that they can get familiar with its behavior and benefits. Not all of the replication products are supported in the first release and certain

other product support will be added later, including support for externally attached storage. software products.

Q.

How is ST9900 Dynamic provisioning software licensed to the customer?

A.

ST9900 Dynamic Provisioning software allows the customer to create "virtual volumes" that have a relationship to a shared pool of physical disks. The customer can purchase Dynamic Provisioning software based on the usable capacity of the physical disk pool(Aggregate usable dynamic pool capacity). The size of the virtual volumes has no direct effect on the license charge. In addition to a very modest "Base License Charge" that includes the first 10TB of pool capacity, Dynamic Provisioning software is sold in fixed blocks of capacity as follows:
* Base License Charge + first 10TB included
* 10TB additional
* 20TB additional
* 50TB additional
* 100TB additional
* >110TB to frame capacity

Example: Customer wants 30TBs of ST9900 Dynamic Provisioning Software capacity for initial testing and evaluation. Customer purchases the Base license with 10TB + they purchase an additional 20TB "block" for a total of 30TBs. Later they can add capacity in the fixed increments or "blocks" that are shown above, i.e. in 10TB, 20TB, 50TB etc. capacity upgrades.

Q.

Why did we create new software suites (bundles) with the ST9990V and what are they?

A.

The new software suites (bundles) were created to simplify the sales process, create new pricing structure that is easier to understand, reduce the installation and maintenance procedures for both our customers and sales personnel and increase customer satisfaction while providing them more value. The goal was to price the new software suites below the cost of the individual products if purchased separately. We also intend to reduce the number of license keys per software bundle to one license key to greatly simplify installation and maintenance. Initially there may be as many as two keys for some of the suites. The new software suites available only on the ST9990V are:

* ST9900 Basic Operating System software (BOS) includes ST9900 Device Manager Software, all ST9900 Resource Manager Software components,

ST9900 Server Priority Manager Software, and ST9900 Virtual Partition Manager Software with support for up to 4 storage partitions. The entire software package can be installed with one license key and it is priced lower than the sum of the individual products. Licensing is based on Internal Raw Capacity only.

* ST9900 Basic Operating System V software (BOS V) requires ST9900 Basic Operating System Software (BOS) as a pre-requisite and contains ST9900 Universal Volume Manager Software and ST9900 Virtual Partition Manager Software for more than 4 partitions. Basic Operating System V software is licensed by the attached external storage usable capacity only

* ST9900 Disaster Recovery Software (Only use this for replication solutions that involve a maximum of 2 datacenters). It includes ST9900 Remote Replication Synchronous Software and ST9900 Universal Replicator Software for both Open Systems and Z/OS mainframes.

* ST9900 Disaster Recovery Extended Software - Customer must have ST9900 Disaster Recovery Software installed as a pre-requisite. It consists of ST9900 Universal Replicator with advanced function which includes the 3 Datacenter capabilities for both Open Systems and z/OS mainframes and the 4x4 function for z/OS mainframes only.

* ST9900 In-System Replication Software ? Consists of ST9900 In-System Replication software for Open Systems and z/OS Mainframes, and Copy-On-Write software for Open Systems only.

* ST9900 Compatible FlashCopy software ? Consists of ST9900 Compatible FlashCopy Version 2 software.

Q.

Exactly what products are contained in the ST9900 Basic Operating System software bundle?

A.

By providing a powerful unified toolset for managing ST9900 storage environments, ST9900 Basic Operating System and ST9900 Basic Operating System V software unifies and simplifies storage tasks. The following products are contained in the ST9900 Basic Operating System software:

* ST9900 Device Manager for Windows, Solaris and Linux
* ST9900 Provisioning Manager for Windows, Solaris and Linux
* ST9900 Virtual LVI/LUN (VLL) software
* ST9900 LUN Management software
* ST9900 Cache Residency software for z/OS
* ST9900 Cache Residency software
* ST9900 Virtual Partition Manager software enabled for up to 4 partitions
* ST9900 Performance Monitor software
* ST9900 Volume Security software
* ST9900 Data Retention software for z/OS

* ST9900 Data Retention software
* ST9900 Volume Port Security software
* ST9900 Volume Shredder software
* ST9900 Storage Navigator software
* ST9900 SNMP API
* ST9900 JAVA API
* ST9900 Database Validator software
* ST9900 Server Priority Manager software

Q.

How do I order the other ST9900 software products that are not contained in the bundles?

A.

All of the other existing ST9900 software can continue to be ordered as individual products with the following exceptions:

* ST9900 Compatible XRC software. Universal Replicator Software is our strategic product for asynchronous remote replication. We will continue to fully support existing XRC customers, but we want to encourage new customers to use Universal Replicator software

* ST9900 Volume Migration software. ST9900 Tiered Storage Manager software is our strategic product for data migration. We will continue to fully support existing Volume Migration software customers, but we want to encourage new customers to use ST9900 Tiered Storage Manager software

* ST9900 Remote Replication software. ST9900 Universal Replication Software is our strategic product for asynchronous remote replication. We will continue to fully support existing ST9900 Remote Replication Asynchronous software customers, but we want to encourage new customers to use ST9900 Universal Replication software.

Q.

How does the ST9990V add value to the ST9900 Storage Management software story?

A.

Sun Data Systems storage management software benefits are based upon one common management software interface. Rather than provide end-users with disparate interfaces for disparate platforms, essentially resulting in multiple islands of storage, Sun provides customers with the same software, the same management interfaces, and the same key tools to manage all of ST9900 storage systems from a single console. Through the standards-based ST9900 Storage Management Software portfolio, customers can manage a broad range of heterogeneous storage devices. The ST9990V builds on this by allowing

storage to be attached, pooled/virtualized and managed.

Q.

Will all current ST9900 software products work on the ST9990V?

A.

Yes they will all work with the same functionality that existed on the ST9900.

Q.

What is the maximum internal and external capacity of the ST9990V?

A.

At its introduction the ST9990V supports a raw internal capacity of 332TB. It's external (virtualized) capacity is 247PB.

Q.

What hard disk drives are supported?

A.

At introduction, internal storage supports 72GB 15K RPM, 146GB 15K RPM and 300GB 10K RPM disk drives with 300K 15K RPM disk drives planned in the fourth calendar quarter of 2007.

Q.

How much cache does the ST9990V have?

A.

At introduction, the ST9990V supports 256GB of Data Cache and 32GB of Control Memory. Data Cache will expand to 512GB by 1QCY2008 with even higher capacity planned in the future.

Q.

In the ST9990 we had the capability to use BED slots for additional front end ports. Does this capability exist in the ST9990V also?

A.

Yes. There are 8 Front End Director slots and an additional 6 Front End Directors can be installed in a Back End Director slot.

Q.

What host connectivity is supported?

A.

ESCON, FICON, and Fibre Channel connectivity is available at General Availability. NAS High and iSCSI support is not available at GA, but is planned for the future.

Q.

Will the ST9990V replace the ST9990 imediately?

A.

Both the ST9990V and current ST9990 will co-exist for a period of time. The ST9990 system will be orderable as a new manufactured product for 12 months beyond the introduction of the ST9990V. Furthermore, the ST9990 systems will continue to be supported for at least another 5 years.

Q.

If the ST9990V supports 224 Fibre Channel ports, why does my customer need a SAN?

A.

In relatively simple environments where the ST9990V is the primary or only storage device, the customer may not need a SAN and will be perfectly well served by attaching his servers directly to the ST9990V. However, most opportunities for ST9990V sales will probably involve relatively complex environments with multiple connections, other storage devices that are not attached to the ST9990V, shared SAN-attached tape libraries, FC to IP protocol conversion for long-haul data transmission, and third party software that must address a variety of devices. In those more complex environments a SAN is usually the best way to solve the customer?s connectivity and management issues.

Q.

Should a failure occur on a non-ST9900 disk attached to the ST9990V, how is the failure reported and who is responsible for repair?

A.

The ST9990V will detect any error associated with the external device and will generate the appropriate message to the Host. The ST9990V

will also generate a service call through HiTrack and, in case of ST9900 devices, will be able to provide a comprehensive set of information related to the possible nature of the failure. For non-ST9900 devices, the ST9990V will be able to provide basic information but will not be able to report specific FRU (Field Replacement Unit) information. The externally attached device must have its own call-home facility enabled through which the maintenance provider will be able to collect the necessary service information. Sun does not assume responsibility for maintaining third party devices externally attached to a ST9990V.

The ST9990V appears as a Windows Host to the externally attached device, which is similar to the way many other devices are normally connected to both ST9900 and third party systems. Thus a ST9990V attachment should not have any impact on third party maintenance agreements.

Q.

How is Dynamic Provisionining Software Licensed and Priced?

A.

Dynamic Provisioning Software is based on the usable capacity Dynamic Provisioning Pool size. You do not need to license Data Provisioning (HDP) for the whole system amount, only the amount needed (Used Capacity).

Q.

Is Dynamic Provisioning software supported on existing ST9990/85 products?

A.

No, Dynamic Provisioning Software (and thin provisioning functionality) is only supported on the new ST9990V platform.

Q.

Does Dynamic Provisioing work with z/OS

A.

No, Dynamic Provisioning is for Open Systems only supporting OPEN-V

Q.

Where can I get even more information on the ST9990V?

A.

For more and up to date information, please visit the following external product page:

http://www.sun.com/storagetek/disk_systems/data_center/9990v

Support Services

Sun StorageTek Service Support Offerings

The Sun StorageTek Service℠ 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 Sun StorageTek Service program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ Operating Environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the Sun StorageTek Service 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.

Sun StorageTek Service 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 Sun StorageTek Service contract. For more information on the Sun StorageTek Service program offerings refer to the following URL:

`http://www.sun.com/service/storageplans/index.xml`

The Gold/Platinum levels of Sun StorageTek Service support contracts are outlined below.

Sun StorageTek Service Program Support

Program	Description
Mission-Critical Sun StorageTek Service Platinum℠ 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 Sun StorageTek Service Gold℠ 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.

Sun StorageTek Service Instant Upgrades

Where available, customers will be able to upgrade the enhanced warranty offering to a Sun StorageTek Service 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 StorageTek 9990V:

Part Number	Description
W9D-T12-990V-3P	Sun StorageTek 9990V System Upgrade to 3 Years of Platinum Support
W9D-T12-1DSK-3P	Sun StorageTek 9990V System Disk Drive Upgrade to 3 Years of Platinum Support

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

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. 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
- Sun StorageTek Service 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 StorageTek 9990V, 9990, 9985, 9980 and 9970 systems. This does not include third-party switch, director or HBA products. These products, while related to the StorageTek 9900 Series products, have standalone product support information (warranty, W9D parts and pricing, installation policy, Sun StorageTek Service pricing, etc.) that are unique to each of these products.

```
The official Sun StorageTek 9990V warranty statements are
maintained at Sun's external web site at

www.sun.com/service/support/warranty

Sun warranty on Sun StorageTek 9900 Series including ST9990V
system currently includes an enhanced warranty with:

   3 years coverage
   7 x 24 Same Day 4-hour* on-site response
   7 x 24 Phone Support.
   *average response times.

All Sun StorageTek 9900 Series hardware components, disk groups,
disk spares, port interface boards, disk frames, etc., receive the
remaining warranty term of the ST9990 controller unit to which they
are attached.  The maximum warranty period of any given controller
unit is 3 years.

If non-controller unit components are purchased from Sun and attached
to an existing installed control unit, the warranty period of the
controller unit is not affected.  The warranty period of the
non-controller unit new components assumes the remaining warranty
period of the attached controller unit.
```

Installation Information

Summary of installation charges for initial install and add on upgrades

StorageTek 9990V :

For customers outside of United States:

Installation Charge	Normal Business Hour	After Hour
Base Charge	No charge, included with product purchase	Extra charge required. Order EIS-9900-E-AH per event.
4 Disk charge	No charge, included with product purchase	Extra charge required Order EIS-9900-4DISKE-AH

For customers in United States:

Installation Charge	Normal Business Hour	After Hour
Base Charge	No charge, included with product purchase	Extra charge required. Order EIS-9900-E-AH per install event
4 Disk charge	No charge, included with product purchase	Extra charge required. Order EIS-9900-4DISKE-AH

StorageTek 9990V product includes Sun StorageTek (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 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/

StorageTek 9990V product purchases sold for installation into existing 9990V systems, i.e. incrementally-sold single drives, 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 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 StorageTek 9900 Series for implementation services that go beyond the basic installation provided by 9900 Installation.

Sun StorageTek 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 StorageTek 9990V components

[1] If installation is performed outside of normal business hours, for customers in all geography's, the customer should be charged a separate line item charge for the following part: EIS-9900-E-AH for base controller and EIS-9900-4DISK charge per number of 4 drive groups.

Connect subsystem to host server(s)[2]

Power up and verify functionality (diagnostic level.)

Install remote console components into customer-supplied workstation

Connect service processor to customer phone line.

Install Sun StorageTek 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 StorageTek 9900 Remote Response with remote support center

System Turnover

Installation review and customer sign off

Provide system reference documentation

[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.

Basic installation does not 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 WWWW (What Works With What) matrix is posted at http://sejsc.ebay/ `or -SunWIN Token # 385413`

Sun StorageTek Service Instant Upgrade (W9D) and Sun StorageTek 9900 Remote Response

Where available, customers will be able to upgrade the enhanced warranty offering to a Sun StorageTek Service 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.)

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

Questions and Answers

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

A. StorageTek 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 WWWW 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 WWWW matrix. Sun does not provide third-party host server break-fix warranty or contract support.

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

A. Sun currently sells Brocade and McData switch and director products as external SAN interconnect in support of StorageTek 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 WWWW 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 WWWW 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 and MainFrame Operating Systems. The nature of this support expertise includes single path interoperability, dual path fail-over involving the Sun StorageTek 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.

Q. How does Sun Support Services provide a compelling reason to repeatedly choose Sun StorageTek 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, installation support, and post-sales engineering support for product configurations via Sun Storage Technical Service Centers. These centers also provide a means to coordinate the receipt and problem resolution as part of Sun Remote Services for proactive, and preventive support.

Sun Support Services provides Sun StorageTek customers with exclusive access to the Sun StorageTek Joint Support Center. The StorageTek 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 StorageTek 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. Sun StorageTek Service 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 StorageTek 9900 customers have access to the Sun StorageTek 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 Sun StorageTek Service Gold and Platinum customers have access to SunVIP and VOS JEC (VERITAS Oracle Sun Joint Esc1STtion Center.)

StorageTek 9990V Warranty Upgrade Part Numbers and Descriptions

StorageTek 9990V Controller

PART NUMBER	NOTE(S)	
W9D-T12-990V-1P	1,2	StorageTek 9990V CONTROLLER UPGRADE TO 1 YEAR OF PLATINUM SUPPORT.
W9D-T12-990V-2P	1,2	ST9990V CONTROLLER UPGRADE TO 2 YEARS OF PLATINUM SUPPORT.
W9D-T12-990V-3P	1,2	ST9990V CONTROLLER UPGRADE TO 3 YEARS OF PLATINUM SUPPORT.

StorageTek 9990V Disk

W9D-T12-1DSK-1P	1,2	ST9990V DISK UPGRADE TO 1 YEAR OF PLATINUM SUPPORT.
W9D-T12-1DSK-2P	1,2	ST9990V DISK UPGRADE TO 2 YEARS OF PLATINUM SUPPORT.
W9D-T12-1DSK-3P	1,2	ST9990V DISK UPGRADE TO 3 YEARS OF PLATINUM SUPPORT.

Ordering Notes

1) Order quantity "1" of 1-, 2-, or 3-year W9D part number for StorageTek 9990V controller unit, plus quantity "n" of same term W9D part number for StorageTek T10-1DSK, where "n" equals the number of disks being configured.

2) The W9D part numbers for control unit and disk groups cover the StorageTek 9900 subsystem warranty upgrade, including all other StorageTek 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.

Sun Educational Services

Sun StorageTek 9990V Differences (IESHDS-450)

The ST9990V System represents an evolution of the current ST9990 products. The ST9990V surpasses the performance, capacity, and scalability of the current product line, delivers thin provisioning, and extends the capabilities of the market-leading controller-based virtualization platform, while minimizing impact on current Data Center operations. The target audience needs to be able to install, configure and troubleshoot the new ST9990V storage array.

A 2 day ST9990V differences course will give the Support audience the chance to install, configure and troubleshoot the new array before being in front of a customer.

Course Name: Sun StorageTek 9990V Differences from the Sun StorageTek 9990
Course Number: IESHDS-450
Course Duration: 2 Days

This course will cover the features, functions and hardware improvements from the StorageTek 9990 and 9985 to the Sun StorageTek 9990V. This course will provide the students with the ability to install, configure and administer the Sun StorageTek 9990V. Experience on the Sun StorageTek 9990 or 9985 is a requirement prior to attending this training.

Participants must already have a good working knowledge of the SE9990/9985 subsystem appropriate to their job responsibilities. As this course focuses primarily on differences, it will make frequent reference to existing products and assume an existing knowledge of the SE9990/9985 architecture, existing component layout, established procedures and product features.

The StorageTek 9990V Differences classes will begin early June and continue past GA for all Geos.

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Sales and Pre-Sales Training
The following Sales and Pre-Sales Technical courses will be available in the next month.

Audience -
  Sales WZO-1506 StorageTek 9900 Series Sales Essentials ?
  1 hour Web-based   Available 6/22/07 Register at Sun LMS via myHR

Audience -
  Pre-Sales Technical WZO-1507 StorageTek 9900 Series Technical Essentials - 3 hour Web-based Available 7/12/07 Regester at Sun LMS via myHR

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

http://www.sun.com/training/

Sun Professional Services

Sun StorageTek 9990V Implementation Service

The Storage and Data Management Practice supports the release of J3 (SE 9990V).

For the ST9990V, Sun Support Services will deliver Professional Services relating to the installation, and implementation of a complete data management solution. Professional Services will be responsible for the pre-sales assessment, architecture and design of these solutions. Implementation services are price listed for the ST9900 product line and will be available for the ST9990V.

Sun Services delivers a number of new services built around the software capabilities of the ST9900V. Implementations are available for the Base Operating System, Disaster Recovery, Disaster Recovery Extended, In-Service Replication, Dynamic Provisioning and Mainframe Software, for both Open Systems and mainframe environments.

Installation

Planning for Installation and Operation

This chapter provides information for planning and preparing a site before and during installation of the Hitachi ST9990V. Please read this chapter carefully before beginning your installation planning. Figure 4.1 shows a physical overview of the ST9990V.

- User Responsibilities and Safety Precautions
- Dimensions, Physical Specifications, and Weight
- Service Clearance, Floor Cutout, and Floor Load Rating Requirements

1. Electrical Specifications and Requirements for Three-Phase Subsystems
2. Electrical Specifications and Requirements for Single-Phase Subsystems
3. Cable Requirements
4. Channel Specifications and Requirements
5. Environmental Specifications and Requirements
6. Control Panel
7. Open-Systems Operations

If you would like to use any of the ST9990V features or software products (for example, Hitachi TrueCopy, 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 DKC510I/DKU505I (ST9990V) 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 ST9990V installation, please contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center.

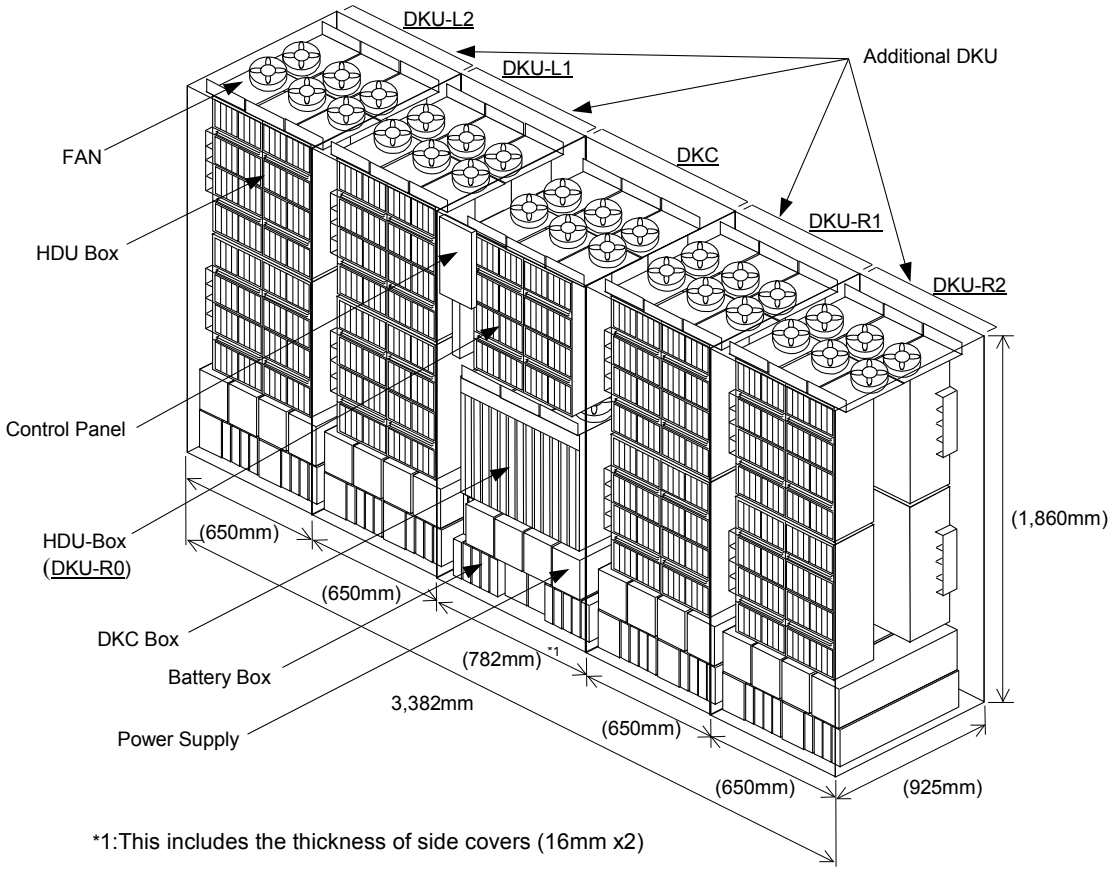


Figure 4.1 Physical Overview of Universal Storage Platform V

User Responsibilities and Safety Precautions

Before the ST9990V 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
- Connectors and receptacles
- Air conditioning
- Floor ventilation areas (recommended but not required)
- Cable access holes

- LAN connection (or RJ-11 analog phone line) for Hi-Track support

Safety Precautions

For safe operation of the ST9990V disk subsystem, please observe the following precautions:

- WARNING: Do not touch areas marked “HAZARDOUS”, even with the power off. These areas contain high-voltage power.
- Use the subsystem with the front and rear doors closed. The doors are designed for safety and protection from noise, static electricity, and EMI emissions.
- Make sure that all front and rear doors are closed before operating the subsystem. The only exceptions are during the power-up and power-down processes.
- 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 sides or bottom of the frames (air inlet), or on top of the frames (air outlet). This interferes with the flow of cooling air.
- 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, please report the exact circumstances surrounding the problem and provide as much detail as possible to expedite problem isolation and resolution.

Dimensions, Physical Specifications, and Weight

shows the physical dimensions of the Hitachi ST9990V (ST9990V). lists the physical specifications for the disk controller (DKC) components of the ST9990V. lists the physical specifications for the disk array unit (DKU) components of the ST9990V.

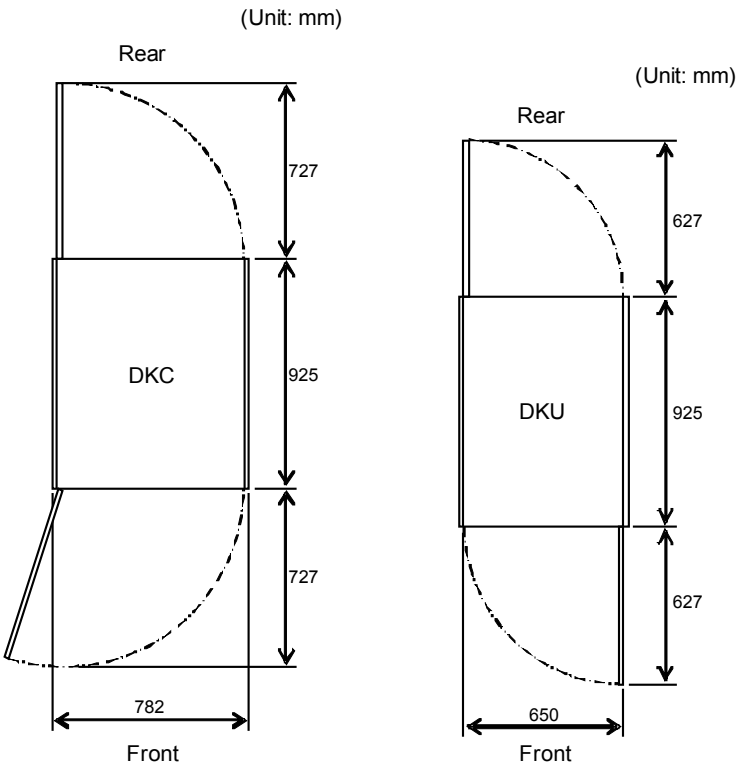


Figure 4.2 DKC and DKU Physical Dimensions for the Universal Storage Platform V

Table 4-2 DKC Component Specifications: Weight, Dimensions

No	Model Number	Weight (kg)	Dimension (mm)		
			Width	Depth	Height
1	DKC610I-5	386.0	782 *1	925	1,920
2	DKC-F610I-DH	90	—	—	—
3	DKC-F610I-DS	90	—	—	—
4	DKC-F610I-3PS	4.3	—	—	—
5	DKC-F610I-3EC	2.8	—	—	—
6	DKC-F610I-3UC	4.9	—	—	—
7	DKC-F610I-1PS	4.0	—	—	—
8	DKC-F610I-1EC	2.8	—	—	—
9	DKC-F610I-1UC	4.7	—	—	—
10	DKC-F610I-1PSD	4.3	—	—	—
11	DKC-F610I-1ECD	2.8	—	—	—
12	DKC-F610I-1UCD	4.7	—	—	—
13	DKC-F610I-APC	12	—	—	—
14	DKC-F610I-AB	14	—	—	—
15	DKC-F610I-ABX	36	—	—	—
16	DKC-F610I-CX	2.2	—	—	—
17	DKC-F610I-C4G	0.08	—	—	—
18	DKC-F610I-C8G	0.08	—	—	—
19	DKC-F610I-SX	1.2	—	—	—
20	DKC-F610I-S2GQ	0.08	—	—	—
21	DKC-F610I-S4GQ	0.08	—	—	—
22	DKC-F610I-CSW	1.8	—	—	—
23	DKC-F610I-DKA	2.6	—	—	—
24	DKC-F610I-SVP	4.1	—	—	—
25	DKC-F610I-PCI	0.3	—	—	—
26	DKC-F610I-R1DC	4.4	—	—	—
27	DKC-F610I-R1UC	5.7	—	—	—
28	DKC-F610I-L1DC	4.3	—	—	—

29	DKC-F610I-L1UC	5.8	—	—	—
30	DKC-F610I-MDM	0.07	—	—	—
31	DKC-F610I-8S	2.7	—	—	—
32	DKC-F610I-8MFS	3.0	—	—	—
33	DKC-F610I-8MFL	3.0	—	—	—
34	DKC-F610I-8FS	2.8	—	—	—
35	DKC-F610I-16FS	3.0	—	—	—
36	DKC-F610I-8IS	2.4	—	—	—
37	DKC-F610I-1FL	0.02	—	—	—
38	DKC-F610I-1FS	0.02	—	—	—

Notes:

- This includes the thickness of side covers (16 mm × 2).
- These options can be used for both of the DKC510I and DKU505I.
- This is common to the option installed in DKC460I (Lightning 9900V). For use on DKC510I (ST9990V), bundle the extra cable.

Table 4-3 DKU-F605I physical specifications

No	Model number	Weight (kg)	Heat Output	Power Consumption	Dimension (mm)			Air Flow (m^3/min.)
			(kW)	(kVA)	Width	Depth	Height	
1	DKU-F605I-18	324	0.601	0.62	650	925	1,920	32
2	DKU-F605I-DH	40	—	—	—	—	—	—
3	DKU-F605I-DS	40	—	—	—	—	—	—
4	DKU-F605I-AKT	37.7	0.291	0.3	—	—	—	—
5	DKU-F605I-EXC	2.8	—	—	—	—	—	—
6	DKU-F605I-72KS	0.9	0.020	0.021	—	—	—	—
7	DKU-F605I-146KS	0.9	0.020	0.021	—	—	—	—
8	DKU-F605I-300JS	0.9	0.020	0.021	—	—	—	—

Service Clearance, Floor Cutout, and Floor Load Rating Requirements

This section specifies the service clearance requirements (a + b) for the ST9990V based on the floor load rating and the clearance (c).

- Figure 4.3 shows the service clearance and floor cutout for one frame (DKC only, no DKUs). Table 4-4 shows the floor load rating requirements for this configuration.
- Figure 4.4 shows the service clearance and floor cutouts for two frames (one DKC, one DKU). shows the floor load rating requirements for this configuration.
- Figure 4.5 shows the service clearance and floor cutouts for three frames (one DKC, two DKUs). Table 4-6 shows the floor load rating requirements for this configuration.
- shows the service clearance and floor cutouts for four frames (one DKC, three DKUs). shows the floor load rating requirements for this configuration.
- shows the service clearance and floor cutouts for five frames (one DKC, four DKUs). 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 subsystem 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.

The following formula can be used to calculate floor loading to ensure that the weight of all equipment to be installed is adequately supported. Total area is defined as machine area plus half the service clearance.

machine weight + (15 lb/ft^2 × 0.5 service clearance) + (10 lb/ft^2 × total area)
total area

The additional weight of the raised floor and the weight of the cables is 10 lb/ft^2 (50 kg/m^2) uniformly across the total area used in the calculations. When personnel and equipment traffic occur in the service clearance area, a distributed weight of 15 lb/ft^2 (75 kg/m^2) is allowed. This distributed weight is applied over half of the service clearance area up to a maximum of 760 mm (30 inches) from the machine.

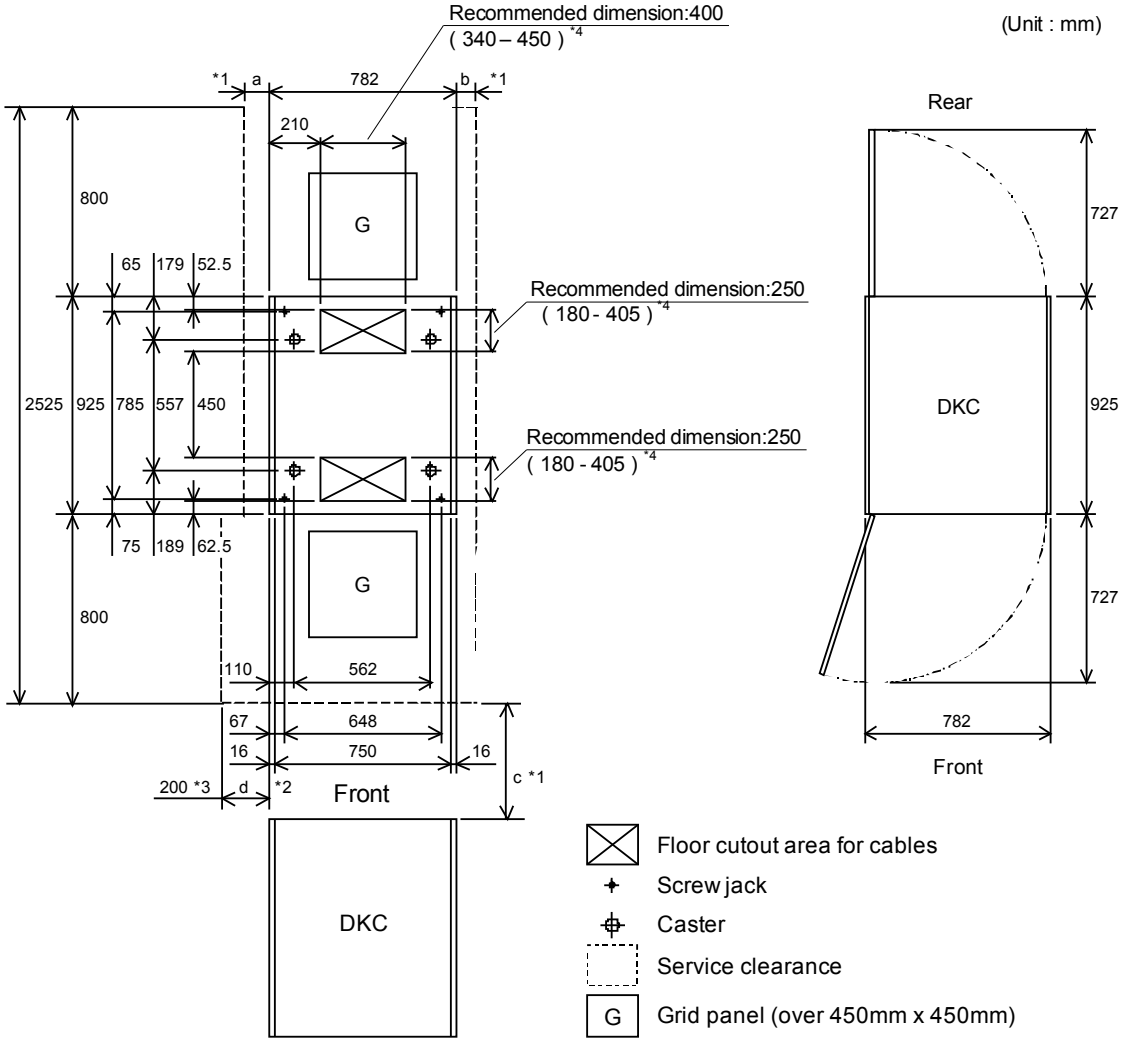


Figure 4.3 DKC Service Clearance and Floor Cutout

*1 Clearance (a+b) depends on the floor load rating and clearance c. Floor load rating and required clearances are in Table 4-4. Allow clearance of 100 mm on both sides of the subsystem when the kick plates are to be attached after the subsystem is installed. However, when subsystems of the same type are to be installed adjacent to each other, clearance between the subsystems may be 100 mm.

*2 Clearance (d) must be over 350mm to open the subsystem front door. If clearance(d) is less than clearance(a), give priority to clearance(a).

*3 The side clearance on the front left side of the subsystem must be 350 mm or wider in order to open the DKC front door. However, priority should be given to the side clearance value "a" according to the load on the floor when the dimension "a" exceeds 350 mm.

*4 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.

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

Table 4-4 Floor Load Rating and Required Clearances for One Frame (DKC only)

Floor load rating (kg/m^2)	Required clearance (a+b) m				
	Clearance (c) m				
	C=0	C=0.2	C=0.4	C=0.6	C=1.0
500	0.4	0.3	0.2	0.1	0
450	0.5	0.4	0.3	0.2	0.1
400	0.8	0.6	0.5	0.4	0.2
350	1.1	0.9	0.8	0.6	0.4
300	1.7	1.4	1.2	1.1	0.8

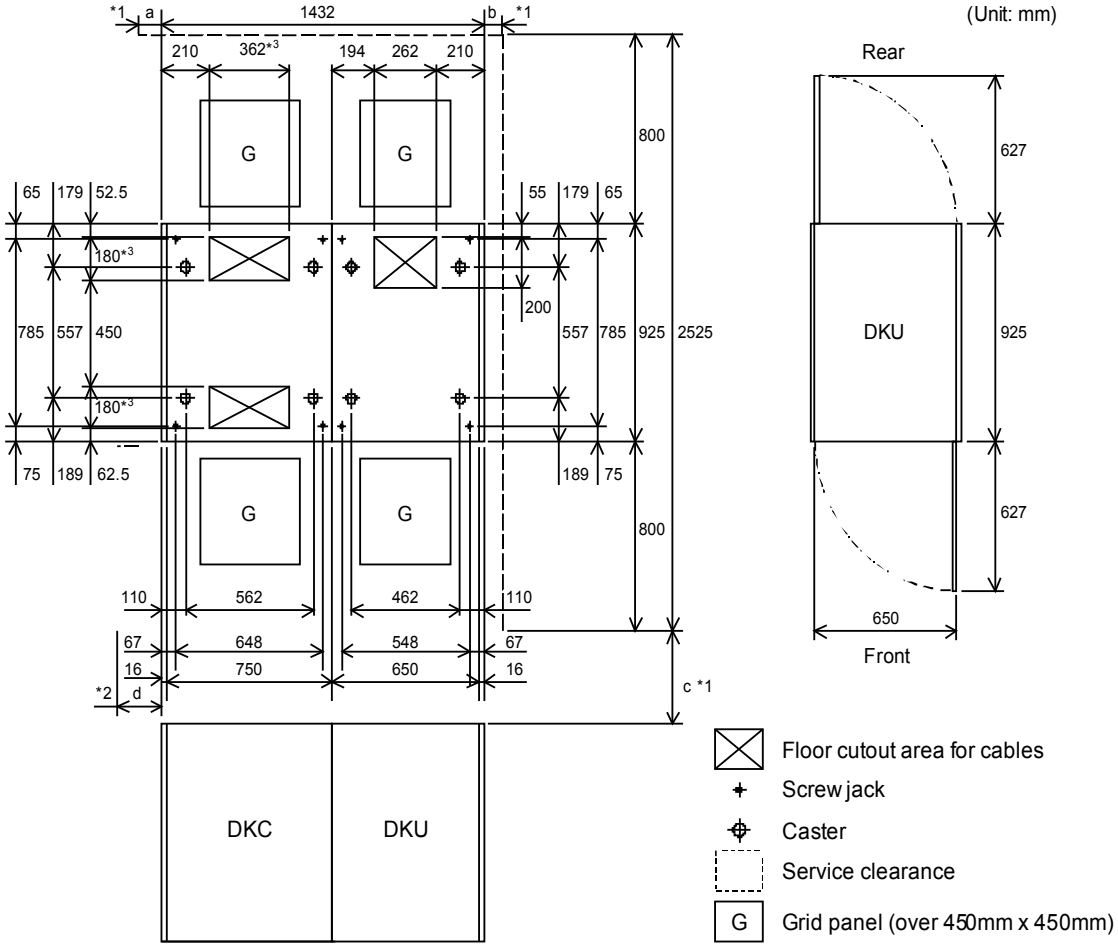


Figure 4.4 Service Clearance and Floor Cutouts for Two Frames

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

*2 Clearance (d) must be over 350 mm to open the subsystem front door (refer to). If clearance (d) is less than clearance (a), give priority to clearance (a).

*3 See for details on the DKC floor cutout.

Table 4-5 Floor Load Rating and Required Clearances for Two Frames

Floor load rating (kg/m^2)	Required clearance (a+b)m				
	Clearance (c)m				
	C=0	C=0.2	C=0.4	C=0.6	C=1.0
500	0.8	0.6	0.4	0.2	0

450	1.1	0.9	0.6	0.5	0.2
400	1.6	1.3	1.0	0.8	0.5
350	2.3	1.9	1.6	1.3	0.9
300	3.3	2.8	2.4	2.1	1.6

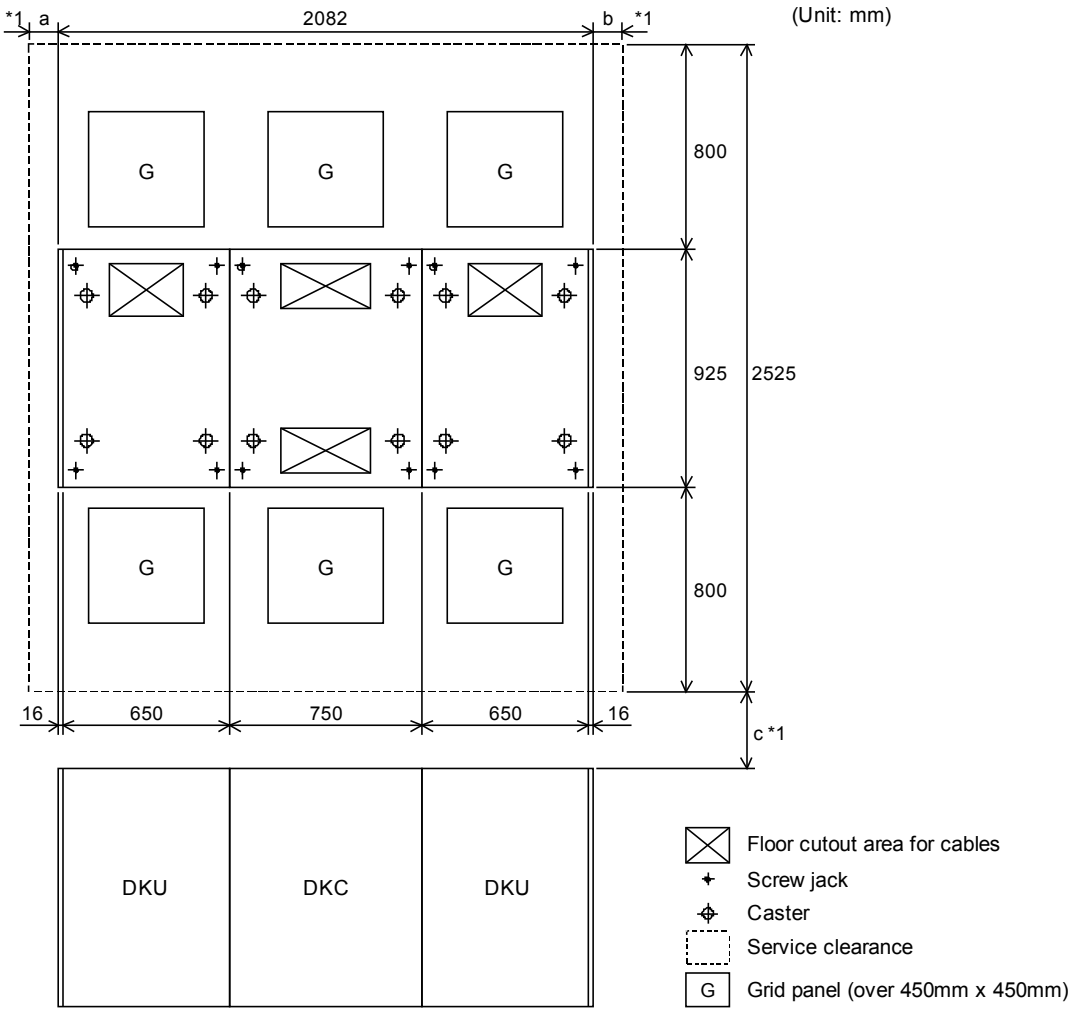


Figure 4.5 Service Clearance and Floor Cutouts for Three Frames

*1. Clearance (a+b) depends on the floor load rating and clearance (c). Floor load rating and required clearances are in Table 4-6.

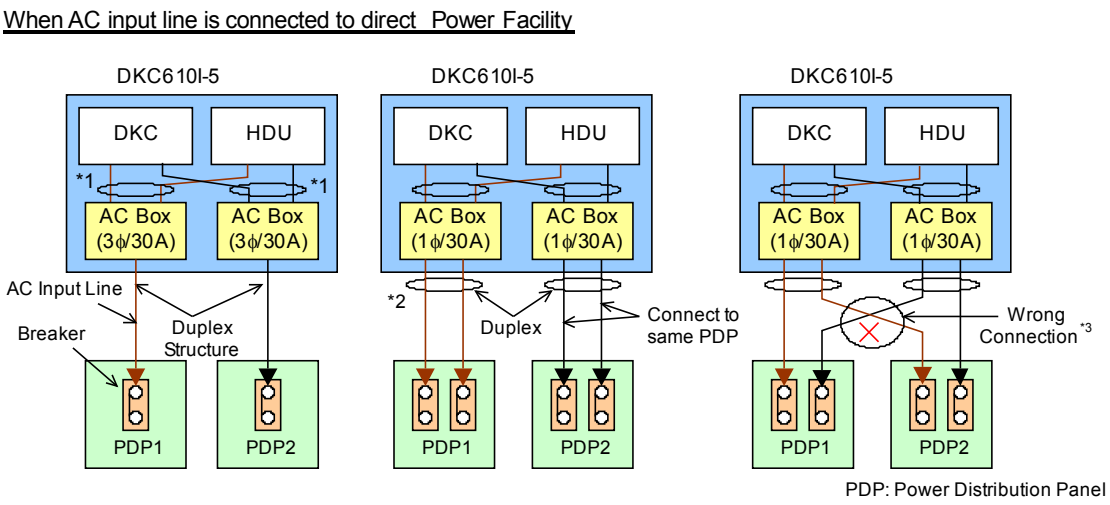
Table 4-6 Floor Load Rating and Required Clearances for Three Frames

Floor load rating (kg/m^2)	Required clearance (a+b)m				
	Clearance (c)m				
	C=0	C=0.2	C=0.4	C=0.6	C=1.0
500	1.2	0.9	0.6	0.3	0.0
450	1.7	1.3	1.0	0.7	0.3
400	2.4	1.9	1.5	1.2	0.7
350	3.4	2.8	2.3	2.0	1.4
300	4.9	4.2	3.6	3.1	2.4

The ST9990V supports three-phase and single-phase power. This section provides electrical specifications and requirements for three-phase subsystems:

- Power plugs for three-phase (Europe)
- Power plugs for three-phase (USA)
- Features for three-phase
- Current rating, power plugs, receptacles, and connectors for three-phase (60 Hz only)
- Input voltage tolerances for three-phase
- Cable dimensions for 50-Hz three-phase subsystems

The AC input to the ST9990V subsystem has a duplex structure per AC box. When installing a subsystem, be careful to correctly connect the AC cable which connects AC box and power distribution panel. If the AC cable is not connected correctly, a system failure is caused when one of AC inputs intercept.



*1: The output of one AC box supplies electric power to the whole DKC610I-5.
*2: Since two AC input lines to which electric power is supplied in one ACBox are not redundant, two AC input lines need to supply electric power.
*3: When PDP1 breaks, since the output of one AC box cannot supply the whole DKC610I-5, it causes a system failure.

Figure 4.6 Three-Phase AC Input, Connection to the Power Facility

Figure 4.7 illustrates the power plugs for a three-phase ST9990V (Europe). The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines), so that AC power of the unit can be supplied from the separate power distribution board with two (2) power supply cords. Similarly, each of the DKU-R1, DKU-R2, DKU-L1, and DKUL2 also has two (2) main disconnect devices.

Caution: The Hitachi Data Systems representative must observe all instructions in the Maintenance Manual before connecting the equipment to the power source and before servicing.

Connection of Power Supply Cord. The unit has two (2) power supply cords. Make sure to prepare the following socket receptacles and power cords between the power distribution board of the building and the power cords for the unit:

- Socket Receptacle: As shown in the following figure.
- Power Cord: Type H07RN-F or equivalent, with five 6 mm2 conductors.

Make sure to connect a power cord to the distribution box as illustrated in Figure 4.7. The wrong connection of neutral line may cause fire or damage to the equipment. To reduce the risk of wrong connection, use the approved type attachment plug and socket for power cord connection.

High leakage current may be caused between the power supply and this unit. To avoid an electric shock by high leakage current, perform the protective earth connection before the supply connections and disconnect it after the supply connections.

Requirements to Branch Circuit. This unit relies on the building installation for protection of the internal components of the equipment. Each line (R/S/T/N line) should be protected by a short-circuit protective device and by an over-current protective device rated 30 amp on building installation.

The protective device on building installation shall be comply with National Standards of the country where the units shall be installed, and if a protective device interrupts a conductor, it shall also interrupt all other supply conductors. This protection is also required for the neutral line of this unit.

Disconnection from Power Supply. The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines). Each DKU has two (2) main disconnect devices (two main breaker CB101s for dual power lines). To remove all utility power from the unit, turn off both main disconnect device CB101s at the same time.

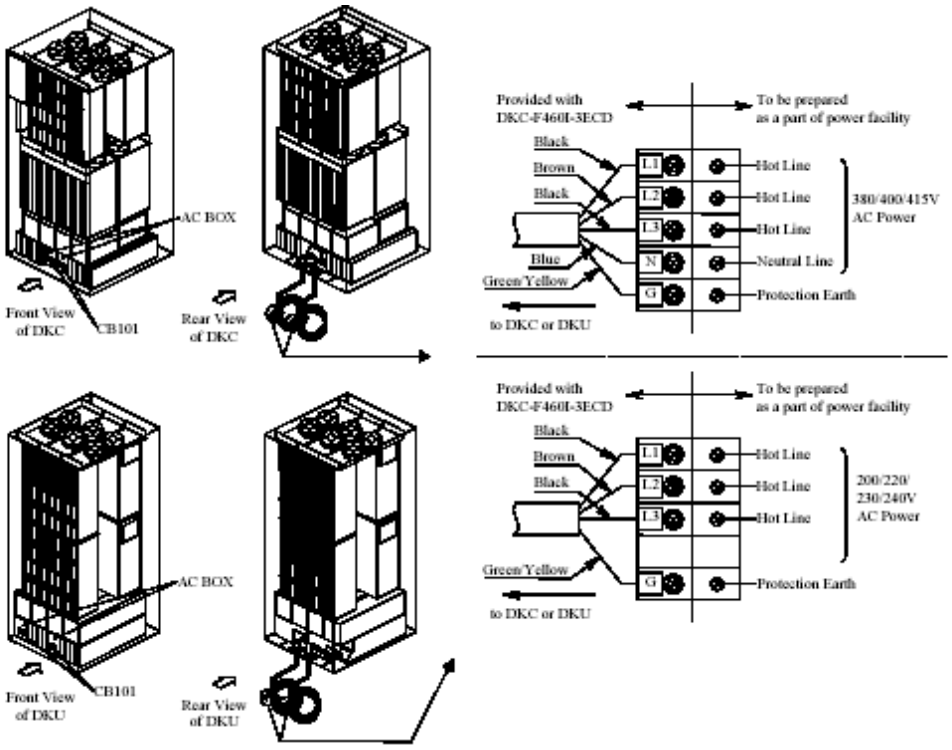


Figure 4.7 Three-Phase 30-Amp Model for Europe

Figure 4.8 illustrates the power plugs for a three-phase ST9990V (USA). The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines), so that AC power of the unit can be supplied from the separate power distribution board with two (2) power supply cords. Similarly, each of the DKU-R1, DKU-R2, DKU-L1, and DKUL2 also has two main disconnect devices.

Caution: The Hitachi Data Systems representative must observe all instructions in the Maintenance Manual before connecting the equipment to the power source and before servicing.

Connection of Power Supply Cord. The unit has two (2) power supply cords with attachment plug type Thomas & Betts 3760PDG or DDK 115J-AP8508. Make sure to prepare the following socket receptacles and power cords between the power distribution board of the building and the attachment plugs for the unit:

- Socket Receptacle: Thomas & Betts 3934
- Power Cord: Type ST or equivalent, non-shielded type, with four min. #8 AWG conductors. Terminated at one end with an assembled on above socket receptacle cap.

Requirements to Branch Circuit. This unit relies on the building installation for protection of the internal components of the equipment. Each line (R/S/T line) should be protected by a short-circuit protective device and by an over-current protective device rated 30 amp on building installation.

The protective device on building installation shall comply with the NEC requirements (or CEC requirements when installed in Canada), and if a protective device interrupts a conductor, it shall also interrupt all other supply conductors. This protection is not required for the neutral line of this unit.

Disconnection from Power Supply. The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines). Each DKU has two main disconnect devices (two main breaker CB101s for dual power lines). To remove all utility power from the unit, turn off both main disconnect device CB101s at the same time.

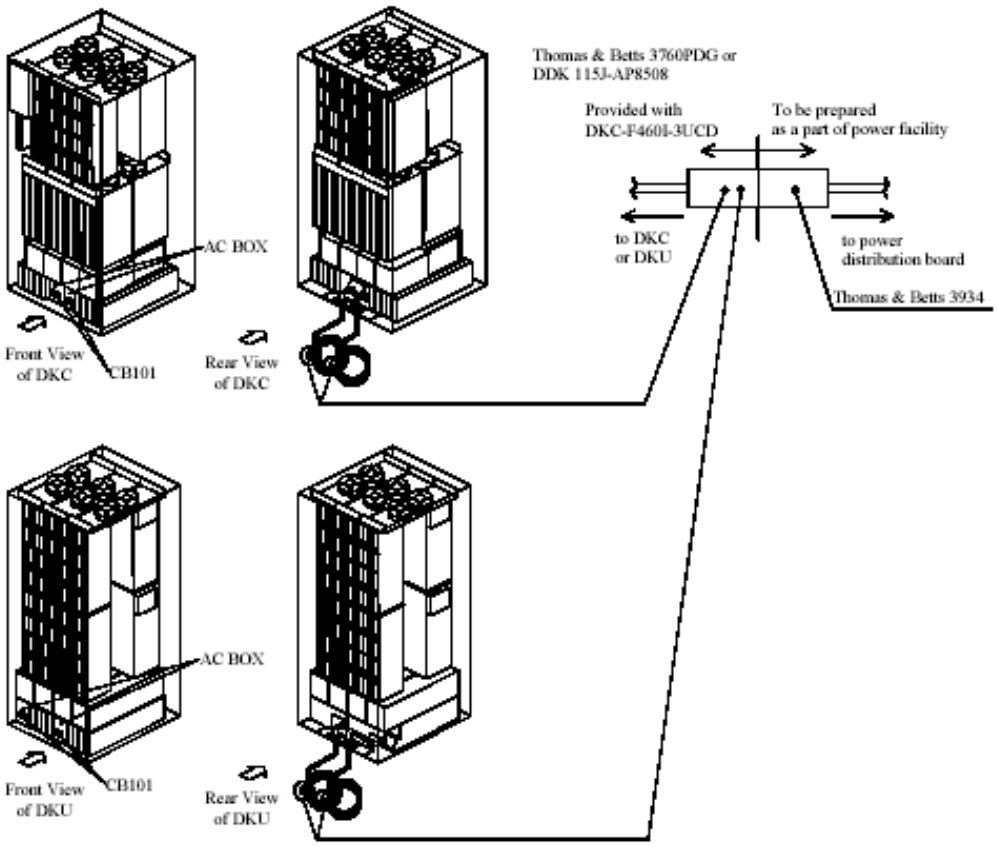


Figure 4.8 Three-Phase 30-Amp Model for USA

Features for Three-Phase

Table 4-7 lists the features for three-phase ST9990V subsystems. The three-phase ST9990V requires dual power feeds to every frame (DKC and all DKU frames).

Table 4-7 Universal Storage Platform V Three-Phase Features

Frame	Feature Number	Description	Comments
Controller	DKC-F610I-3PS	AC Box Kit for 3-Phase/30A	Required when the specification for the power supplied to the subsystem is 200V/3-phase, and a breaker capacity of power facility is 30A. The option can be used for both DKC and DKU frames. Two 30A power facilities per DKC or DKU frame are required.
Disk Array	DKC-F610I-3PS	AC Box Kit for 3-Phase/30A	Same as option for DKC. Two 30A power facilities per DKC or DKU frame are required.

Power Cables and Connectors for Three-Phase

Table 4-8 lists the power cables and connectors for three-phase subsystems.

The user must supply all power receptacles and connectors for the ST9990V. Thomas & Betts (T&B) (formerly R&S) type connectors (or Hubbell or Leviton) are recommended for 60-Hz subsystems.

Note: Each ST9990V disk array frame requires two power connections for power redundancy. It is strongly recommended that the second power source be supplied from a separate power boundary to eliminate source power as a possible single (non-redundant) point of failure.

Table 4-8 Power Cables and Customer-Supplied Connectors for Three-Phase

Model	Part	Connector	Comments
DKC-F460I-3UCD For DKC & DKU	Power Cable Unit	Thomas & Betts: 3934	U.S. - Power Cable Kit / 3-Phase 30A / 60Hz
DKC-F460I-3ECD For DKC & DKU	Power Cable Unit	N/A	Europe – Power Cable Kit / 3-Phase 30A / 50Hz

****Note:*** For information on power connection specifications for locations outside the U.S., contact the Hitachi Data Systems Support Center for the specific country.

Input Voltage Tolerances for Three-Phase

Table 4-9 lists the input voltage tolerances for the three-phase ST9990V subsystem. Transient voltage conditions must not exceed +15-18% of nominal and must return to a steady-state tolerance within of +6 to -8% of the normal related voltage in 0.5 seconds or less. Line-to-line imbalance voltage must not exceed 2.5%. Non-operating harmonic contents must not exceed 5%.

Table 4-9 Input Voltage Specifications for Three-Phase AC Input

Frequency	Input Voltages (AC)	Wiring	Tolerance	Remarks
60 Hz ± 0.5 Hz	200V, 208V, or 230V	3-phase, 3 wire + ground	+6% or -8%	For North America 200V
50 Hz ± 0.5 Hz	200V, 220V, 230V, or 240V	3-phase, 3 wire + ground	+6% or -8%	For Europe 200V
50 Hz ± 0.5 Hz	380V, 400V, or 415V	3-phase, 4 wire + ground	+6% or -8%	For Europe

Note: These specifications apply to the power supplied to the ST9990V subsystem, not to the subsystem-internal power system.

Cable Dimensions for 50-Hz Three-Phase Subsystems

Table 4-10 and show the data required for 50-Hz three-phase cable installations.

Table 4-10 Cable and Terminal Dimensions for 50-Hz Three-Phase Subsystems

	Power Cable			Terminal		
Model	Outer Sheath Overall Diameter A	Insulator Outer Diameter B	Electric Wire Cross-Section Area C	Internal Diameter D	External Diameter E	Screw Size
DKC-F460I-3ECD (30A)	18.0-24.5mm	5.2 mm	6.0 mm^2	6.4 mm	12.0 mm	M6

The ST9990V supports three-phase and single-phase power. This section provides electrical specifications and requirements for single-phase subsystems:

- Power plugs for single-phase (Europe)
- Power plugs for single-phase (USA)
- Features for single-phase
- Current rating, power plugs, receptacles, and connectors for single-phase (60 Hz only)
- Input voltage tolerances for single-phase
- Cable dimensions for 50-Hz single-phase subsystems

Figure 4.9 and Figure 4.10 show the single-phase AC input power for the ST9990V DKC and DKU frames, respectively.

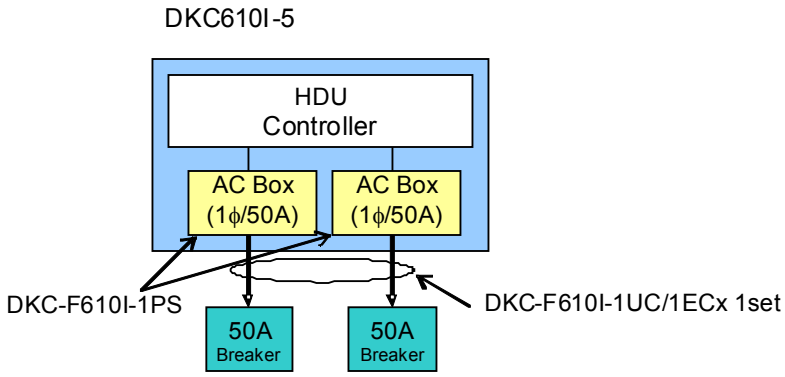


Figure 4.9 Single-Phase AC Input Power (DKC)

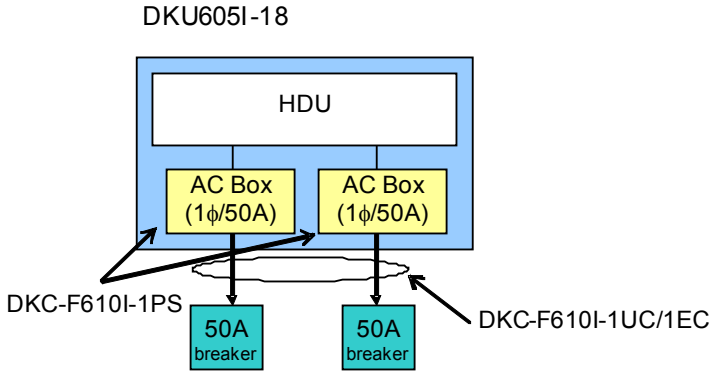


Figure 4.10 Single-Phase AC Input Power (DKU)

Figure 4.11 illustrates the power plugs for a single-phase ST9990V controller (Europe). The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines), so that AC power of the unit can be supplied from the separate power distribution board with two (2) power supply cords. Similarly, each of the DKU-R1, DKU-R2, DKU-L1, and DKU-L2 also has two (2) main disconnect devices (two main breaker CB101s for dual power lines).

Caution: The Hitachi Data Systems representative must observe all instructions in the Maintenance Manual before connecting the equipment to the power source and before servicing.

Connection of Power Supply Cord. The unit has two power supply cords. Be sure to prepare the following socket receptacles and power cords between the power distribution board of the building and the power cords for the unit.

- Socket Receptacle: As shown in the following figure.
- Power Cord: Type H07RN-F or equivalent, with three 10 mm2 conductors.

Make sure to connect a power cord to the distribution box as illustrated in Figure 4.11. The wrong connection of neutral line may cause fire or damage to the equipment. To reduce the risk of wrong connection, you should use approved type attachment plug and socket for power cord connection.

High leakage current may be caused between the power supply and this unit. To avoid an electric shock by high leakage current, perform the protective earth connection before the supply connections and disconnect it after the supply connections.

Requirements to Branch Circuit. This unit relies on the building installation for protection of the internal components of the equipment. Each line (U/L1, N/L2 line) should be protected by a short-circuit protective device and by an over-current protective device rated 50 amp on building installation.

The protective device on building installation shall be comply with National Standards of the country where the units shall be installed, and if a protective device interrupts a conductor, it shall also interrupt all other supply conductors. This protection is also required for the neutral line of this unit.

Disconnection from Power Supply. The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines). Each DKU has two (2) main disconnect devices (two main breaker CB101s for dual power lines). To remove all utility power from the unit, turn off both main disconnect device CB101s at the same time.

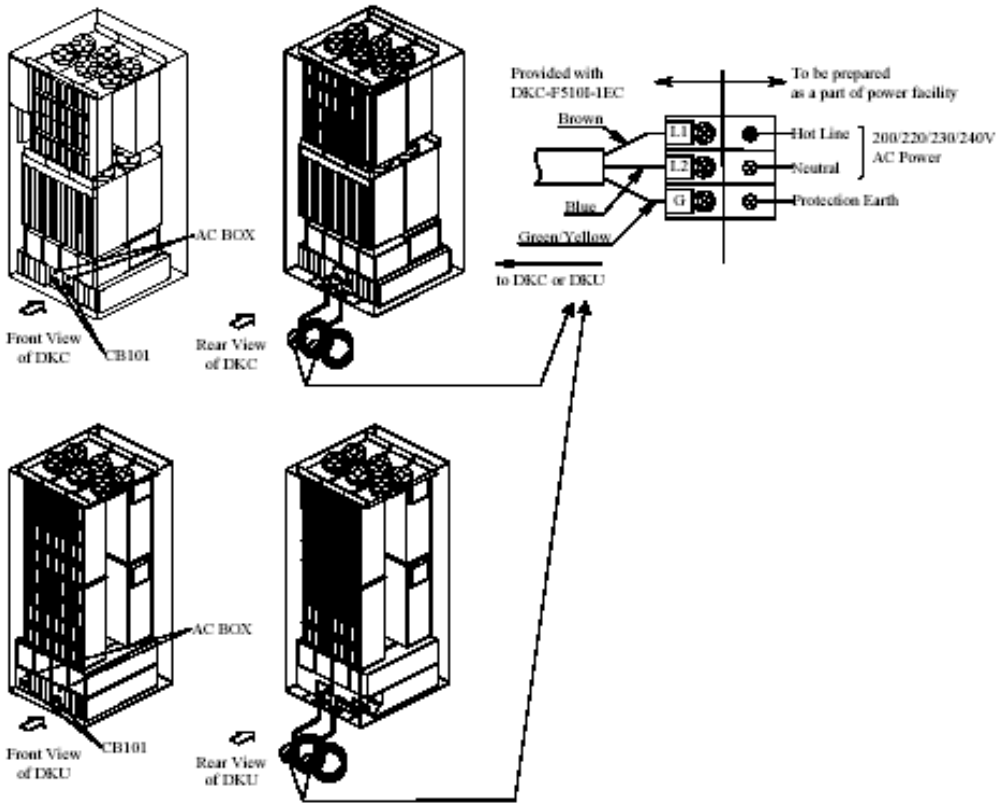


Figure 4.11 Single-Phase 50-Amp Model for Europe

illustrates the power plugs for a single-phase ST9990V controller (USA). The DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines), so that AC power of the unit can be supplied from the separate power distribution board with two (2) power supply cords. Similarly, each of the DKU-R1, DKU-R2, DKU-L1, and DKU-L2 also has two (2) main disconnect devices (two main breaker CB101s for dual power lines).

Caution: The Hitachi Data Systems representative must observe all instructions in the Maintenance Manual before connecting the equipment to the power source and before servicing.

Connection of Power Supply Cord. The unit has two (2) power supply cords with attachment plug type Thomas & Betts 9P53U2. Make sure to prepare the following socket receptacles and power cords between the power distribution board of the building and the attachment plugs for the unit:

- Socket Receptacle: Thomas & Betts 9C53U2 or 9R53U2W
- Power Cord: Type ST or equivalent, non-shielded type, with three min. #6 AWG conductors. Terminated at one end with an assembled on above socket receptacle cap.

Requirements to Branch Circuit. This unit relies on the building installation for protection of the internal components of the equipment. Each line (U/L1, V/L2 line) should be protected by a short circuit protective device and by an over current protective device rated 50 amp on building installation.

The protective device on building installation shall comply with the NEC requirements (or CEC requirements when installed in Canada), and if a protective device interrupts a conductor, it shall also interrupt all other supply conductors. This protection is not required for the neutral line of this unit.

Disconnection from Power Supply. DKC has two (2) main disconnect devices (two main breaker CB101s for dual power lines). Each DKU has two (2) main disconnect devices (two main breaker CB101s for dual power lines). To remove all utility power from the unit, turn off both main disconnect device CB101s at the same time.

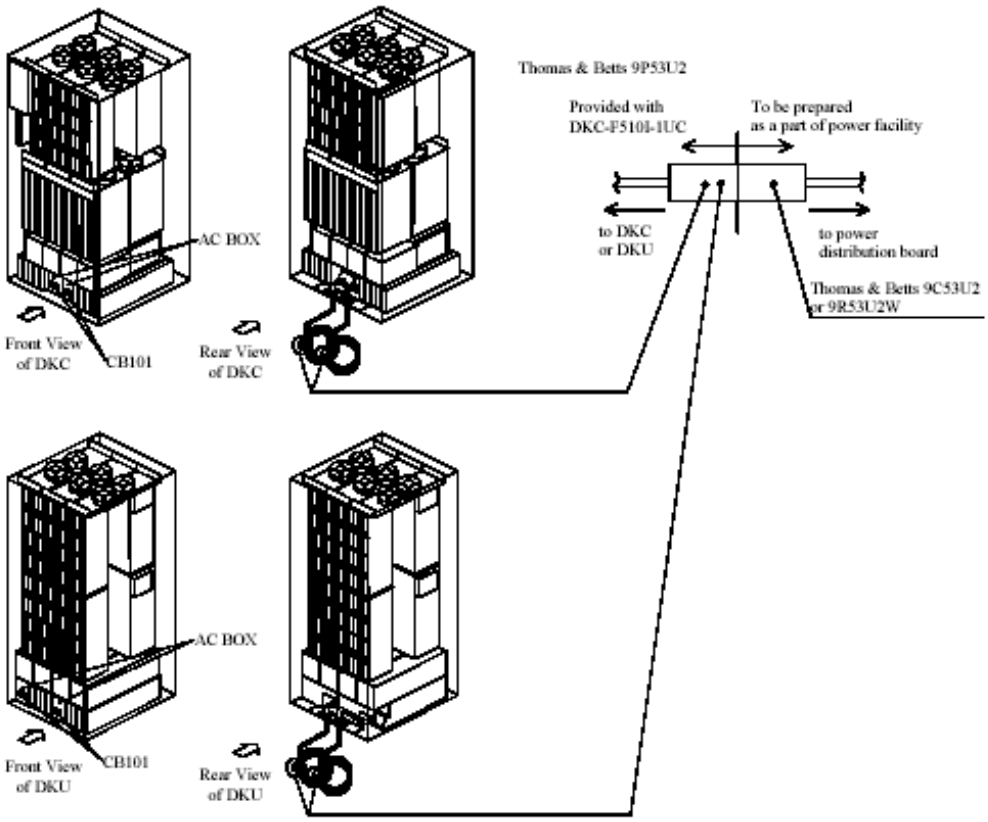


Figure 4.12 Single-Phase 50-Amp Model for USA

Features for Single-Phase

Table 4-11 lists the features for single-phase ST9990V subsystems. The single-phase 50A ST9990V requires dual power feeds to every frame (DKC and all DKU frames). Single-phase 30A can require four feeds, but this is not supported by Hitachi Data Systems (see the following ***Note***).

Note: Hitachi Data Systems does not support 30A single-phase (DKC-F510I-1PSD feature not supported). With this input power certain upgrade paths become disruptive.

Table 4-11 Universal Storage Platform V Single-Phase Features

Frame	Feature Number	Description	Comments
Controller	DKC-F610I-1PS	AC Box kit for Single-Phase/50A	Required when the specification for the power supplied to the subsystem is 200V/Single-phase, and a breaker capacity of power facility is 50A. The option can be used for both DKC and DKU frames. Two 50A power facilities per DKC or DKU frame are required.
Disk Array	DKC-F610I-1PS	AC Box kit for Single-Phase/50A	Same as option for DKC. Two 50A power facilities per DKC or DKU frame are required.

Power Cables and Connectors for Single-Phase

Table 4-12 lists the power cables and connectors for single-phase subsystems.

The user must supply all power receptacles and connectors for the ST9990V. Thomas & Betts (T&B) (formerly R&S) type connectors (or Hubbell or Leviton) are recommended for 60-Hz subsystems.

Note: Each ST9990V disk array frame requires two power connections for power redundancy. It is strongly recommended that the second power source be supplied from a separate power boundary to eliminate source power as a possible single (non-redundant) point of failure.

Table 4-12 Power Cables and Customer-Supplied Connectors for Single-Phase

Model	Part	Connector	Comments
DKC-F610I-1UC For DKC and DKU	Power Cable Unit	Thomas & Betts: 9C53U2 **or** 9R53U2W	U.S. - Power Cable Kit / 1-Phase 50A / 60Hz
DKC-F610I-1EC For DKC and DKU	Power Cable Unit	N/A	Europe – Power Cable Kit / 1-Phase 50A / 50Hz

***Note:** For information on power connection specifications for locations outside the U.S., contact the Hitachi Data Systems Support Center for the specific country.

Input Voltage Tolerances for Single-Phase

Table 4-13 lists the input voltage tolerances for the single-phase ST9990V subsystem. Transient voltage conditions must not exceed +15-18% of nominal and must return to a steady-state tolerance of between +6 and -8% of the normal related voltage in 0.5 seconds or less. Line-to-line imbalance voltage must not exceed 2.5%. Non-operating harmonic contents must not exceed 5%.

Table 4-13 Input Voltage Specifications for Single-Phase Power

Frequency	Input Voltages (AC)	Wiring	Tolerance	Remarks
60 Hz ±0.5 Hz	200V, 208V or 230V	Single-phase, two wire + ground	+6% or -8%	For North America 200V
50 Hz ±0.5 Hz	200V, 220V, 230V or 240V	Single-phase, two wire + ground	+6% or -8%	For Europe 200V

Cable Dimensions for 50-Hz Single-Phase Subsystems

Table 4-14 and show the data required for 50-Hz single-phase cable installations.

Table 4-14 Cable and Terminal Dimensions for 50-Hz Single-Phase Subsystems

	Power Cable			Terminal		
	Outer Sheath Overall Diameter	Insulator Outer Diameter	Electric Wire Cross-Section Area	"Internal Diameter"	"External Diameter"	Screw Size
Model	**A**	**B**	**C**	**D**	**E**	
DKC-F610I-1EC	20.0-25.5 mm	6.6 mm	10.0 mm^2	6.4 mm	12.0 mm	M6

Table 4-15 lists the specifications for each ST9990V mainframe channel option. Table 4-16 lists the specifications for each ST9990V open-systems channel option. Each channel adapter (CHA) feature consists of a pair of cards.

Note: Additional power supply is needed for the following configurations:

- When the total number of installed CHA and DKA options is four or more.
- When 68 GB or more of cache memory is to be installed.
- When 65 or more HDD canisters are to be installed.

Database Validator: All fibre-channel options for the ST9990V are equipped with the Database Validator function. 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 4-15 Mainframe Channel Specifications

	ESCON	Mainframe Fibre 8port	
		Short Wave	Long Wave
Model number	DKC-F610I-8S	DKC-F610I-8MFS	DKC-F610I-8MFL
Main board name	WP612-A	WP611-A	WP611-B
MP board name	SH343-C	SH444-A	SH444-A
Host interface	ESCON	FICON	FICON
Data transfer rate (MB/s)	17	100/200/400	100/200/400
Number of options installed ( ): DKA slot used	1/2/3/4/5/6/7/8 (9/10/11/12/13/14)	1/2/3/4/5/6/7/8 (9/10/11/12/13/14)	1/2/3/4/5/6/7/8 (9/10/11/12/13/14)
Number of ports/Option	8	8	8
Number of ports/Subsystem ( ): DKA slot used	8/16/24/32/40/48/56/64 (72/80/88/96/104/112)	8/16/24/32/40/48/56/64 (72/80/88/96/104/112)	
Maximum cable length	3km	500m/300m/150 m[*1]	10km

Notes:

Figure 1. Each port on the fibre adapters can be configured with a short- or long-wavelength transceiver. Short-wavelength transceivers are installed by default, so an optional long-wavelength transceiver is required separately when changing the standard port to long wavelength (DKC-F610I-1HL/1FL/1FL4).

Figure 2. The mainframe fibre adapters require an LC-type connector for multimode/single-mode fiber-optical cable. When 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.

Figure 3. 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), 300 m (200 MB/s), and 150 m (400 MB/s) are decreased to 300 m, 150 m, and 75 m respectively.

Table 4-16 Open-Systems Channel Specifications

		Fibre		iSCSI*3
		8port	16port	8port
Model number		DKC-F610I-8FS*4	DKC-F610I-16FS*4	DKC-F610I-8IS
Main board name		WP610-B	WP610-A	WP613-A
MP board name		SH444-A	SH444-A	SH444-A
Host interface		FCP	FCP	Gigabit Ethernet
Data transfer rate (MB/s)		100/200/400	100/200/400	100
Number of options installed ( ): DKA slot used		1/2/3/4/5/6/7/8 (9/10/11/12/13/14)	1/2/3/4/5/6/7/8 (9/10/11/12/13/14)	1/2/3/4/5/6/7/8 (9/10/11/12/13/14)
Number of ports / Option		8	16	8
Number of ports/Subsystem ( ): DKA slot used		8/16/24/32/40/48/56/64 (72/80/88/96/104/112)	16/32/48/64/80/96/112/128 (144/160/176/192/208/224)	8/16/24/32/40/48/56/64 (72/80/88/96/104/112)
Maximum cable length	Short Wave	500m/300m/150m *1	500m/300m/150m *1	500m/275m *2
	Long Wave	10km	10km	-

Notes:

N Each port on the fibre adapters can be configured with a short- or long-wavelength transceiver. Short-wavelength transceivers are installed by default, so an optional long-wavelength transceiver is required separately when changing the standard port to long wavelength (DKC-F510I-1HL/1FL/1FL4).

N 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.

N The maximum number of NAS CHAs that can be installed is 4.

N 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), 300 m (200 MB/s), and 150 m (400 MB/s) are decreased to 300 m, 150 m, and 75 m respectively.

N 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

The environmental specifications and requirements for the ST9990V include:

- Temperature, humidity, and altitude requirements
- Power consumption and heat output specifications
- Loudness
- Air flow requirements
- Vibration and shock tolerances

Temperature, Humidity, and Altitude Requirements

Table 4-17 lists the temperature, humidity, and altitude requirements for the ST9990V. The recommended operational room temperature is 70–75°F (21–24°C). The recommended operational relative humidity is 50% to 55%.

Table 4-17 Temperature, Humidity, and Altitude Requirements

	Operating [*1]		Non-Operating [*2]		Shipping & Storage [*3]	
Parameter	**Low**	**High**	**Low**	**High**	**Low**	**High**
Temperature °F (°C)	60 (16)	90 (32)	14 (-10)	109 (43)	5 (-25)	140 (60)
Relative Humidity (%) [*4]	20 - 80		8 – 90		5 – 95	
Max. Wet Bulb °F (°C)	79 (26)		81 (27)		84 (29)	
Temperature Deviation °F (°C) / hour	18 (10)		18 (10)		36 (20)	
Altitude	-60 m to 3,000 m				—	

Notes:

1. Environmental specification for operating condition should be satisfied before the disk subsystem is powered on. The maximum temperature of 90°F (32°C) should be strictly satisfied at the air inlet portion of the subsystem. The recommended temperature range is 70-75°F (21-24°C).
2. Non-operating condition includes both packing and unpacking conditions unless otherwise specified.
3. During shipping or storage, the product should be packed with factory packing.
4. No condensation in or around the drive should be observed under any conditions.

The Hitachi ST9990V 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 ST9990V control panel must be **ON** when the subsystem is operating online.

Table 5-18 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.

Table 5-18 Troubleshooting

Error Condition	Recommended Action
Error message displayed.	Determine the type of error (refer to the SIM codes 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.
General power failure.	Call the Hitachi Data Systems Support Center for assistance. ***WARNING:*** Do not open the Universal Storage Platform V control frame or touch any of the controls.
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.
READY LED does not go on, or there is no power supplied.	Call the Hitachi Data Systems Support Center for assistance. ***WARNING:*** Do not open the Universal Storage Platform V control frame or touch any of the controls.
Emergency (fire, earthquake, flood, etc.)	Pull the emergency power-off (EPO) switch. You must call the Hitachi Data Systems Support Center to have the EPO switch reset.
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.

The ST9990V generates service information messages (SIMs) to identify normal operations (for example, TrueCopy pair status change) as well as service requirements and errors or failures. ***Note:*** For assistance with SIMs, please call the Hitachi Data Systems Support Center.

SIMs can be generated by the front-end and back-end directors and by the SVP. All SIMs generated by the ST9990V are stored on the SVP for use by Hitachi Data Systems personnel, logged in the SYS1.LOGREC dataset of the mainframe host system, displayed by the Storage Navigator software, and reported over SNMP to the open-system host. The SIM display on ST9990V Storage Navigator enables users to remotely view the SIMs reported by the attached ST9990Vs. Each time a SIM is generated, the amber Message LED on the ST9990V control 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. The serious and acute SIMs (highest severity) are reported to the mainframe host(s) once every eight hours. ***Note:*** If a serious or acute-level SIM is reported, the user should call the Hitachi Data Systems Support Center immediately to ensure that the problem is being addressed.

Figure 5.13 illustrates a typical 32-byte SIM from the ST9990V. 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.

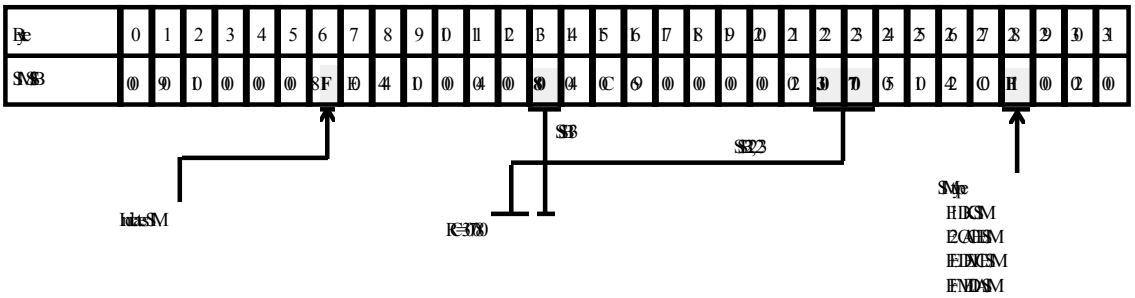


Figure 5.13 Typical SIM Showing Reference Code and SIM Type

Units and Unit Conversions

This appendix describes the Storage capacities for LDEVs on the ST9990V are calculated based on the following values: 1 KB = 1,024 bytes, 1 MB = $1,024^2$ bytes, 1 GB = $1,024^3$ bytes, 1 TB = $1,024^4$ bytes. Storage capacities for HDDs are calculated based on 1,000 (10^3) instead of 1,024 (2^{10}).

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) $°C = (°F - 32) \times 0.555556$
Degrees centigrade (°C)	multiply by 1.8, then add 32 to result	Degrees Fahrenheit (°F) $°F = (°C \times 1.8) + 32$
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 StorageTek 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).
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.

Term	Definition
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 *mirrored cache.*
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 *Path Fail-over and Recovery*
FC-AL	Fibre Channel arbitrated loop, a loop topology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled *fibre* in the context of Fibre Channel.
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.
FICON	Short for ***Fi**ber **Con**nection*, or ***Fi**ber **Con**nectivity*, 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.

Term	Definition
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).
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 StorageTek Remote Response service. Helps facilitate a point-to-point connection from a remote support center.

Term	Definition
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 a 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.
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.

Term	Definition
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.
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 *Switch Fabric Cards.*
SFP	Small form pluggable.
SIO	See *Storage I/O Cards.*
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 *Storage Resource Card.*
SVP	*See Storage Service Processor.*
Storage domain	A logical domain with its own storage, and its own management environment.
Storage extent	See *Extent.*

Term	Definition
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 *Profile*.
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 StorageTek Storage Pool Manager software	Uses virtualization capabilities of the Sun StorageTek 9990V system to simplify storage management, using storage pools and application-oriented storage profiles.
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 StorageTek 9990V arrays to track events and alerts as well as informational and notice messages. This log file can be sent periodically to a host server for evaluation using the `syslogd(1M)` function.
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 *IOPS and I/O rate.*
Topology	The components used to connect two or more ports together. Also, a specific way of connecting those components, as in point-to-point, fabric, or arbitrated loop.
Transfer rate	The rate at which data is transferred, usually measured in megabytes 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 #

ST9990V Data Sheet	503961
ST9990V Just the Facts	503962
ST9990V Customer Presentation	503963
ST9990V Technical Presentation	503964

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.

Sun StorageTek 9990V User Guide MK-95RD279

WEB INFORMATION:

Internal

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http://onestop/storage/9900/index.shtml?menu

http://mysalesstg.central/public/storage/products/highend/
http://www.sun.com/storagetek/disk_systems/data_center/9990v

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 WWWWs)

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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