



StorageTek Virtual Tape Storage System (VTSS) for VSM5[®]

Planning and System Assurance Guide

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Virtual Tape Storage Subsystem (VTSS) for VSM5[®]

Planning and System Assurance Guide

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Revision A (September 2006)

This document contains 118 pages. "[Revision History / Summary of Changes](#)" on page v lists release dates, part numbers, and editions for this document, plus a brief summary of significant content changes.

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Revision History / Summary of Changes

EC	Doc PN	SAP Revision	Release Date	Supported Versions / Summary of Changes
133687	96257	A	September 2006	New document created for FRS release of VSM5-VTSS system (Phase 1), including 2Gb back-end FC loops, VCF3 cards, 146GB drives, detached operator panel, etc.

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Any changes or modifications made to this equipment which are not expressly approved in advance by Sun will void the warranty, and may cause the equipment to create harmful interference.

■ Class 1 Laser Product Notice

Laser transceivers are classified as Class 1 Laser Product, and have an output less than 70 microwatts and a wavelength of 850 nm. Sun Class 1 Laser Products comply with EN 60 825-1(+A-11) and with sections 21 CFR 1040.10 and 1040.11 of the Food and Drug Administration (FDA) regulations. The following translations are provided to identify laser safety and classification:

Finnish: Luokan 1 laserlaite

French: appareil A laser de classe 1

Swedish: klasse 1 laser apparat



DANGER !!

Lasers and high-frequency signals used in optical fiber cables can cause eye injury if safety precautions are not followed. To prevent injury, observe these precautions: Never look directly into an optical fiber cable, laser transceiver, or connector; ensure that all transceiver optical ports are terminated with a cable or cover; and comply with all warning labels on fiber optic components.

■ Cabling Notice

Cables that connect peripherals to the VSM system must be shielded and grounded. Operation of peripheral equipment with cables that are not shielded and correctly grounded may result in interference to radio and TV reception.

■ Hazardous Materials Handling

Lead-acid battery packs and lithium-battery cards used in the VSM-VTSS are classified as hazardous materials. Sun personnel are required to comply with U.S. Department of Transportation (DOT), International Civil Aviation Organization (ICAO) and International Maritime Dangerous Goods (IMDG) Code requirements for shipping, recycling, and disposal of hazardous materials. If you have questions about these requirements, contact the Sun Environmental Health and Safety (EHS) group in Louisville, Colorado (USA).

■ Standards Conformance

This VSM5-VTSS system conforms to all necessary North American (U.S./Canada) and international standards for product safety, electromagnetic compatibility (EMC), body schemes, and binary multiples as defined below.

Product Safety Standards

This VSM5-VTSS system complies with the following product safety standards:

- Underwriters Laboratories (UL) – Listed by Underwriters Laboratories UL 1950, Information Technology Equipment, Third Edition
- Canadian Standards Association (CSA) – Certified to Canadian Standards Association, CAN/CSA C22.2 No. 950-95, Information Technology Equipment, Third Edition
- International Electrotechnical Commission (IEC) – Complies with IEC Publication 950, Safety Information Technology Equipment through TUV (Technischer Ueberwachungsverein)

Electromagnetic Compatibility

This VSM5-VTSS system complies with the following referenced standards for electromagnetic compatibility (EMC):

United States: Federal Communications Commission (FCC) – This equipment complies with FCC Title 47, Part 15 Subpart B, Unintentional Radiators Class A.

FCC Compliance Statement: This equipment has been tested and found to comply to the limits for Class A digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

Canada: Canadian Department of Communications (CDC) – This equipment complies with Canadian EMC law CDC ICES-003.

European Union (CE Mark) – This equipment complies with Electromagnetic Compatibility Directive 89/336 (as amended).

Australia/New Zealand – This equipment complies with EMC Framework—AS/NZS 3548: 1995.

China – This equipment complies with CNS 13438.

Korea – This equipment complies with Korean EMC Law.

Japan: Voluntary Control Council for Interference (VCCI) – This equipment complies with VCCI (Japan) Class A (C15PR22).

VCCI Compliance Statement (Japanese translation):

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI Compliance Statement (English translation): This is a Class A product based on the Technical Requirement of the Voluntary Control Council for Interference (VCCI) by information technology equipment. In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective action.

Taiwan: Bureau of Commodity Inspection and Quarantine (BCIQ) – This equipment complies with BCIQ EMC Law—Taiwan: CNS13438.

The following warning label statement pertains to BSMI regulations in Taiwan, R.O.C.:

Taiwan Warning Label Statement (Taiwanese translation):

警告使用者: 這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Taiwan Warning Label Statement (English translation): This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

CISPR 22 and EN55022 Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Internal Code License Statement

NOTICE

INTERNAL CODE LICENSE

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 7. You may transfer possession of the Internal Code to another party only with the transfer of the Equipment on which its use is authorized, and your license to use the Internal Code is discontinued when you are no longer an owner or a rightful possessor of the Equipment. You must give such transferee all copies of the Internal Code for the transferred Equipment that are in your possession, along with a copy of all provisions of this Notice. Any such transfer by you is automatically (without further action on the part of either party) expressly subject to all the terms and conditions of this Notice passing in full to the party to whom such Equipment is transferred, and such transferee accepts the provisions of this license by initial use of the Internal Code. You cannot pass to the transferee of the Equipment any greater rights than granted under this Notice, and shall hold Sun harmless from any claim to the contrary by your transferee or its successors or assigns. In addition, the terms and conditions of this Notice apply to any copies of Internal Code now in your possession or use or which you hereafter acquire from either Sun or another party.
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If you need a backup or archival copy of the Internal Code, Sun, or your authorized Sun distributor or reseller, will make one available to you, it being acknowledged and agreed that you have no right to make such a copy.

Safety / Fiber Optic / ESD Precautions

The following precautions must be followed during all phases of equipment installation, operation, and servicing. Equipment users are responsible for following warnings and cautions, and for taking other appropriate steps to assure safe equipment operation. Sun assumes no liability for failure to comply with these requirements.

■ Safety Precautions

To prevent hazardous conditions and personal injury, follow these safety precautions:

Verify Proper Equipment Grounding

Ensure cabinet frames are properly connected to an electrical earth ground. AC power supplies require a three-conductor power cable. Source power cables must be plugged into approved three-contact electrical outlets. Power cable jacks and mating plugs must meet electrical code requirements for the intended area of use and also comply with International Electrotechnical Commission (IEC) safety standards.

Avoid Electric Shocks

Only qualified personnel may remove equipment covers for servicing. Before starting a service procedure, remove conductive metal objects from your person including rings, watches, necklaces, and badge chains. Use a conductive wrist strap and work mat grounded to a jack or unpainted metal surface on a cabinet frame. Never touch exposed connector pins or sockets, or leave 'live' cable ends exposed.

Use Only Approved Tools and Test Equipment

Use only approved tools and test equipment supplied in the standard CSE tool kit. Always ground test equipment to a grounding jack on the cabinet frame. Repair or replace any damaged tools or test equipment prior to use.

Be Aware of Your Operating Environment

Never operate electrical or electronic equipment in the presence of flammable gases or fumes, as these can create an explosion hazard.

Never Service or Adjust Equipment Alone

Never service or adjustment equipment unless another person capable of rendering first aid and resuscitation is present.

Do Not Substitute Parts or Modify Equipment

To assure equipment safety features are maintained, and to avoid introducing additional hazards, never install substitute parts or modify Sun equipment without explicit permission from Sun technical support personnel. Never remove, cut, or relocate raised-floor tiles without first receiving customer permission.

Provide Adequate Equipment Clearances

Make sure there is sufficient clearance around equipment to facilitate airflow and heat dissipation, and to maintain ambient system temperatures within recommended operating ranges. Provide clearances that allow cabinet doors to open at least 90 degrees, and to be easily removed for servicing equipment or in emergency situations.

Strictly Comply With Caution and Warning Messages

To prevent injury and equipment damage, comply with all caution and warning messages in this document. Also employ any and all other precautions which you deem necessary for safe operation of equipment in your specific operating environment.

Carefully Follow Procedural Steps

Always complete procedural steps in listed order. Performing steps out of order can expose you to potentially hazardous or lethal conditions.

Protect Yourself From Moving Parts

Restrict loose clothing and long hair to avoid becoming entangled in moving parts such as fans, impellers, and blowers.

Promptly Reinstall Covers and Doors

After completing service procedures, promptly reinstall cabinet covers, and close and lock cabinet doors to maintain proper cabinet airflow, prevent overheating, and restrict accessibility to energized FRUs.

Miscellaneous Safety Precautions

To prevent tipovers, never tilt a cabinet beyond a 15-degree angle (e.g., when ascending or descending ramps). Use caution when working near open floor tiles. Use good house-keeping practices to avoid fire hazards and to reduce the potential for mishaps.

■ Electrostatic Discharge Precautions

Electrostatic discharge (ESD)-sensitive components must always be handled under protected conditions, and ESD-preventive equipment must be used when servicing equipment. Employees who handles ESD-sensitive parts must be aware of the damage that ESD can cause, and must take the following precautions to prevent it.

Use ESD-Preventive Equipment

Always use Field Service Grounding Kit P/N 4711 when installing or servicing Sun equipment. Always use a conductive wrist strap and antistatic work mat, and ensure those are grounded to a jack or unpainted metal on the cabinet frame when working.

Regularly Check and Clean ESD-Preventive Equipment

Regularly (at least monthly during frequent use) verify the resistance of wrist-strap grounding cords to be between 0.8M ohm (Ω) and 1.2M ohm (Ω), and work mat cords to be less than 1.2M ohm (Ω); replace damaged cords or any that do not meet these specifications. Regularly (at least monthly during frequent use) clean antistatic work mats; ACL Conductive Cleaner is preferred for this purpose since it leaves no residue, but isopropyl alcohol or a mild detergent and water solution can also be used.

Remove Conductive Personal Items

Before beginning service procedures inside a cabinet, remove all conductive metal objects from your person including rings, watches, necklaces, and badge chains.

Handle ESD-Sensitive Components Carefully

Keep circuit cards, ASICs, and other ESD-sensitive components away from ESD sources and extraneous electrical currents. Keep parts in ESD-protective packaging until installation, and store removed ESD-sensitive parts in protective packaging.

■ Fiber Optic Component Handling Precautions

To prevent damage to optical fiber cables and connectors, and to mitigate inherent hazards from laser-light emissions, always follow these general handling precautions:

Protect Your Eyes

Never aim the output of a laser, or of an optical fiber connected to a laser, directly into your eyes. Do not examine an optical connector on any cable that is still attached to its data transmission port, since laser light may be present in the cable. Before examining the end of an optical fiber, verify that no laser-light signals are present. Always cap unused data transmission ports on channel interface cards.

Handle Fiber Optic Components Gently

Handle fiber cables and connectors gently to prevent damage. Never grasp cables or connectors with pliers or grippers, or attach pulling devices to them. Never bend fiber cables (e.g., when routing along cable paths or guides) to a radius of <12 mm (<0.5 in.), and do not coil cables to <96 mm (<3.74 in.) in diameter. Use strain-relief mechanisms to prevent the weight of cables from damaging fibers. Protect cables from sharp edges or protrusions, heat sources, and other damaging conditions. Ensure that equipment openings and floor cutouts have protective edging at cable contact points.

Prevent Contamination of Cable Ends

Avoid touching the core of optical cables, as this can contaminate fibers and prevent light transmission. If a cable-end becomes contaminated, remove any loose debris using canned air or by gently tapping the connector, then clean the cable-end with an approved cleaning kit. Leave protective caps on cable-ends until cables are attached to a connector; after disconnecting cables, always reinstall clean protective caps.

About This Guide

■ Product Overview

The Sun StorageTek Virtual Storage Manager® (VSM®) is a disk-based virtual tape system that provides enterprise-class storage management capabilities for MVS-based systems. Its scalable design, which includes Virtual Tape Control System (VTCS) host software and an intelligent Virtual Tape Storage Subsystem (VTSS) disk buffer, optimizes streaming workloads and backup and recovery functions, reduces management overhead, and maximizes tape capacity utilization to reduce data protection costs in a wide range of storage environments.

■ Intended Audience

This document is intended for use by Sun Microsystems personnel and other qualified service providers (QSPs)¹ involved with site planning, installation, configuration, testing, certification, servicing, and technical support of VSM5 system equipment.

Users of this document should have a working knowledge of the following concepts and technologies: virtualization; Ethernet; FICON, fibre channel, and network topologies; tape storage (tape drives and tape libraries); and disk storage.

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If a digitized photograph, screen capture, line drawing, or other graphic has been reduced to fit in this document, small text in the image may be unreadable when viewed in an Adobe Acrobat® PDF file at 100% or lower scaling on some electronic displays.

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1. Third-party contractors certified and authorized by Sun to work with systems and equipment described in this guide.

■ Alert Messages

Alert messages used within this document are presented as follows:

Note: A note provides emphasis or additional useful detail about a topic or procedure, and can either precede or follow the information it references.



CAUTION !

A caution directs urgent attention to an action or condition which could damage equipment or corrupt data or system software if the accompanying procedure is not completed or is performed incorrectly. A caution always precedes the information it references.



DANGER !!

A danger message directs urgent attention to an action or condition that has potential to create a hazardous situation or to cause immediate, severe, and possibly fatal injury or adverse long-term health effects if the accompanying procedure is not completed or is performed incorrectly. A danger message always precedes the information it references.

■ Notational and Typographic Conventions

The following notational and typographic conventions are used throughout this document to highlight special words, phrases, and actions.

Item	Example(s)	Description of Convention
Publications; course titles	<i>Installation and Service Guide</i>	Italic font
MS Windows or GUI screen titles	<i><u>Ethernet Setup</u></i> screen	Italic underlined font
Computer keyboard input keys	Press the [<u>Enter</u>] key.	Monospaced underlined font in square brackets []
User-keyed non-variable inputs; system-generated outputs	show systemstate	Monospaced bold font
User-keyed variable inputs	Name = <system name>	Monospaced italic bold font in angled brackets < >
E-mail and IP addresses; URLs; file and folder names; active fields and icons in GUI windows	<u>glslfs@sun.com</u> ; click <u>Submit</u> ; <u>www.support.storagetek.com</u> ; <u>cli.exe</u> file; <u>129.80.64</u> subnet	Monospaced underlined font
Emphasized text	Do <u>not</u> touch exposed wiring...	Underlined font
Physical VTSS labels for FRUs, LED indicators, ports, or switches	POWER ON indicator; ETH0 port; POWER ENABLE switch	Bold caps font
Hypertext link (in PDF file) to a figure, table, procedure step, or section heading	See Figure 2-1 on page 2-27; Repeat Step 3 ; See " Assigning Passwords " on page 4-11.	Blue font (prints black in black and white photocopies)
Text references to numbered callouts in accompanying artwork	Pull the D-ring handle [3] .	Bold font in bold square brackets []

■ Where to Find Additional Information

Additional information about the complete line of Sun StorageTek products and services is provided through various media, as described below.

Reference Documents

The VSM5 Virtual Tape Storage Subsystem (VTSS) is one of several hardware and software components that link together to create the VSM5 system. Besides this document, it may be useful to consult some or all of the reference documents listed below to complete planning, system assurance, installation, and service tasks for other VSM components designed for a specific customer site.

Document Name and Part Number	Availability
VSM Hardware	
VTSS for VSM5 – Planning and System Assurance Guide, 96257	1
VTSS for VSM5 – Installation and Service Guide, 96254	1
T9x40 Tape Drive Planning and Migration Guide, MT6004	1
Nearline Physical Planning Guide, ML0041	1
Nearline Enterprise 9310/4410/9360 LSM System Assurance Guide, ML6500	1
TimberWolf 9740 Library Storage Module System Assurance Guide, MT5100	1
VSM Software	
VTCS <i>n.n</i> * Quick Reference Guide	1, 2
VTCS <i>n.n</i> * Installation and Configuration Guide	1, 2
VTCS <i>n.n</i> * Administrator's Guide	1, 2
VTCS <i>n.n</i> * Command and Utility Reference	1, 2
VTCS <i>n.n</i> * Messages and Codes	1, 2
VTCS <i>n.n</i> * XML Reference	1, 2
Remote Service and Support	
Service Delivery Platform System Assurance Guide	1, 3
Service Delivery Platform Installation and Configuration Guide	1, 3
Notes:	
<ol style="list-style-type: none"> 1. Sun StorageTek Customer Resource Center (CRC) website: www.support.storagetek.com. 2. Sun StorageTek Software Manufacturing and Distribution – Web: www.support.storagetek.com, then under <i>CRC Tools</i> click <i>Software Manufacturing and Distribution</i>; E-mail: LSVSMD-list@louisville.stortek.com; Phone: U.S. (outside Colorado) and Canada 1.800.436.5554, International and within Colorado 1.303.673.8562. 3. Sun StorageTek Hardware Manual Scheduling – Phone: 1.303.673.6241. <ul style="list-style-type: none"> • * Use documents labeled as version 6.0 or higher, which is the minimum host software level required for compatibility with VTSS back-end FICON channels. 	

VSM Engineering Website

Extensive and detailed information about VSM, including engineering documents, Red-books, White Papers, and standards, is available through the VSM Engineering website at <http://vsm.stortek.com>. Website access is restricted to Sun employees.

Customer Resource Center

The Sun StorageTek Customer Resource Center (CRC) website at www.support.storagetek.com provides resources including product documents, software keys, code downloads, SE tools, and information on product education and training. Website access is restricted to Sun employees, registered customers with a current warranty or maintenance service agreement, and registered partners.

Product-Specific Documentation

The latest editions of documents for all Sun StorageTek products can be printed from PDF files available on the CRC website; see "[Customer Resource Center](#)" above for more information. VSM documents, including those for VTCS software and VTSS hardware, are available through the path Current Products > Tape Products > Virtual Storage Manager on the CRC website.

VTCS software documents, including a *Quick Reference Guide, Installation and Configuration Guide, Administrator's Guide, Command and Utility Reference, Messages and Codes, and XML Reference*) also are provided on a CD-ROM that ships with each VSM system. To order additional CDs, contact Sun StorageTek Software Manufacturing and Distribution (SMD) at 800.436.5554, 303.673.8600, or www.support.storagetek.com, and request the *VTCS Information* CD. To order individual software documents in bound-book format, contact the SMD group.

Product Education and Training

The Sun StorageTek Learning Network website at <http://learning.stortek.com> provides education and training courses for all Sun products, including the VTSS for VSM5. Website access is restricted to Sun employees. Courses for the VSM5 system include:

- [CRS100178](#) – *VSM MVS System Administration* for [employees](#)
- [CRS100267](#) – *VSM MVS System Administration* for [customers](#)
- [CRS-102711](#) – *Detached Operator Panel (DOP)* webinar
- [CRS101nnn](#) – *VTSS for VSM5 Differences*
- [CRS100014](#) – *SVA9500 and VSM Installation and Maintenance*
- [CRS101182](#) – *FICON Native - T9X40 Tape Drive*.

SE Support Tools

SE tools, white papers, and other content for use with Sun StorageTek products, including VSM5 system equipment, are available through the SE Support Tools website at <http://setools>. Website access is restricted to Sun employees.

Global Services Field Support Tools

Resources to assist with sales and support of VSM5 system equipment and other Sun StorageTek products and services are located on the Global Services Field Support Tools website at http://sunsolve.central.sun.com/handbook_internal/FieldTools/. Website access is restricted to Sun employees.

Storage Sales Community

Marketing collaterals and configuration documents for all Sun StorageTek products, including VSM5 system equipment, are available on the Storage Sales Community website at <https://portal.storagetek.com/sales>. Website access is restricted to Sun employees.

Partners

The Sun StorageTek Partners website at <https://members.storagetek.com> provides information about products, services, customer support, upcoming events, training programs, and sales tools to support Sun Partners. Website access is restricted to Sun employees and registered Sun partners.

'Documents on CD'

Documents on CD is a set of CD-ROMs that contain documents for many Sun StorageTek tape, disk, and storage networking products, and is shipped quarterly to field offices. Contact your manager to obtain a current copy.

■ Colophon

This document was created using Adobe FrameMaker 7.0 publishing software, and was converted to a PDF (portable document format) file using Adobe Acrobat Writer 6.0 document conversion software. Acrobat Reader software (Version 4.0 or higher)¹ is required to view PDF versions of this document.

1. This software can be downloaded free from www.adobe.com.

Planning and Implementation Overview

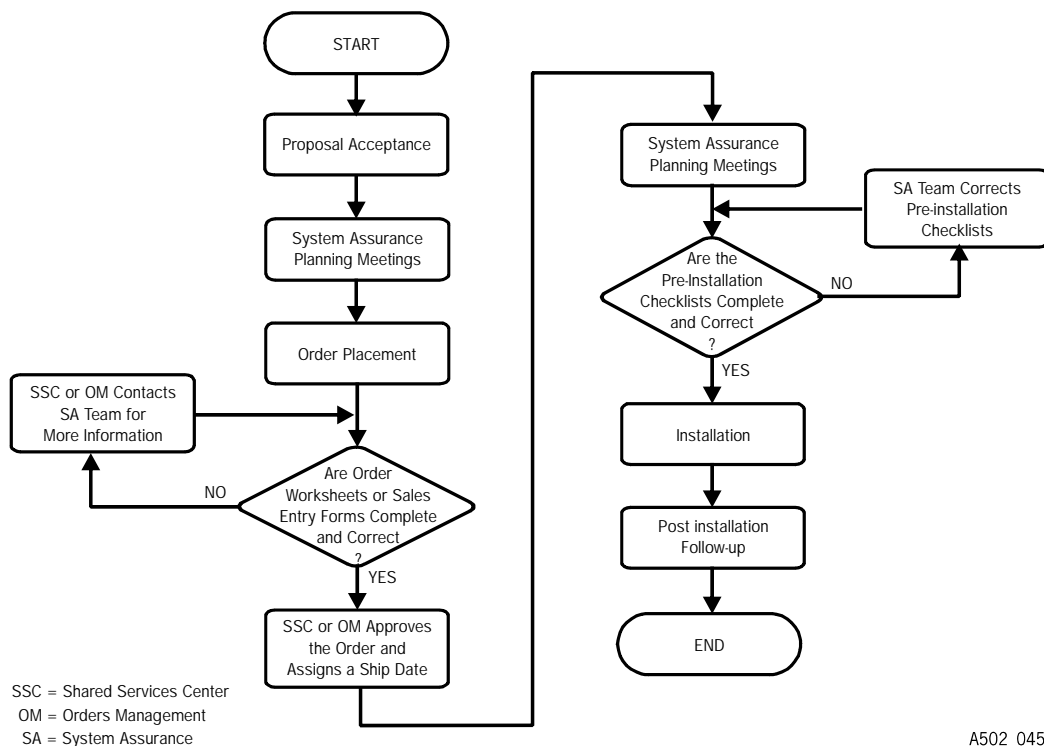
1

This chapter provides an overview of key participants, timelines, and activities involved in planning for and implementing a VSM5 system.

Successful implementation requires regular communication and coordination between customer personnel and the Sun account team. This ongoing collaboration helps ensure that all factors critical to the implementation are identified and addressed before equipment is delivered to the site. The primary goals of the planning process are to:

- Ensure the VSM5 system is properly designed to meet the requirements of the customer, and that it is ordered, delivered, installed, configured, tested, certified, and turned over with a minimum of disruptions and problems
- Ensure the installation site infrastructure is equipped to handle the power, data-handling, and environmental requirements of VSM5 system equipment, and that customer personnel are trained to assist with delivery, installation, configuration, testing, certification, and operation of the VSM5 system equipment.

Figure 1-1. System Assurance Process Flow



■ Creating Planning Teams

Once a sales proposal has been accepted, the Sun customer service manager (CSM) should confer with customer-site personnel including the network administrator, data center manager, and facilities manager to identify which individuals who should be involved with implementation planning, site readiness planning, and delivery and installation planning.

Customer and Sun personnel who participate in these planning teams jointly own and control the various processes, activities, and deliverables of those teams.

Once the team participants have been identified, one customer team member and one Sun team member should be selected to act as coordinators for each team. Regular meetings should be scheduled to:

- Define roles and responsibilities for all team members
- Define required implementation activities and task completion dates
- Identify and address issues that could impede delivery, installation, or implementation of system equipment.

Forms and worksheets in [Appendix D](#) can be used by both customer and Sun planning team members to record key system hardware and software information, identify planning factors and considerations, and record completion dates for critical planning and implementation activities.

Customer membership for the various planning and implementation teams should consist of:

- Persons who will determine the configuration and location of VSM5 system equipment, including but not limited to: the data center manager; one or more network administrators; the facilities manager; the site engineer, etc.
- Persons who will be directly involved with installation, testing, certification, and operation of VSM5 system equipment, including but not limited to: facilities personnel; system operators; network/IT personnel, etc.
- Persons who will be involved with delivery and dock-to-data center transit of VSM5 system equipment, including but not limited to: the dock manager; dock personnel; facilities personnel, etc.

Sun membership for the various teams may include some or all of the following: the sales representative (SR); the local customer services manager (CSM); a systems engineers (SE); a system support specialist (SSS); a technical support specialist (TSS); a professional services (PS) consultant; and a customer service engineer (CSE).

■ Planning / Readiness / Implementation Timelines

The following activity guidelines allow sufficient time for planning, readiness, and implementation tasks to be completed prior to delivery of VSM5 system equipment to a customer site.

1. Three months before the scheduled delivery date for the VSM5 system equipment:
 - The network administrator, data center manager, and Sun account representative, systems engineer (SE), and technical support specialist (TSS) define a system configuration that best addresses customer requirements.
 - The site engineer, facilities manager, and Sun Professional Services consultant review site factors that present existing or potential safety and environmental hazards which could negatively affect the operation of the VSM5 system. See [“Site Evaluation – External Considerations”](#) and [“Site Evaluation – Internal Considerations”](#) on page 4-46.
 - The facilities manager and Sun Professional Services review equipment transfer requirements and define a compliance plan as needed. See [“Transferring Equipment Point-to-Point”](#) on page 4-47.
 - The facilities manager and Sun Professional Services consultant review power supply and cabling requirements, and evaluate compliance to requirements. See [“Site Power Distribution Systems”](#) on page 4-49.
 - The site engineer, facilities manager, and structural engineer (if needed) review floor construction and load ratings, and evaluate compliance. See [“Floor Construction Requirements”](#) and [“Floor Loading Requirements”](#) on page 4-52.
 - The network administrator, data center manager, and Sun technical support specialist review data cabling requirements for the VSM5 system configuration, and evaluate compliance to requirements. See [“Fibre Channel Cables — Available Lengths”](#) on page B-166.
 - After completing reviews of power, environmental, flooring, and network connectivity requirements, the site engineer and facilities manager schedule needed facilities upgrades, targeting completion for not later than one week before delivery of system equipment (two weeks is preferable).
2. Two months before the scheduled delivery date for the VSM5 system equipment:
 - The site engineer and facilities manager create a floorplan/layout for all VSM5 system equipment, and review it with the Sun Professional Services consultant. See [“Physical Space Requirements”](#) on page 4-55.

Note: A copy of the final floorplan/layout should be given to the Sun sales representative to attach to the sales order.

 - The facilities manager and Sun technical support specialist measure and record cable-layout distances between AC source power locations, host systems, network servers, remote support devices, and VSM5 system hardware components.

- The dock manager and/or facilities manager and Sun customer service manager identify any special shipping requirements, and notify the Sun manufacturing group as needed.
 - The Sun sales representative completes and submits the equipment sales order, including all necessary cabling and spare parts.
 - The network administrator and data center manager select appropriate personnel for VSM5 system training, targeting completion for no later than one week before delivery of equipment.
3. One month before the scheduled delivery date for the VSM5 system equipment:
- The network administrator, data center manager, and Sun sales representative verify that all required components in the specified configuration, and all cables of the required length, have been ordered.
 - The Sun customer service manager reconfirms the scheduled system delivery date with the Sun manufacturing facility.
 - The facilities manager verifies compliance of input power systems and power cabling in the data center. See [“Site Power Distribution Systems”](#) on page 4-49.
 - The facilities manager verifies environmental compliance and HVAC systems readiness in the delivery, staging, and installation areas.
 - The site engineer and structural engineer verify floor loading compliance along the delivery path and at the data center installation location. See [“Floor Construction Requirements”](#) and [“Floor Loading Requirements”](#) on page 4-52.
 - The Sun customer services manager identifies which Sun personnel will perform the VSM5 system installation at the customer site.
4. Two weeks before the scheduled delivery date for the VSM5 system equipment:
- The Sun sales representative verifies that all parts and bills of material (BOM) have been delivered to the site to allow hardware and software conversions and feature changes in previously-installed equipment.
 - The facilities manager and Sun customer service manager verify the delivery dock and data center personnel, and Sun CSEs who will be available to accept delivery of the system equipment, and assist in unpackaging, point-to-point transfer, and installation of system equipment.
 - The facilities manager, data center manager, and Sun customer service manager agree on firm dates and timeframes for delivery, installation, certification, and operational testing of system equipment.

Configuration Planning

2

This chapter provides an overview of configuration planning considerations and activities that are used to design a VSM5 system tailored to customer requirements, and to ensure proper implementation of the system.

Designing an optimized VSM5 system to meet specific customer requirements requires close collaboration between Sun personnel (the account representative (AR), systems engineers (SEs), and technical support specialists (TSSs)) and key customer decisionmakers (network administrators, data center managers, etc.) who are involved with selecting and implementing the system.

Planning for more complex system implementations may require consultation with the Sun Global Professional Services group.

Table 2-1. Configuration Planning Overview

Key High-Level Activities	Key Sub-Tasks	Key Participants
<ul style="list-style-type: none">• Define customer requirements.• Assess budgetary constraints.• Design an optimized VSM5 system based on defined requirements and constraints.	<ul style="list-style-type: none">• Use sizing tools to estimate requirements and propose a VSM5 system configuration• Create high-level conceptual diagram of proposed VSM5 system configuration• Create detailed engineering diagram of proposed VSM5 system configuration• Present VSM5 system physical and functional configuration plans to key decisionmakers• Complete applicable Appendix D worksheets	<ul style="list-style-type: none">• Customer: network administrator; data center manager• Sun: account representative; systems support specialist; technical support specialist; systems engineer

■ Defining Customer Requirements

Customized tools are available to assist Sun personnel with estimating customer requirements and configuring a unique VSM5 system to meet those needs.

VSM Quick is a pre-sales tool package designed for use by SEs and ARs. It provides potential customers with a quick estimate of the size and scope of a VSM5 system that is tailored to their requirements.

VSM Quick and other VSM-related tools are available on the SE Tools website at <http://setools>. Use of VSM Quick requires a Pentium system with a minimum of 128MB RAM (256MB+ recommended), 8MB of free disk space, Windows 2000 or XP operating system, and the MS Office Suite 2000 (or later).¹

The VSM Quick tool package currently consists of four discrete tools: the VSM Sizer tool, MVC Sizer tool, MVC Migration tool, and CDS Sizer tool, as described in the following pages. [Figure 2-1](#) shows the VSM Quick tool selection screen.

Detailed information on how to use each tool is available in the help file that accompanies the download of the VSM Quick program.



Figure 2-1. VSM Quick Tool – Tool Selection Screen

1. Also, a CD-ROM with SE tools for many other StorageTek products is available on the SE tools website at <http://setools>, or from the StorageTek Software Manufacturing and Distribution (SMD) group.

VSM Sizer Tool

As shown in [Figure 2-2](#), the VSM Sizer tool requests inputs on mount activity, file size, the estimated growth rate of data, and the current configuration of libraries, transports, and cartridges to determine customer requirements for a VSM5 system.

Based on the results of its calculations, the tool identifies an optimum VSM5-VTSS configuration and minimum number of RTDs to meet the defined requirements. The tool also suggests possible hardware reductions that could result from installing the proposed VSM5 system.

The screenshot shows the 'VSM Sizer' application window. The title bar reads 'VSM Quick.xls'. The interface includes a navigation menu with 'VSM Sizer' and 'Inputs Page'. A banner at the top right says 'INFORMATION made POWERFUL' and 'S.E. Support Tools VSM QUICK'. The main area is divided into two sections:

- Your Existing 36-track Configuration**: These inputs are for your entire configuration.
 - How many 4410 / 9310 Libraries do you have? [input field]
 - How many 36-track Drives do you have? [input field]
 - How many 36-track Drives are attached to the Libraries? [input field]
 - How many total cartridges do you have? [input field]
 - How many cartridges are in the libraries? [input field]
 - How many total mounts per day? [input field]
- VSM Plans for 36-track Conversion**: These inputs are for VSM conversion information only.
 - What % of mounts will be used in VSM? [input field: 50]
 - OR
 - Enter average mounts per hour [input field]
 - OR
 - Enter total mounts per day [input field]
 - OR
 - Enter peak mounts per hour [input field]
 - What is your % estimated annual growth rate? [input field: 10]
 - What is your average file size? (Mb's) [input field: 100]
 - Do you use tape stacking?
 - Yes
 - No
 - What is your % of tape utilization? [slider]

At the bottom right, there are 'Back' and 'Results' buttons.

Figure 2-2. VSM Sizer Tool

MVC Sizer Tool

As shown in [Figure 2-3](#), the MVC Sizer tool estimates the number of Multiple Volume Cartridges (MVCs) required for a VSM installation at intervals of 90 days, 180 days, 270 days, one year, two years, and three years, based on mount activity and average file size.

The tool also reports estimated hours needed for daily reclaim activity, and the average number of MVCs to be added on a monthly basis after the first 90 days.

The screenshot shows the MVC Sizer tool interface with the following sections:

- MVC Inputs:**
 - Enter average mounts per hour: 222
 - Enter total mounts per day: []
 - Enter peak mounts per hour: []
 - Peak FE Bandwidth Required (GB/Hour): []
 - Peak FE Bandwidth Required (MB/Sec): []
 - What is your average file size? (MBs): 100
- MVC Assumptions:**
 - Reclaim Threshold (% of good data remaining): 30%
 - Number of days of Scratches: 3
 - Percent of Data Archived Daily: 3.0%
 - Duplex: No
- MVC Outputs:**
 - Lowest estimated number of MVC's needed:**

90 Days	180 Days	270 Days	1 Year	2 Year	3 Year
[]	[]	[]	[]	[]	[]
 - Highest estimated number of MVC's needed:**

90 Days	180 Days	270 Days	1 Year	2 Year	3 Year
[]	[]	[]	[]	[]	[]
 - MVC Outputs are based on a 19GB cartridge.
 - Average number of MVC's added per month after 90 days: 8
 - Estimated daily hours of reclaim: 1

Buttons: Back, Results, Exit

Figure 2-3. MVC Sizer Tool

MVC Migration Tool

As shown in [Figure 2-4](#), the MVC Migration tool evaluates existing tape systems, tape media, channels, and data set size to estimate the number of Multiple Volume Cartridges (MVCs) required for a VSM installation at intervals of 90 days, 180 days, 270 days, one year, two years, and 3 years, and the amount of time needed to migrate data from existing manual or Nearline tape devices to the proposed VSM5 system.

The screenshot shows the MVC Migration Tool interface with the following fields and values:

MVC Migration Inputs		Solution	
Silo or Rack	Silo	Number of MVCs required	27.8
Robot type (source to host)	4410	Time to complete project (Hrs.)	229.66
Media type	9840		
Number of external drives planned	1		
Channel type (source to host)	ESCON		
Number of external channels planned	1		
Number of tapes to write to MVCs	10,000		
Average dataset size (MB)	450		
MVC Migration Outputs			
MVC type being used	9840B		
Duplex	No		

Inputs changes have been made. Make sure to click the 'Results' button for updated figures.

Buttons: Back, Results, Exit

Figure 2-4. MVC Migration Tool

CDS Sizer Tool

As shown in [Figure 2-5](#), the CDS Sizer is used to determine size requirements for the HSC control data set (CDS) based on a specific VSM5 system configuration.

The tool requests detailed inputs about the VSM configuration (number of LSMs, VTVs, MVCs, VTSSs, configured MVC ranges, and configured VTV ranges), then calculates the number of 4K blocks needed in the HSC database to accommodate the LSM and VSM configurations.

The screenshot shows the 'CDS Sizer' window from 'VSM Quick.xls'. The window title bar includes 'VSM Quick.xls' and standard window controls. The main content area is divided into two columns: 'CDS Sizer Inputs' and 'CDS Sizer Outputs'. The 'Inputs' column contains six text boxes with the following values: 2, 20,000, 3,000, 2, 4, and 2. The 'Outputs' column contains three text boxes with the following values: 385, 440, and 825. At the bottom of the window, there are three buttons labeled 'Back', 'Results', and 'Exit'. The window also features a header with 'S.E. Support Tools VSM QUICK' and a small image of a globe.

CDS Sizer Inputs		CDS Sizer Outputs	
Number of LSMs	2	Number of 4K blocks required for LSM	385
Number of VTVs	20,000	Number of 4K blocks required for VSM	440
Number of MVCs	3,000	Total number of 4K blocks required	825
Number of VTSSs	2		
Number of configured MVC ranges	4		
Number of configured VTV ranges	2		

Figure 2-5. CDS Sizer Tool

■ VTSS Configuration Planning

A VSM5 system consists of Virtual Tape Control System (VTCS) host software, Virtual Tape Storage Subsystem (VTSS) disk hardware (tape buffers)¹, real tape drives (RTDs) which attach to an Automated Cartridge System (ACS), and automated cartridge systems (ACSS), a.k.a. tape libraries.

A VSM5-VTSS connects to IBM S/390-equivalent data-streaming architectures and related hardware², and has front-end and back-end FICON connections. ESCON connections are not available for VSM5-VTSS.

VSM5-VTSS Environmental Requirements

Table 2-2. VSM5-VTSS Environmental Requirements

Environmental Factor	Shipping Environment Limits*	Storage Environment Limits [#]	Operating Environment Limits
Temperature	-40°C to +60°C (-40° F to +140° F)	10°C to 40 C (50° F to 104° F)	16°C to 32°C (60° F to 90° F)
Thermal Change (maximum rate/hr)	15 C (27° F)	15°C (27° F)	5°C (9° F)
Humidity [‡]	10% to 80%	10% to 80%	20% to 80%
Altitude	0m to 15,240m (0 ft. to 50,000 ft.)	0m to 3050m (0 ft. to 10,000 ft.)	0m to 2439m (0 ft. to 8000 ft.)

Notes:

- Abbreviations key: C = Centigrade; F = Fahrenheit; ft. = foot / feet; m = meter(s)
- * The shipping environment must not exceed the storage environment limits longer than 10 days.
- # The storage environment must not exceed the operating environment limits longer than 60 days.
- ‡ Humidity specifications exclude conditions that may cause condensation on disk drives.

VSM5-VTSS Physical Characteristics

Table 2-3. VSM5-VTSS Physical Characteristics

Physical Attribute	Specification
Height	154.94cm (61.0 in.)
Width (with both side covers attached)	92.1cm (36.24 in.)
Depth (with front and rear doors attached)	77.1cm (30.34 in.)
Maximum Weight (with 64 array drives)	445kg (982 lbs.)
Footprint	7093.7cm ² (1099.5 in ²)
Recommended Service Clearance, Front/Rear (door swing radius)	54.1cm (21.3 in.)
Recommended Left/Right Side Clearance (optional)	6.4cm (2.5 in.)

1. Both a primary VTSS and secondary VTSS can be used within a single system configuration.
2. Including, but not limited to: OS/390, z/OS, MVS, and VM host systems and FICON directors (switches) by Brocade, CNT, and McData. Check with Sun product marketing for the latest certification and compatibility information for VSM systems.

Model Numbers / Configurations / Capacities

Table 2-4. VSM5-VTSS Model Numbers / Configurations / Capacities

Base Model Number	Disk Arrays Configuration	Data Drives* Total Capacity	Capacity Feature Code	PCap Capacity#	Published Effective 4:1 Capacity	Actual Effective 4:1 Capacity‡	PCap Utilization#
VSMB-465	2 x 13 + 2 + 1 (32 drives*)	3737.6 GB (1:1 uncompressed) ----- 14,950.4 GB (4:1 compression)	Base model	330GB	1250GB	1320GB	8.8%
			VC15	660GB	2500GB	2640GB	17.7%
			VC16	1320GB	5000GB	5280GB	35.3%
			VC21	1970GB	7500GB	7880GB	52.7%
			VC18	2890GB	11,000GB	11,560GB	77.3%
			VC19	3551GB	14,000GB	14,203GB	95.0%
VSMC-465	3 x 13 + 2 + 1 (48 drives*)	5606.4 GB (1:1 uncompressed) ----- 22,425.5 GB (4:1 compression)	Base model	4200GB	16,000GB	16,800GB	74.9%
			VC22	4730GB	18,000GB	18,920GB	84.4%
			VC23	5326GB	21,000GB	21,304GB	95.0%
VSMD-465	4 x 13 + 2 + 1 (64 drives*)	7475.2 GB (1:1 uncompressed) ----- 29,900.7 GB (4:1 compression)	Base model	6040GB	23,000GB	24,160GB	80.8%
			VC24	6570GB	25,000GB	26,280GB	87.9%
			VC25	7101GB	28,000GB	28,406GB	95.0%

Notes:

- Abbreviations key: GB = gigabyte(s) (10⁹ bytes); PCap = Physical Capacity Control feature
- * 32-drive configuration = 26 data drives, 4 parity drives, 2 spare drives, 30 read actuators, and 13 write actuators; 48-drive configuration = 39 data drives, 6 parity drives, 3 spare drives, 45 read actuators, and 13 write actuators; 64-drive configuration = 52 data drives, 8 parity drives, 4 spare drives, 60 read actuators, and 13 write actuators.
- # PCAP utilization is the sum of PCap capacity divided by the uncompressed capacity of all data drives in a base model. Example: Model VSMB-465 with capacity feature VC15 has a PCap capacity of 660GB and a data drive capacity of 3737.6GB (13 drives), or a 17.7% utilization rate. PCap utilization is capped to a maximum of 95% to ensure at least 5% of data drive space is available for free space collection.
- ‡ Actual effective 4:1 capacity = PCap capacity with 4:1 compression, based on number of data drives per array (13) x number of arrays (2, 3, or 4) x base capacity per drive (143.75GB).

Prerequisites for FICON Connectivity

Note: VTCS 5.1 code or later and VTSS code D01.01.00.17 or higher are required prerequisites for enabling front-end FICON connectivity between a VTSS and main-frame (host) CPU or FICON director. VTCS 6.0 code or higher and VTSS code D01.02.00.00 or higher are required prerequisites for enabling back-end FICON connectivity between a VTSS and RTDs or cluster-links (Clinks).

In a VSM5-VTSS, front-end channel transfers are never synchronized with back-end array transfers. As such, timing problems associated with channel extenders for traditional disk storage systems do not apply to the VSM5-VTSS.

A VTSS must be ordered with minimum of 4 VCF3 cards for front-end FICON connections. The field upgrade procedure is disruptive, i.e., the VTSS must be powered down and host interfaces must be reconfigured after installing the VCF3 cards and 32-Port FICON option. Whether FICON connectivity is provided through a factory-ordered unit or a field upgrade, the 32-Port FICON option must be installed.

Prerequisites for front-end FICON connectivity to hosts and FICON directors are:

- Two VCF3 card pairs (four cards total)
- VTCS code level 5.1 or higher
- VTSS code level D01.01.00.17 or higher.

Prerequisites for back-end FICON connectivity to real tape drives (RTDs) and cluster-links (Clinks) are:

- One or more VCF2 card pairs in place of a like number of ICE3 card pairs
- VTCS code level 6.0 or higher
- VTSS code level D01.02.00 or higher.

Additional Prerequisites for FICON RTDs

Additional prerequisites applicable only for back-end FICON connectivity to RTDs are:

- Minimum tape drive microcode levels
 - 9840B tape drives = 1.35.304 or higher
 - 9940B tape drives = 1.35.404 or higher
 - 9940C tape drives = 1.35.504 or higher
 - T10000 tape drives = 1.35.604 or higher
- 3490 Emulation Mode – All RTDs must use 3490 Emulation Mode, which is selected at the T9X40 [Emulation Mode](#) submenu.
- Receive Buffer Frame Size – All RTDs must have their receive buffer frame size set to 2048 MB, which is selected at the T9X40 [Port A/B Maximum Data Size](#) submenu.

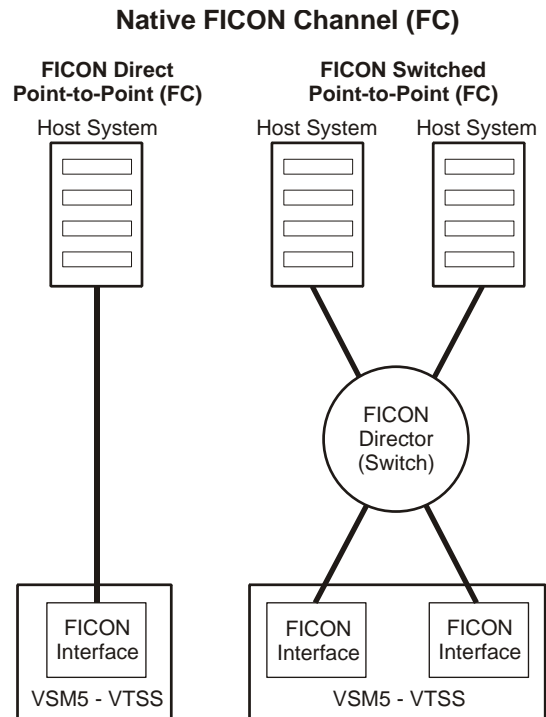
See [Chapter 5](#) of the *T9X40 Service Reference Manual*, P/N 95740, for details on how to verify code levels and set the parameters listed above.

Native FICON Attachment

Native FICON attachment refers to a FICON CPU channel connected to a FICON control unit interface, which may pass through a FICON director (switch). Since the connection is all-FICON, all channels can provide the increased performance of FICON if the attached devices are capable of FICON speeds.

Figure 2-6 illustrates the two attachment modes for native FICON: direct and switched. Direct (point-to-point) attachment consists of a CPU FICON channel that connects directly to a FICON control unit interface, without any intervening directors (switches).

Switched attachment is similar to direct attachment except that the FICON path passes through a FICON switch, similar to an ESCON director. Adding a FICON director/switch provides increased flexibility and connectivity similar to what ESCON directors provide, but with the benefits and features of FICON.



A504_020

Figure 2-6. Native FICON Attachment Options

FICON Data Transfer Rates

The fastest native FICON channels are rated at 200 MB/sec., but actually can achieve a maximum data rate of only 170 MB/sec. under optimum conditions. In actual practice, FICON typically operates at 40-60 MB/sec. using the 32 KB block size commonly found in tape workloads.

VCF3 cards support 2 Gb link speeds; actual throughput speed is determined by many factors including block size, microcode level, etc.

FICON Cabling — Short-Wave vs. Long-Wave Connections

Currently, FICON channels send data via fiber-optic cables only; copper-wire cables are not supported. Fiber-optic data communication cables are either single-mode or multi-mode, as summarized in [Table 2-5](#), and have these characteristics:

- Single-mode cables have a smaller core size than multi-mode, typically 8.5 or 9 microns, and use long wavelengths to transmit data over greater distances (up to 10 km; 20 km with an RPQ)¹
- Multi-mode cables have a larger core size than single-mode cables, typically 50 or 62.5 microns, and use short wavelengths, which limits transmission range to distances less than 500 m (1640 ft.). Multi-mode cables are more economical when long transmission distances are not a requirement.

VCF2 (FICON) cards support both short- and long-wave connections through different SFP connectors, which can be intermixed on individual cards. By default, VCF2 cards ship with long-wave (LX) SFP connectors; an orderable option allows field upgrades to short-wave (SX) connections.

LC Fibre connectors are used on both short- and long-wave SFPs, which requires use of LC-LC or LC-SC cables for all VTSS-to-host connections.

Table 2-5. Single-Mode vs. Multi-Mode FICON Cabling

Mode Type	Core Size	Wavelength	Color	Max. Transmission Distance	Relative Cost
Single-mode (SM)	8.5 to 9 microns	Long (LX)	Yellow	<ul style="list-style-type: none"> • 10 km (6.2 mi.) • 20 km (12.4 mi.) with RPQ • 100 km (62 mi.) with repeaters 	More
Multi-mode (MM)	50 to 62.5 microns	Short (SX)	Orange	<ul style="list-style-type: none"> • 50 micron: ≤500 m (1640 ft.) • 62.5 micron: ≤175 m (574 ft.)* 	Less
Note: * Requires mode-conditioner patch (MCP) cables, used in pairs. Data rates >100 MB/sec. are not supported when MCP cables are used.					

1. RPQ is not available with FICON channels rated at 200 MB/sec.

VCF3 (FICON) Card Configuration Examples

Note: VCF3 (FICON) cards must be installed and removed in pairs. A minimum VSM5-VTSS configuration requires four VCF3 cards. Cards must be removed in the reverse order they were installed. Although there is no mechanism to restrict or support which slots VCF cards are placed in, configurations other than those shown in Figure 2-7 through Figure 2-9 will not be supported.

As shown in Figure 2-7, the required minimum configuration of four VCF cards provides eight physical FICON ports, and each port supports 64 host paths (512 paths total). The first four VCF3 cards must be installed in slots VCF00, VCF02, VCF10, and VCF12.

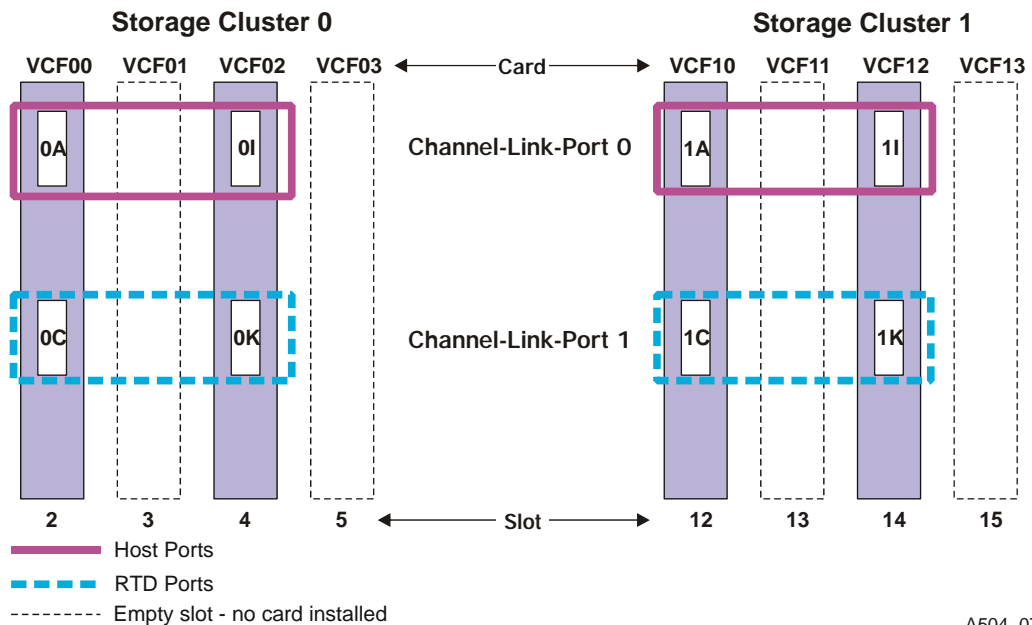


Figure 2-7. FICON Channel Card Configuration – 4 VCF Cards

A504_070

As shown in Figure 2-8, six VCF cards provide 12 physical FICON ports, and each port supports 64 host paths (768 paths total). Cards must be installed in the slots shown (i.e., the third VCF3 card pair must be installed in slots VCF01 and VCF11).

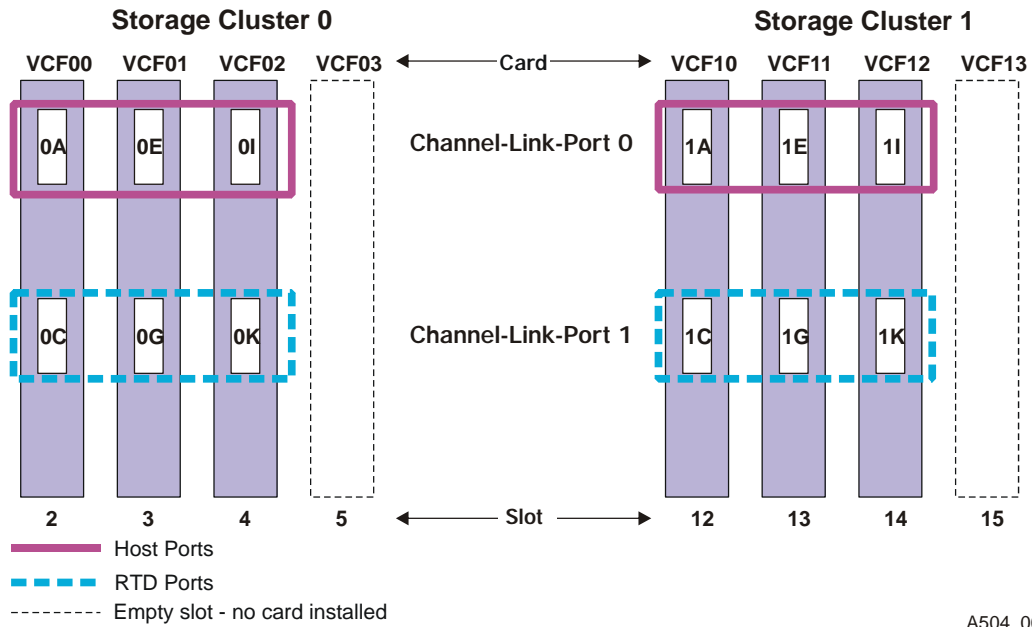


Figure 2-8. FICON Channel Card Configuration – 6 VCF Cards

As shown in Figure 2-9, eight VCF cards provide 16 physical FICON ports, and each port supports 64 host paths (1024 paths total). Cards must be installed in the slots shown (i.e., the third VCF3 card pair must be installed in slots VCF03 and VCF13).

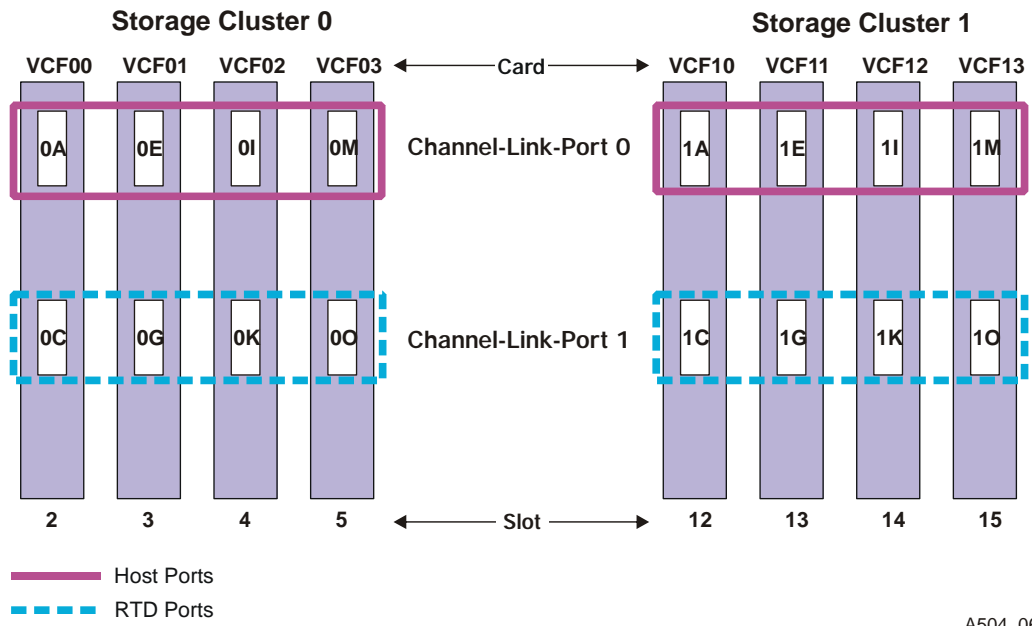


Figure 2-9. FICON Channel Card Configuration – 8 VCF Cards

■ Fibre Channel Cables — Available Lengths

Table 2-6. Fibre Channel Cables – Available Lengths

Description / Length	Part Number
LC-LC, 9/125, Duplex, Plenum, 10 meter (32.8 ft.), RoHS-5	10800330
LC-LC, 9/125, Duplex, Riser, 10 meter (32.8 ft.), RoHS-5	10800331
LC-LC, 9/125, Duplex, Plenum, 50 meter (164 ft.), RoHS-5	10800332
LC-LC, 9/125, Duplex, Riser, 50 meter (164 ft.), RoHS-5	10800333
LC-LC, 9/125, Duplex, Plenum, 100 meter (328 ft.), RoHS-5	10800305
LC-LC, 9/125, Duplex, Riser, 100 meter (328 ft.), RoHS-5	10800306
LC-SC, 9/125, Duplex, Plenum, 10 meter (32.8 ft.), RoHS-5	10800334
LC-SC, 9/125, Duplex, Riser, 10 meter (32.8 ft.), RoHS-5	10800335
LC-SC, 9/125, Duplex, Plenum, 50 meter (164 ft.), RoHS-5	10800336
LC-SC, 9/125, Duplex, Riser, 50 meter (164 ft.), RoHS-5	10800337
LC-SC, 9/125, Duplex, Plenum, 100 meter (328 ft.), RoHS-5	10800303
LC-SC, 9/125, Duplex, Riser, 100 meter (328 ft.), RoHS-5	10800304
SC-SC, 50/125, Duplex, Plenum, 10 meter (32.8 ft.), RoHS-5	10800294
SC-SC, 50/125, Duplex, Riser, 10 meter (32.8 ft.), RoHS-5	10800297
SC-SC, 50/125, Duplex, Plenum, 50 meter (164 ft.), RoHS-5	10800295
SC-SC, 50/125, Duplex, Riser, 50 meter (164 ft.), RoHS-5	10800298
SC-SC, 50/125, Duplex, Plenum, 100 meter (328 ft.), RoHS-5	10800296
SC-SC, 50/125, Duplex, Riser, 100 meter (328 ft.), RoHS-5	10800299

Notes:

- Order plenum-rated cables for sites where cables will be routed through HVAC ductwork. Plenum cables have fire-retardant coating to prevent release of toxic gases and smoke in case of fire, so cost more than riser cables.
- Order riser cables for sites where cables will be installed in vertical riser shafts. Riser cables cannot be used in plenum areas unless specifically permitted by local codes. Riser cables provided by Sun are compliant with the standard flame spread test requirements outlined in UL specification 1666.
- When ordering cables, add a 'service loop' of at least 4.6 m (15 ft.) of extra cable at each end of the measured VTSS-to-host length to allow the VTSS to be moved as needed for servicing, room reconfigurations, etc. Store extra cabling either on the floor beneath the VTSS or inside the VTSS, but not in an under-floor cable trough. If in doubt as to where locate the loop, contact the data center manager or Sun Technical Support.

AC Source Power Specifications and Connectors

Table 2-7. VSM5-VTSS AC Source Power Specifications and Connectors

AC Source Power Requirement	Power Specification
Power and Frequency	Single-phase 170-240 VAC 30A @ 47-63 Hz
Heat Dissipation	4.77 minimum kBTU/hr — 7.64 maximum kBTU/hr
kVA	1.42 minimum kVA — 2.29 maximum kVA
Connector Type or Location	Connector Specification
Sun-supplied VTSS power cables (from VTSS power strips to AC source connector)	<ul style="list-style-type: none"> • RussellStoll RS3750DP* (North America only) • No connector (all sites outside North America)
Customer-supplied wall receptacles or connector cables (from AC source connector to VTSS power strips)	<ul style="list-style-type: none"> • RussellStoll RS 9R33u0W (rigid mount) • RussellStoll RS 9C33U0 (flexible mount)

Notes:

- Abbreviations key: AC = alternating current; Hz = hertz; kVA = kilovolt-amperes; V = volt(s)
- * There is no equivalent Hubbell connector.

DC Power Supply Voltage Ripple Specifications

Table 2-8. VSM5-VTSS DC Power Supply Voltage Ripple

DC Power Supply Type	Output Voltage	Maximum Ripple (mV peak-to-peak)
Logic Power Supply	5.1	50
Array Power Supplies	5.1 12 (logic)	50 240

Power Requirements

Table 2-9. VSM5-VTSS Power Requirements — Single AC Source Power Cable Operation

Number of 16-Drive Arrays	AC Source Voltage In	AC Source Amps (Current) In	kVA	kW	Power Factor	kBTUs Per Hour
2	264V	10.1A	2.7	2.5	0.95	8.6
	208V	12.4A	2.6	2.5	0.98	8.6
	180V	16.2A	2.9	2.9	0.99	9.9
3	264V	13.0A	3.4	3.3	0.95	11.1
	208V	16.0A	3.3	3.3	0.98	11.1
	180V	18.3A	3.3	3.3	0.99	11.1
4	264V	14.5A	3.8	3.6	0.95	12.4
	208V	17.8A	3.7	3.6	0.98	12.4
	180V	20.3A	3.7	3.6	0.99	12.4

Notes:

- Abbreviations key: A = ampere(s); AC = alternating current; kBTUs = thousand British Thermal Units; kVA = kilovolt-amperes; kW = kilowatts

Table 2-10. VSM5-VTSS Power Requirements — Dual AC Source Power Cable Operation

Number of 16-Drive Arrays	AC Source Voltage In	AC Source Amps (Current) In*	kVA	kW	Power Factor	kBTUs Per Hour
2	264V	5.6A	3.0	2.8	0.95	9.6
	208V	6.9A	2.9	2.8	0.98	9.6
	180V	7.9A	2.8	2.8	0.99	9.6
3	264V	6.3A	3.3	3.1	0.95	10.7
	208V	7.7A	3.2	3.1	0.98	10.7
	180V	8.8A	3.2	3.1	0.99	10.7
4	264V	6.9A	3.7	3.5	0.95	11.9
	208V	8.5A	3.5	3.5	0.98	11.9
	180V	9.8A	3.5	3.5	0.99	11.9

Notes:

- * Values are for each line cord; multiply this value by two to obtain the total current for both line cords.
- Abbreviations key: A = ampere(s); AC = alternating current; kBTUs = thousand British Thermal Units; kVA = kilovolt-amperes; kW = kilowatts

Implementation Planning

This chapter provides an overview of implementation planning activities and tasks, which are designed to ensure a VSM5 system is properly configured, tested, and certified according to customer requirements.

Table 3-1 provides an overview of high-level activities, sub-tasks, and participants encompassed by the implementation planning process.

Table 3-1. Implementation Planning Overview

Key High-Level Activities	Key Sub-Tasks	Key Participants
<ul style="list-style-type: none"> • Select implementation planning team members, and define roles and responsibilities. • Schedule and attend implementation planning meetings. • Determine task completion priorities and scheduling. 	<ul style="list-style-type: none"> • Define plan for integrating other devices and systems with the VSM5 system • Define plan for migrating data from other devices and systems to the VSM5 • Determine default settings for the VSM5 system • Define plan for configuring and managing system hardware (channel resources, physical disk, RTDs, etc.) • Define plan for configuring and managing VSM5 system software (ExPR, ExLM, HSC, MVS, NCS, VTCS, etc.) • Define policies for configuring and managing VSM5 system virtual entities (CLINKs, Nearlinks, VACSSs, VTDs, VTVs, etc.) • Define plan for performance tuning, testing, and certification of the VSM5 system • Assess personnel requirements for knowledge-transfer and hands-on training; facilitate scheduling and completion of training activities. • Complete applicable Appendix D worksheets 	<ul style="list-style-type: none"> • Customer: network administrator; system administrator; data center manager; system operator • Sun: professional services personnel (delivery consultant; systems support specialist; technical support specialist; systems engineer)

The implementation planning process is designed to identify and schedule completion of configuration, performance tuning, and performance testing activities for a VSM5-VTSS after it has been physically installed at a site.

A team comprised of key customer personnel (systems administrator; network administrator; data center manager, system operator, etc.) and Sun Professional Services personnel (technical support specialist; systems engineer; customer service manager, etc.) works to complete these primary tasks:

- Defining a plan for integrating existing devices and systems with the VSM5 system
- Defining a plan to migrate data from other devices and systems to the VSM5 system
- Defining a plan to accommodate the physical layout and floor space requirements of the VSM5-VTSS and other system devices
- Defining a plan for configuring the VSM5 system hardware (channel resources, physical disk, RTDs, etc.), software (ExPR, ExLM, HSC, MVS, NCS, VTCS, etc.), and virtual entities (CLINKs, Nearlinks, VACSSs, VTDS, VTVs, etc.)
- Defining a plan for completing performance tuning, performance testing, and certification of VSM5 system hardware and software in the data center environment
- Identifying personnel training needs and scheduling appropriate knowledge-transfer training sessions.

Site Readiness Planning

4

This chapter provides information about activities designed to ensure the site is equipped to accommodate the power, safety, environmental, HVAC, and data handling requirements of VSM5 system equipment.

Table 4-1. Site Readiness Planning Overview

Key High-Level Activities	Key Sub-Tasks	Key Participants
<ul style="list-style-type: none"> • Select site readiness team members, and define roles and responsibilities. • Complete site surveys to: <ul style="list-style-type: none"> - Document existing or potential external and internal environmental hazards - Assess site power, safety, environmental, HVAC, and data handling capabilities versus VSM5 system requirements - Confirm floor load ratings along the transit path and at the installation location for VSM5-VTSS cabinets - Assess ceiling, hallway, and door clearances, elevator capacities, and ramp angles versus VSM5-VTSS cabinet requirements. • Attend planning meetings. 	<ul style="list-style-type: none"> • Verify site power, safety, environmental, HVAC, and data handling capabilities match VSM5-VTSS requirements. • Define plan to eliminate/mitigate environmental hazards. • Evaluate floor load ratings along transit path and at the VSM5-VTSS installation location. • Verify site door, hall and ceiling clearances, elevator capacity, ramp angles, etc. match VSM5-VTSS requirements. • Identify required infrastructure modifications/upgrades; set work completion schedule. • Evaluate readiness progress, and certify site readiness. • Complete applicable Appendix D worksheets. 	<ul style="list-style-type: none"> • Customer: site engineer; facilities manager; data center manager; network administrator • Sun: technical support specialist; systems engineer

Key site readiness planning considerations include, but are not limited to:

- Site surveys to evaluate and eliminate or mitigate factors which could negatively affect delivery, installation, and operation of VSM5 system equipment.
- A plan for the layout and location of VSM5 system equipment and cabling that allows for efficient use and easy maintenance, plus adequate space and facilities for Sun support personnel and their equipment.
- Facilities construction that provides an optimum operating environment for VSM5 system equipment and personnel, as well as safe flooring and protection from fire, flooding, contamination, and other potential hazards.
- Scheduling of key events and task completion dates for facilities upgrades, personnel training, and delivery, implementation, installation, testing, and certification activities.

Customers ultimately are responsible for ensuring that their site is physically prepared to receive and operate VSM5 system equipment, and that the site meets the minimum specifications for equipment operation as detailed in this guide.

■ Site Evaluation – External Considerations

Several months before delivery of VSM5 system equipment, a readiness planning team should identify and evaluate all external site factors that present existing or potential hazards, or which could adversely affect delivery, installation, or operation of the system. External factors that should be evaluated include:

- Reliability and quality of electrical power provided by the local utility, backup power generators, and uninterruptible power supplies (UPSs), etc.
- Proximity of high-frequency electromagnetic radiation sources (e.g., high-voltage power lines; television, radio, and radar transmitters)
- Proximity of natural or man-made floodplains and the resultant potential for flooding in the data center
- Potential effects of pollutants from nearby sources (e.g., industrial plants).

If any existing or potential negative factors are discovered, the site readiness planning team should take appropriate steps to eliminate or mitigate those factors before VSM5 system equipment is delivered. Sun Global Services offers consultation services and other assistance to identify and resolve such issues. Contact your Sun account representative for more information.

■ Site Evaluation – Internal Considerations

Several months before delivery of VSM5 system equipment, a readiness planning team should identify and evaluate all internal site factors that present existing or potential hazards, or which could adversely affect delivery, installation, or operation of the system. Internal factors that should be evaluated include:

- Structural dimensions, elevator capacities, floor-load ratings, ramp inclines, and other considerations when transferring equipment point-to-point between the delivery dock, staging area, and data center installation site
- Site power system(s) design and capacity
- VSM5 system equipment power system design and capacity
- Data center safety system design features and capabilities
- Data center environmental (HVAC) design features and capabilities
- Potential effects of corrosive materials, electrical interference, or excessive vibration from sources in close proximity to system equipment.

If any existing or potential negative factors are discovered, the site readiness planning team should take appropriate steps to eliminate or mitigate those factors before VSM5 system equipment is delivered. Sun Global Services offers consultation services and other assistance to identify and resolve such issues. Contact your Sun account representative for more information.

Transferring Equipment Point-to-Point

Site conditions must be verified to ensure all VSM5 system equipment can be safely transported between the delivery dock, staging area, and data center without encountering dimensional restrictions, obstructions, or safety hazards, or exceeding rated capacities of lifting and loading equipment, flooring, or other infrastructure. Conditions that must be verified are described below.

Structural Dimensions and Obstructions

Dimensions of elevators, doors, hallways, etc. must be sufficient to allow unimpeded transit of VSM5-VTSS cabinets (in shipping containers, where appropriate) from the delivery dock to the data center installation location. See [“VSM5-VTSS Physical Characteristics”](#) on page 2-33 for VTSS cabinet-dimension details.

Elevator Lifting Capacities

Any elevators that will be used to transfer VSM5-VTSS cabinets must have a certified load rating of at least 1000 kg (2200 lbs.). This provides adequate capacity to lift the heaviest packaged, fully-populated VTSS cabinet (roughly 480 kg/1056 lbs. with 64 array drives), a pallet jack (allow 100 kg/220 lbs.), and two persons (allow 200 kg/440 lbs.). See [“VSM5-VTSS Physical Characteristics”](#) on page 2-33 for additional cabinet-weight details.

Floor-Load Ratings

Solid floors, raised floors, and ramps located along the transfer path for VSM5-VTSS cabinets must be able to withstand concentrated and rolling loads generated by the weight of a populated cabinet, equipment used to lift a cabinet (e.g., a pallet jack), and personnel who are moving the cabinet from point to point.

Raised floor panels located along a transfer path must be able to resist a concentrated load of 454 kg (1000 lbs.) and a rolling load of 181 kg (400 lbs.) anywhere on the panel, with a maximum deflection of 2 mm (0.08 in.). Raised floor pedestals must be able to resist an axial load of 2268 kg (5000 lbs.). See [“Floor Loading Requirements”](#) on page 4-52 for additional floor-loading details.

When being moved from one location to another, a VSM5-VTSS cabinet generates roughly twice the floor load as in a static state. Using 19 mm (0.75 in.) plywood along a transfer path reduces the rolling load produced by a cabinet.

Ramp Inclines

To prevent VSM5-VTSS cabinets from tipping on ramps while being moved from point to point, the site engineer or facilities manager must verify the incline angle of all ramps in the transfer path. Inclines cannot exceed 10 degrees (176 mm/m; 2.12 in./ft.).

Data Center Safety

Safety must be a primary consideration in planning installation of VSM5 system equipment, and is reflected in such choices as where equipment will be located, the rating and capability of electrical, HVAC, and fire-prevention systems that support the operating environment, and the level of personnel training. Requirements of local authorities and insurance carriers will drive decisions as to what constitutes appropriate safety levels in a given environment.

Occupancy levels, property values, business interruption potential, and fire-protection system operating and maintenance costs should also be evaluated. The [Standard for the Protection of Electronic Computer / Data Processing Equipment \(NFPA 75\)](#), the [National Electrical Code \(NFPA 70\)](#), and local and national codes and regulations can be referenced to address these issues.

Emergency Power Control

The data center should be equipped with readily-accessible emergency power-off switches to allow immediate disconnection of electrical power from VSM5 system equipment. One switch should be installed near each principal exit door so the power-off system can be quickly activated in an emergency. Consult local and national codes to determine requirements for power disconnection systems.

Fire Prevention

The following fire-prevention guidelines should be considered in the construction, maintenance, and use of a data center:

- Store gases and other explosives away from the data center environment.
- Ensure data center walls, floors, and ceilings are fireproof and waterproof.
- Install smoke alarms and fire suppression systems as required by local or national codes, and perform all scheduled maintenance on the systems.

Note: Halon 1301 is the extinguishing agent most commonly used for data center fire suppression systems. The agent is stored as a liquid and is discharged as a colorless, odorless, electrically nonconductive vapor. It can be safely discharged in occupied areas without harm to personnel. Additionally, it leaves no residue, and has not been found to cause damage to computer storage media.

- Install only shatterproof windows, in code-compliant walls and doors.
- Install carbon dioxide fire extinguishers for electrical fires and pressurized water extinguishers for ordinary combustible materials.
- Provide flame-suppressant trash containers, and train personnel to discard combustible waste only into approved containers.
- Observe good housekeeping practices to prevent potential fire hazards.

Site Power Distribution Systems

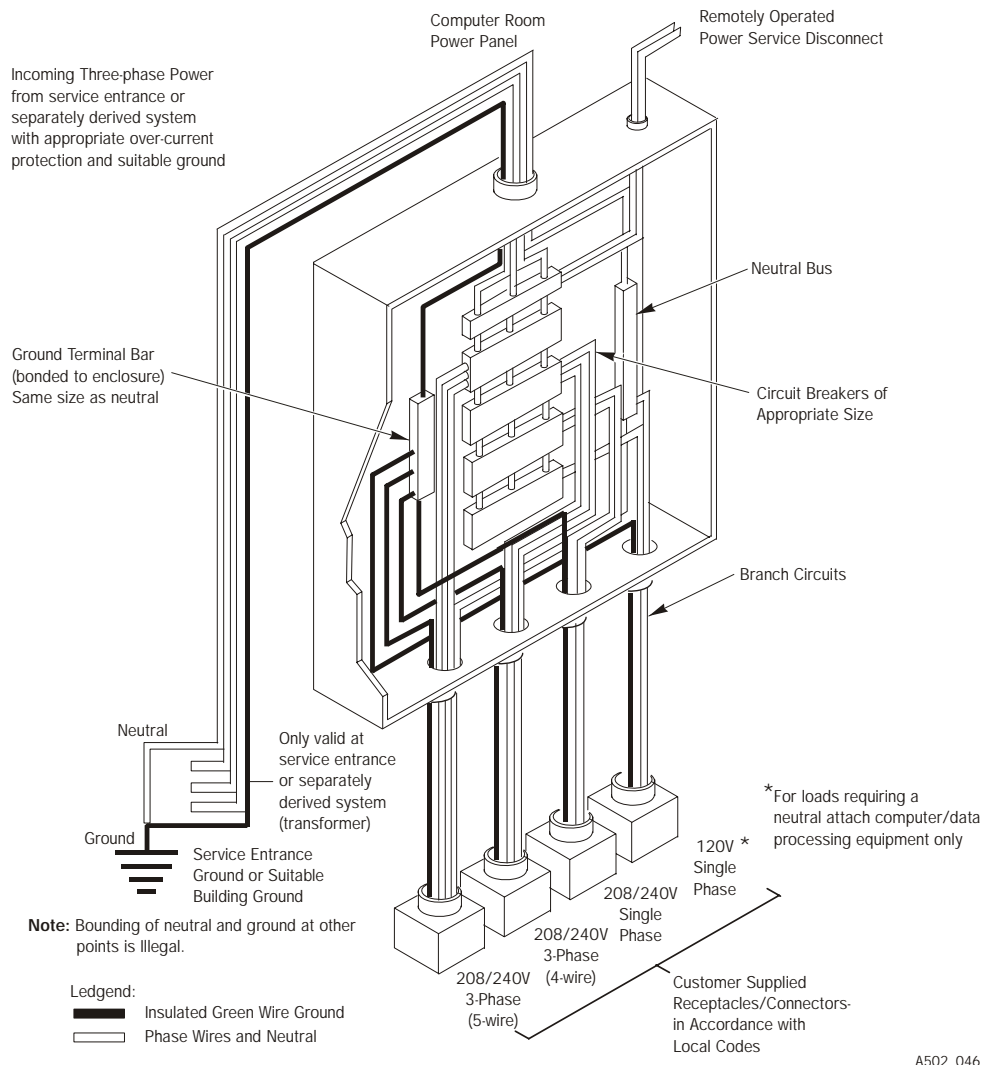
The following elements of the site power distribution system should be evaluated when planning an installation of VSM5 system equipment.

System Design

A properly installed power distribution system is required to ensure safe operation of VSM5 system equipment. Power should be supplied from a feeder separate from one used for lighting, air conditioning, and other electrical systems.

A typical input power configuration, shown in Figure 4-1, is either a five-wire high-voltage or a four-wire low-voltage type, with three-phase service coming from a service entrance or separately derived source, and with overcurrent protection and suitable grounding. A three-phase, five-wire distribution system provides the greatest configuration flexibility, since it allows power to be provided to both three-phase and single-phase equipment.

Figure 4-1. Site Electrical Power Distribution System



Equipment Grounding

For safety and ESD protection, VSM5 system equipment must be properly grounded. VTSS cabinet power cables contain an insulated green/yellow grounding wire that connects the frame to the ground terminal at the AC source power outlet. A similar insulated green or green/yellow wire ground, of at least the same diameter as the phase wire, is required between the branch circuit panel and the power receptacle that attaches to each cabinet.

Source Power Input

Voltage and frequency ranges at the AC source power receptacle(s) that will supply power to VSM5 system equipment must be measured and verified to meet the specifications shown in [Table 4-2](#).

Table 4-2. Source Power Requirements for VSM5 Equipment

Source Power	Voltage Range	Frequency Range (Hz)
AC, single-phase, 3-wire	170-240	47-63

Dual Independent Source Power Supplies

VSM5-VTSS cabinets have a redundant power distribution architecture designed to prevent disruption of system operations from single-source power failures.

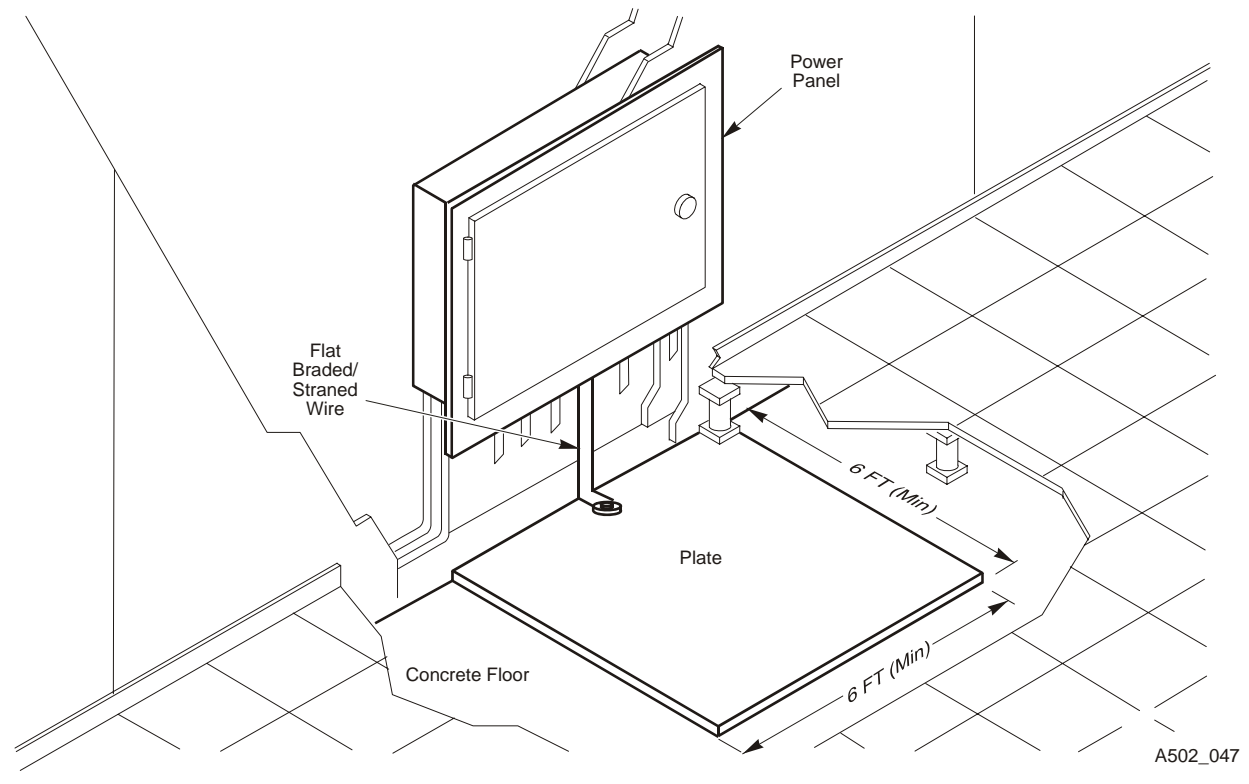
To enable this capability, the two VTSS cabinet power-strip cables must be connected to separate, independent power sources that are unlikely to fail simultaneously (e.g., one to local utility power, the other to an uninterruptible power supply (UPS) system). Connecting both cabinet power-strip cables to the same power source will not enable this redundant power capability.

Transient Electrical Noise and Power Line Disturbances

Reliable AC source power free from interference or disturbance is required for optimum performance of VSM5 system equipment. Most utility companies provide power that can properly operate system equipment. However, equipment errors or failures can be caused when outside (radiated or conducted) transient electrical noise signals are superimposed on power provided to equipment.

Additionally, while VSM5 system equipment is designed to withstand most common types of power line disturbances with little or no effect on operations, extreme power disturbances such as lightning strikes can cause equipment power failures or errors if steps are not taken to mitigate such disturbances.

To mitigate the effects of outside electrical noise signals and power disturbances, data center source power panels should be equipped with a transient grounding plate similar to that shown in [Figure 4-2](#) on page 4-51.

Figure 4-2. Transient Electrical Grounding Plate

Electrostatic Discharge

Electrostatic discharge (ESD; static electricity) is caused by movement of people, furniture, and equipment. ESD can damage circuit card components, alter information on magnetic media, and cause other equipment problems. The following steps are recommended to minimize ESD potential in the data center:

- Provide a conductive path from raised floors to ground.
- Use floor panels with nonconducting cores.
- Maintain humidity levels within recommended control parameters.
- Use grounded anti-static work mats and wrist straps to work on equipment.

HVAC Requirements

Cooling and air-handling systems must have sufficient capacity to remove heat generated by equipment and data center personnel. Raised-floor areas should have positive under-floor air pressure to facilitate airflow. If conditions change within a data center (e.g., when new equipment is added or existing equipment is rearranged), airflow checks should be done to verify sufficient airflow.

Environmental Requirements and Hazards

VSM5 system components are sensitive to corrosion, vibration, and electrical interference in enclosed environments such as data centers. Because of this sensitivity, equipment should not be located near areas where hazardous and/or corrosive materials are manufactured, used, or stored, or in areas with above-average electrical interference or vibration levels.

For best performance, equipment should be operated at nominal environmental conditions. If VSM5 system equipment must be located in or near adverse environments, additional environmental controls should be considered (and implemented where practicable) to mitigate those factors prior to installation of the equipment.

Floor Construction Requirements

VSM5 system equipment is designed for use on either raised or solid floors. Carpeted surfaces are not recommended since these retain dust and contribute to the buildup of potentially damaging electrostatic charges. A raised floor is preferable to a solid floor since it permits power and data cables to be located safely away from floor traffic and other potential floor-level hazards.

Floor Loading Requirements



DANGER !!

Exceeding recommended raised-floor loads can cause a floor collapse, which could result in severe injury or death, equipment damage, and infrastructure damage. It is advisable to have a structural engineer perform a floor-load analysis before beginning installation of VSM5 system equipment.



CAUTION !

When being moved, a VTSS cabinet creates almost twice the floor load as when static. To reduce floor load and stress, and the potential for damage or injury when moving a VTSS (e.g., during installation), consider using 19 mm/ 0.75 in. plywood on the floor along the path where the cabinet will be moved.

Flooring with an overall (superimposed) load rating of 490 kg/m² (100 lbs./ft²) is recommended. If floors do not meet this rating, a site engineer or facilities manager must consult the floor manufacturer or a structural engineer to calculate actual loads and determine if the weight of a particular VSM5 system configuration can be safely supported.

When being moved from one location to another, a VSM5-VTSS system cabinet generates roughly twice the floor load as in a static state. Using 19 mm (0.75 in.) plywood along a transfer path reduces the rolling load produced by a cabinet.

Floor Loading Specifications and References

Table 4-3. VSM5-VTSS Floor Loading Specifications

Basic Floor Load*	Maximum Superimposed Floor Load #
730 kg/m ² (149 lbs./ft ²)	485 kg/m ² (99 lbs./ft ²)

Notes:

- * Load over footprint surface area (7093.7 cm²/1099.5 in²) of an unpackaged VSM5-VTSS cabinet, with a maximum weight of 445 kg/982 lbs., i.e., a VTSS with 64 array disk drives.
- # Assumes minimum Z+Z axis dimension of 185.3 cm/73.0 in. (i.e., cabinet depth 77.1 cm/30.4 in. + front service clearance of 54.1 cm/21.3 in. + rear service clearance of 54.1 cm/21.3 in.), minimum X+X axis dimension of 104.9 cm/41.2 in. (i.e., cabinet width 92.1 cm/36.3 in. + left clearance of 6.4 cm/2.5 in. + right clearance of 6.4 cm/2.5 in.).

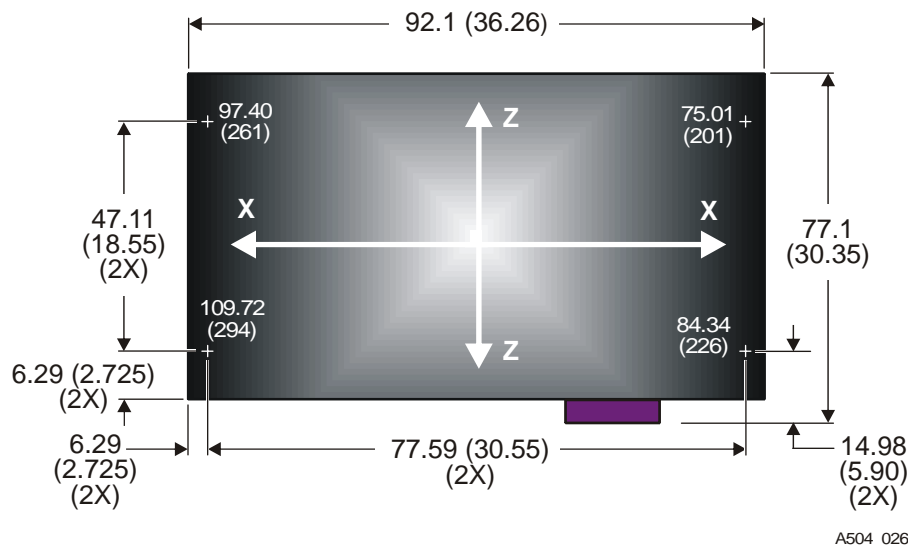
Table 4-4. VSM5-VTSS Cabinet Superimposed Floor Loading Example

Total Front + Rear Service Clearance (Z+Z) / 2	Total Left + Right Side Clearance (X+X) / 2				
	7.6 cm (3.0 in.)	61.0 cm (24.0 in.)	91.4 cm (36.0 in.)	121.9 cm (48.0 in.)	152.4 cm (60.0 in.)
55.9 cm (22.0 in)	443 kg/m ² (91 lb./ft ²)	340 k.g/m ² (70 lb/ft ²)	308 kg/m ² (63 lb./ft ²)	285 kg/m ² (58 lb./ft ²)	268 kg/m ² (55 lb./ft ²)
96.5 cm (38.0 in)	374 kg/m ² (77 lb./ft ²)	295 k.g/m ² (60 lb/ft ²)	270 kg/m ² (55 lb./ft ²)	252 kg/m ² (52 lb./ft ²)	239 kg/m ² (49 lb./ft ²)
116.8 cm (46.0 in)	350 kg/m ² (72 lb./ft ²)	279 kg/m ² (57 lb./ft ²)	257 kg/m ² (53 lb./ft ²)	241 kg/m ² (49 lb./ft ²)	229 kg/m ² (47 lb./ft ²)
137.2 cm (54.0 in)	331 kg/m ² (68 lb./ft ²)	267 kg/m ² (55 lb./ft ²)	247 kg/m ² (51 lb./ft ²)	232 kg/m ² (48 lb./ft ²)	222 kg/m ² (45 lb./ft ²)
157.5 cm (62.0 in)	315 kg/m ² (64 lb./ft ²)	256 kg/m ² (52 lb./ft ²)	238 kg/m ² (49 lb./ft ²)	225 kg/m ² (46 lb./ft ²)	215 kg/m ² (44 lb./ft ²)

Notes:

- See [Figure 4-3 on page 4-53](#) for the location and load of each VTSS cabinet support point.
- Values assume 15 lb./ft² (73 kg/m²) superimposed dead load over entire area for raised floor, cables, etc., and 15 lb./ft² (73 kg/m²) live load for personnel and equipment in clearance areas between units.
- Loading of adjacent floor areas must be considered when evaluating overall floor capacity.
- To evaluate floor loading for other possible configurations, consult a structural engineer.

Figure 4-3. VSM5-VTSS Cabinet Weight Distribution and Leveler Locations



Raised-Floor Lateral Stability Ratings

In areas of high earthquake activity, the lateral stability of raised floors must be considered. Raised floors where VSM5 system equipment is installed must be able to resist the horizontal-stress levels shown in [Table 4-5](#).

Table 4-5. Raised Flooring Horizontal Force Chart

Seismic Risk Zone	Horizontal Force (V) Applied at Top of Pedestal
1	13.5 kg / 29.7 lbs
2A	20.2 kg / 44.6 lbs
2B	26.9 kg / 59.4 lbs
3	40.4 kg / 89.1 lbs
4	53.9 kg / 118.8 lbs

Note: Horizontal forces are based on the 1991 Uniform Building Code (UBC) Sections 2336 and 2337, and assume minimum operating clearances for multiple VSM5 cabinets. Installations in areas not covered by the UBC should be engineered to meet seismic code provisions of the local jurisdiction.

Raised-Floor Panel Ratings

Raised floor panels must be able to resist a concentrated load of 454 kg (1000 lbs.) and a rolling load of 181 kg (400 lbs.) anywhere on the panel with a maximum deflection of 2 mm (0.08 in.). Perforated floor panels are not required for VSM5 system equipment, but if used must comply with the same ratings.

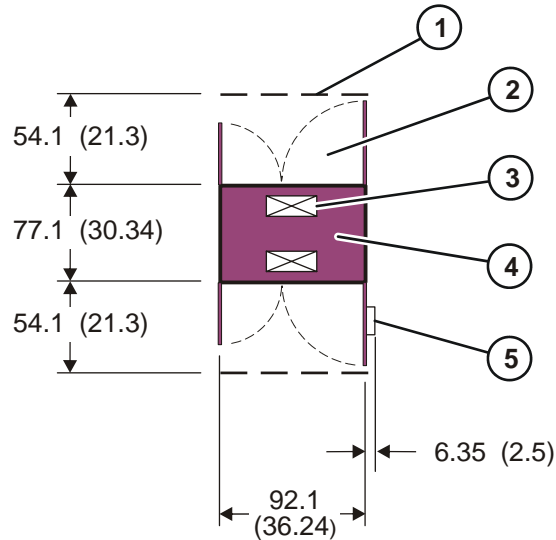
Raised-Floor Pedestal Ratings

Raised floor pedestals must be able to resist an axial load of 2268 kg (5000 lbs.). Where floor panels are cut to provide service access, additional pedestals may be required to maintain the loading capacity of the floor panel.

Physical Space Requirements

Floor space and layout requirements can differ for each VSM5 system configuration. [Figure 4-4](#) shows dimensions and recommended service clearances for a VSM5-VTSS cabinet. Considerations for floor space layout may include, but are not limited to: available space; required service clearances; intended equipment applications; equipment priority assignments; equipment visibility from the host console; operator convenience; cable lengths; and future expansion plans.

Figure 4-4. VSM5-VTSS Cabinet Dimensions for Physical Space Planning



A504 028

1. Boundary of recommended service access area	4. Openings for entry / exit of data and power cables
2. Open radius of front and rear doors (4 total)	5. Front cover bezel (additional 6.35 cm (2.5 inches) right-side clearance required to open door 90 degrees)
3. Cabinet	

Notes:

- Metric dimensions are shown first (in centimeters), followed by English dimensions (in inches).
- Front and rear doors are shown in the open position to indicated dimensions required for service access.
- The VTSS does not require or provide side access; side covers are permanently attached and should not be removed under normal circumstances

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Specifications and Additional Information

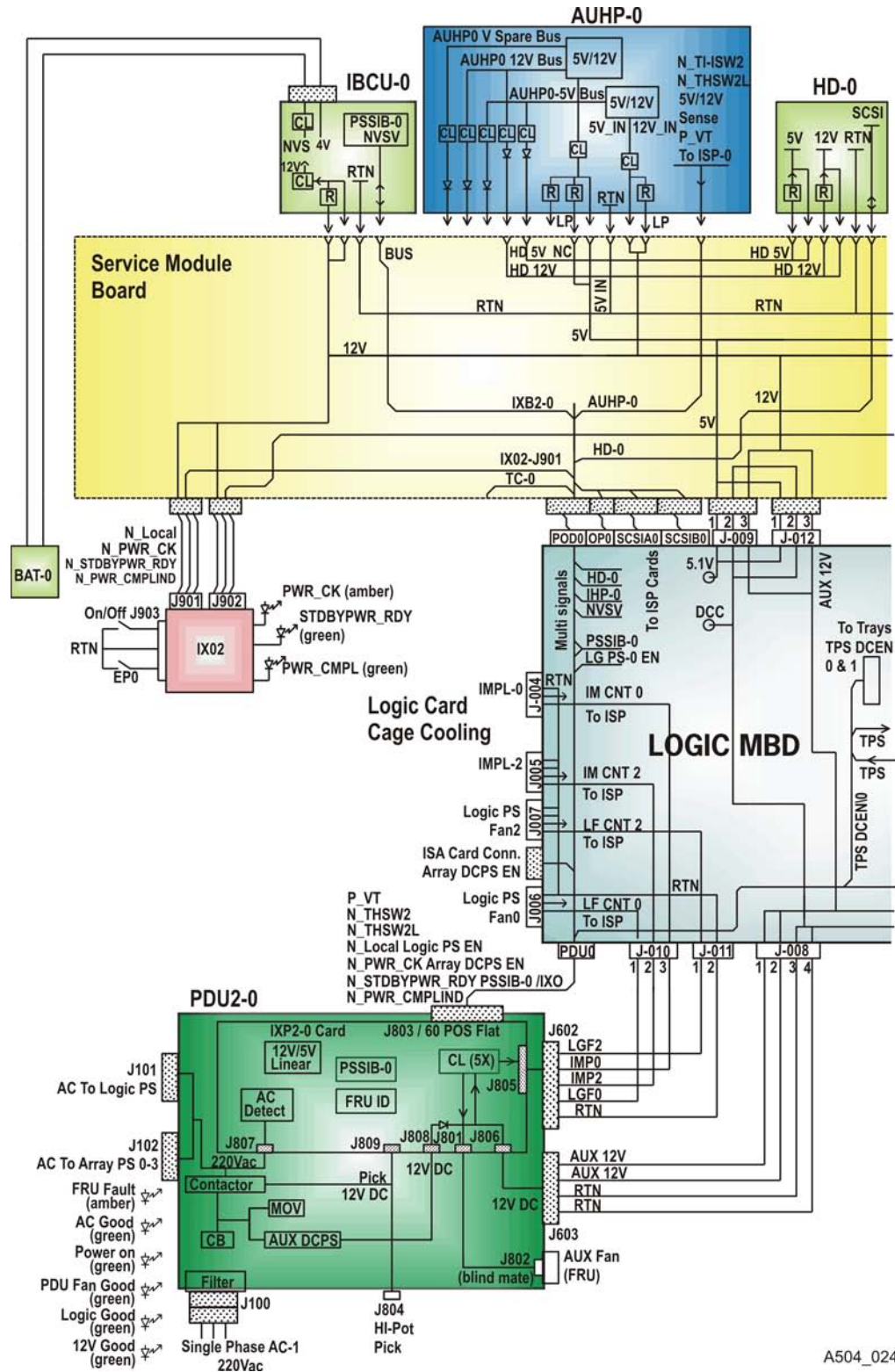


This appendix provides specifications and additional information for the VSM5-VTSS. Content includes:

- [“Motherboard and FRU Interconnections – Side 0”](#) on page A-58
- [“Motherboard and FRU Interconnections – Side 1”](#) on page A-59
- [“Power Safety Grounding Diagram – Side 0”](#) on page A-60
- [“Power Safety Grounding Diagram – Side 1”](#) on page A-61
- [“Power System Diagram”](#) on page A-62
- [“Data Paths and Interfaces”](#) on page A-63
- [“Fiber Optic Cable Specifications”](#) on page A-64
- [“VShell Command Reference”](#) on page A-64
- [“Sample IOCP Gen for FICON Configuration”](#) on page A-65
- [“Virtual Tape Drive Mapping and Host Addressing”](#) on page A-66
- [“FRU Identifiers”](#) on page A-67
- [“Array Drive Module Status Descriptions”](#) on page A-72

■ Motherboard and FRU Interconnections – Side 0

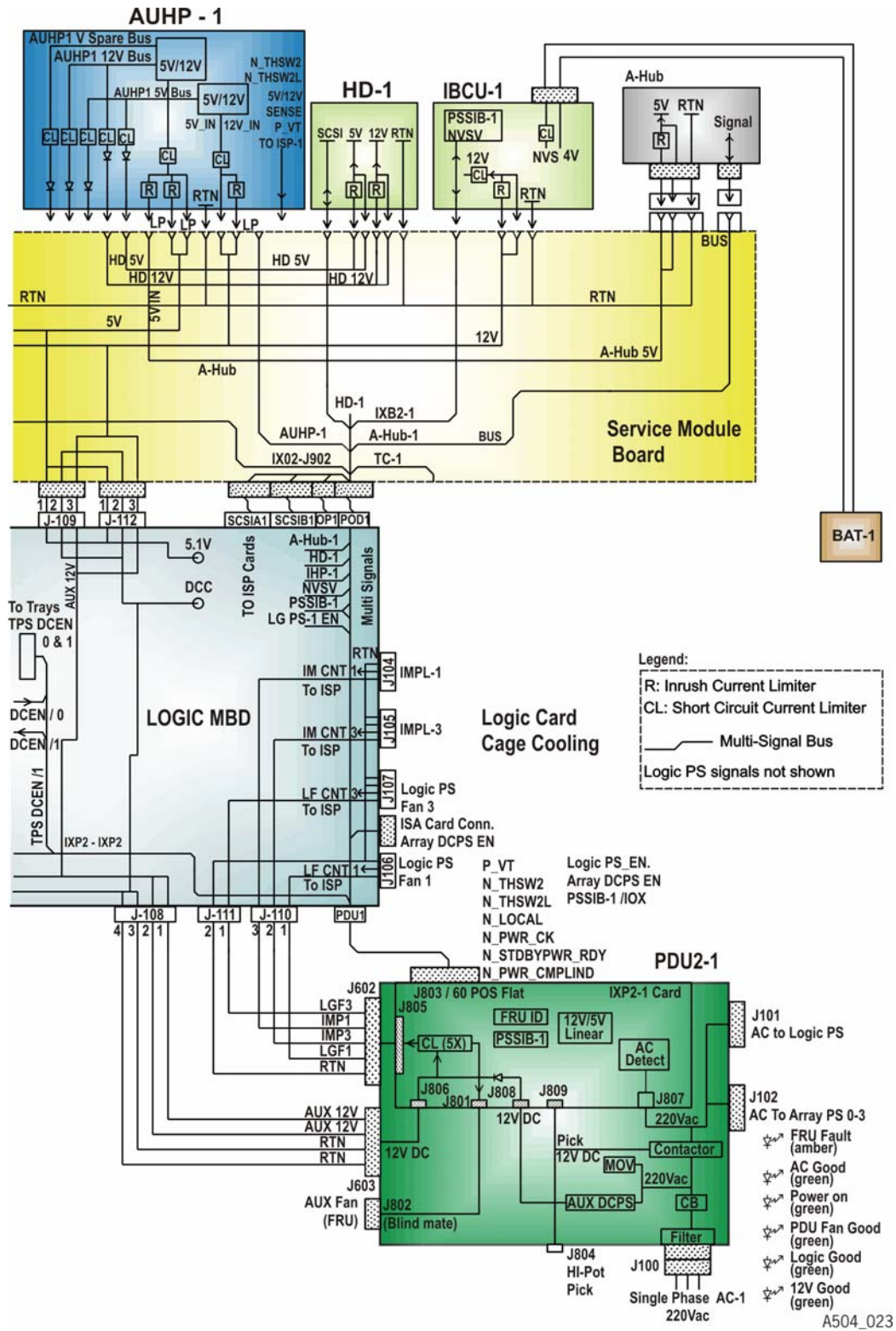
Figure A-1. VSM5-VTSS Motherboard and FRU Interconnections – Side 0



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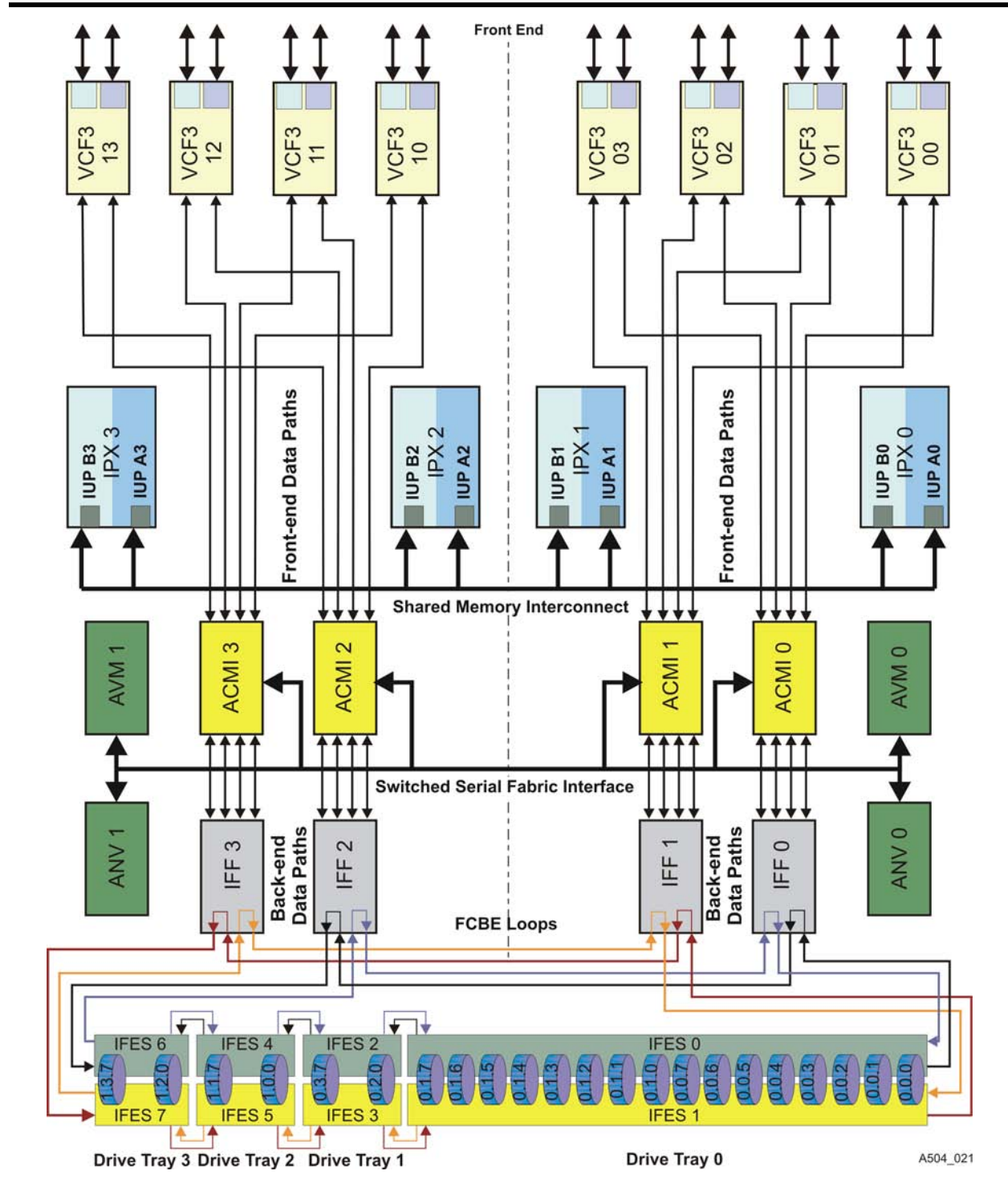
■ Motherboard and FRU Interconnections – Side 1

Figure A-2. VSM5-VTSS Motherboard and FRU Interconnections – Side 1



■ Data Paths and Interfaces

Figure A-6. VSM5-VTSS Data Paths and Interfaces



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■ Fiber Optic Cable Specifications

Table A-1. Fiber Optic Cable Specifications

Optical Performance	Specification
Attenuation	1.0 dB/km @ 1300 nm
Bandwidth	500 MHz/km @ ≤2 km
Handling Characteristics	Specification
Pulling Strength	27.2 kg (60 lbs.)
Crush Resistance	650 Newtons/cm (371 ft-lbs/in ²)
Minimum Bend Radius	96 mm (3.74 in.)
Cable Weight	59.7 kg/100 m (401 lbs./1000 ft.)
Bending Cycles	100 at minimum bend radius
Physical Environment	-16° C to +32° C (3.2° F to 89.6° F)

Note: Abbreviations key: C = centigrade; dB = decibel(s); F = Fahrenheit; ft. = foot / feet; in² = inch(es) squared; km = kilometer(s); lb(s) = pound(s); m = meter(s); MHz = megahertz; mm = millimeter(s); nm = nanometer(s)

■ VShell Command Reference

Table A-2. VShell Command Reference

Command	Meaning / Description
Status avail	Displays <i>Subsystem Availability</i> screen
Status subsystem	Displays <i>Subsystem Configuration and Status</i> screen
Status cfes	Lists current Composite Failure Events (CFEs)
Status ispdrive	Lists status of ISP hard drives and shown which SRL are preloaded
Status adrives prod	Lists all HDAs assigned in production arrays
Status adrives spares	Lists all HDAs assigned as global spares
Status adrives unavail	Lists all HDAs unavailable for use (including U.B.—unavailable broken)
Status interfaces	Displays <i>Subsystem Interface Status</i> screen
Status channels	Displays <i>Channel Configuration Status</i> screen
Ecu	Preloads EC upgrade microcode
Hicstat \$	Displays and downloads <code>hic_stat.dia</code> file to a selected current drive
Realtime	Lists DOP <i>Status</i> field messages in real time; useful for monitoring system IML
Showsrl	Lists the system release level (SRL) that is currently running on the VTSS
State <name>	Downloads the named state save file to a selected current drive
Allstate \$	Downloads all state saves and associated files to a selected current drive
Help	Displays online help file for all commands; click [Enter] to close
Help <command>	Displays online help file with information about the named command

■ Sample IOCP Gen for FICON Configuration

Figure A-7. Sample IOCP Gen for FICON Configuration

>> NOTE: The example below shows an IOCP gen for a single MVS host connected to a VSM5 through FICON directors.

```
ESCD4C CHPID PATH=(20,70), TYPE=FC, SWITCH=4C
ESCD4C CHPID PATH=(21,71), TYPE=FC, SWITCH=4D
ESCD4C CHPID PATH=(30,80), TYPE=FC, SWITCH=4E
ESCD4C CHPID PATH=(31,81), TYPE=FC, SWITCH=4F
```

```
CU1  CNTLUNIT CUNUMBER=001
      PATH=(20,21,30,31,70,71,80,81),
      LINK=(D0,D4,D0,D4,D4,D0,D4,D0),
      UNIT=3490,CUADD=0,
      UNITADD=((00,16))
```

```
STRING1 IODEVICE ADDRESS=(0500,16),
         CUNUMBER=(001),
         UNIT=3490,
         UNITADD=00,STADET=Y
```

```
CU2  CNTLUNIT CUNUMBER=002
      PATH=(20,21,30,31,70,71,80,81),
      LINK=(D0,D4,D0,D4,D4,D0,D4,D0),
      UNIT=3490,CUADD=1,
      UNITADD=((00,16))
```

```
STRING2 IODEVICE ADDRESS=(0510,16),
         CUNUMBER=(002),
         UNIT=3490,
         UNITADD=00,STADET=Y
```

```
.
.
.
```

```
CU15  CNTLUNIT CUNUMBER=015
       PATH=(20,21,30,31,70,71,80,81),
       LINK=(D0,D4,D0,D4,D4,D0,D4,D0),
       UNIT=3490,CUADD=E,
       UNITADD=((00,16))
```

```
STRING15 IODEVICE ADDRESS=(05E0,16),
          CUNUMBER=(015),
          UNIT=3490,
          UNITADD=00,STADET=Y
```

```
CU16  CNTLUNIT CUNUMBER=016
       PATH=(20,21,30,31,70,71,80,81),
       LINK=(D0,D4,D0,D4,D4,D0,D4,D0),
       UNIT=3490,CUADD=F,
       UNITADD=((00,16))
```

```
STRING16 IODEVICE ADDRESS=(05F0,16),
          CUNUMBER=(016),
          UNIT=3490,
          UNITADD=00,STADET=Y
```

■ Virtual Tape Drive Mapping and Host Addressing

A VSM5-VTSS can be configured with up to 256 virtual tape drives (VTDs). During VTSS installation, all 256 available VTDs are mapped as shown in [Table A-3](#) below. Mapping of all available VTDs is required by VTSS microcode, and applies whether the VTDs are ultimately defined or undefined.

Table A-3. Mapping Parameters for 256 Virtual Tape Drives (VTDs)

Sequential Device Numbers	Parameters	Sequential Device Numbers	Parameters
0 - 15	VCU0 DEV 0-255 FDID 00-0F CUADD=0	128 -143	VCU8 DEV 0-255 FDID 80-8F CUADD=8
16 - 31	VCU1 DEV 0-255 FDID 10-1F CUADD=1	144 -159	VCU9 DEV 0-255 FDID 90-9F CUADD=9
32 - 47	VCU2 DEV 0-255 FDID 20-2F CUADD=2	160 -175	VCUA DEV 0-255 FDID A0-AF CUADD=A
48 - 63	VCU3 DEV 0-255 FDID 30-3F CUADD=3	176 -191	VCUB DEV 0-255 FDID B0-BF CUADD=B
64 -79	VCU4 DEV 0-255 FDID 40-4F CUADD=4	192 -207	VCUC DEV 0-255 FDID C0-CF CUADD=C
80 -95	VCU5 DEV 0-255 FDID 50-5F CUADD=5	208 -223	VCUD DEV 0-255 FDID D0-DF CUADD=D
96 -111	VCU6 DEV 0-255 FDID 60-6F CUADD=6	224 -239	VCUE DEV 0-255 FDID E0-EF CUADD=E
112 -127	VCU7 DEV 0-255 FDID 70-7F CUADD=7	240 -255	VCUF DEV 0-255 FDID F0-FF CUADD=F

FRU Identifiers

Table A-4. VSM5-VTSS FRU Identifiers

Physical Location	FRU Common Name	FRU Silkscreen	FRU Number (Hex)	FRU Number (Decimal)	FRU Location ID (Unit.Tray.Slot)
Power Distribution Units					
CU Front Tray 0	Power Distribution Unit 0	PDU2-0	4E	78	CU.0.PDU0
CU Front Tray 0	Power Distribution Unit 1	PDU2-1	4F	79	CU.0.PDU1
Inside PDU0	PDU0 Internal Fan	FAN 0	3C1	961	CU.0.FAN0
Inside PDU1	PDU1 Internal Fan	FAN 1	3C2	962	CU.0.FAN0
Maintenance Pod					
CU MPOD Tray	Battery Charger Unit	IBCU-0	4C	76	CU.3.BCU0
CU MPOD Tray	Battery Charger Unit	IBCU-1	4D	77	CU.3.BCU1
CU MPOD Tray	ISP Hard Drive	HD2-0	384	900	CU.3.HD0
CU MPOD Tray	ISP Hard Drive	HD2-1	385	901	CU.3.HD1
CU MPOD Tray	5v/12v Power Supply	AUHP-0	388	904	CU.3.AUHP0
CU MPOD Tray	5v/12v Power Supply	AUHP-1	389	905	CU.3.AUHP1
CU MPOD Tray	A-Hub Card Faceplate Assembly	??	386	902	CU.3.???
CU MPOD Tray	Battery Pack	BAT-0	394	916	CU.3.BAT0
CU MPOD Tray	Battery Pack	BAT-1	395	917	CU.3.BAT1
CU Front Tray 3	Power Control Panel	PPNL	387	903	CU.3.PPNL
DC Power Supplies					
CU Rear Tray 1	Logic Power Supply 0	LPS2-0	1A	26	CU.1.LPS0
CU Rear Tray 1	Logic Power Supply 1	LPS2-1	1B	27	CU.1.LPS1
DA Rear Tray 0	Array Power Supply 0	APS-0	94	148	DA.0.APS
DA Rear Tray 1	Array Power Supply 1	APS-1	95	149	DA.1.APS
DA Rear Tray 2	Array Power Supply 2	APS-2	A8	168	DA.2.APS
DA Rear Tray 3	Array Power Supply 3	APS-3	A9	169	DA.3.APS
DA Rear Tray 4	Array Power Supply 4	APS-4	F8	248	DA.4.APS
DA Rear Tray 5	Array Power Supply 5	APS-5	F9	249	DA.5.APS
DA Rear Tray 6	Array Power Supply 6	APS-6	10C	268	DA.6.APS
DA Rear Tray 7	Array Power Supply 7	APS-7	10D	269	DA.7.APS

Table A-4. VSM5-VTSS FRU Identifiers (Continued)

Physical Location	FRU Common Name	FRU Silkscreen	FRU Number (Hex)	FRU Number (Decimal)	FRU Location ID (Unit.Tray.Slot)
Logic Motherboard and Cards					
CU Rear	CU Motherboard	ACMB	1C	28	CU.1.ACMB
CU Front Tray1	VCF3 Card 0	VCF00	5	5	CU.1.VCF00
CU Front Tray1	VCF3 Card 1	VCF01	6	6	CU.1.VCF01
CU Front Tray1	VCF3 Card 2	VCF02	8	8	CU.1.VCF02
CU Front Tray1	VCF3 Card 3	VCF03	9	9	CU.1.VCF03
CU Front Tray1	VCF3 Card 4	VCF10	16	22	CU.1.VCF10
CU Front Tray1	VCF3 Card 5	VCF11	15	21	CU.1.VCF11
CU Front Tray1	VCF3 Card 6	VCF12	13	19	CU.1.VCF12
CU Front Tray1	VCF3 Card 7	VCF13	12	18	CU.1.VCF13
CU Front Tray1	IPX5 Card 0	IPX0	1	1	CU.1.IPX0
CU Front Tray1	IPX5 Card 1	IPX1	B	11	CU.1.IPX1
CU Front Tray1	IPX5 Card 2	IPX2	E	14	CU.1.IPX2
CU Front Tray1	IPX5 Card 3	IPX3	18	24	CU.1.IPX3
CU Front Tray1	ISP3A Card 0	ISP0	1F	31	CU.1.ISP0
CU Front Tray1	ISP3A Card 1	ISP1	20	32	CU.1.ISP1
CU Rear Tray 1	ISP Clock Battery	PB-0	398	920	CU.1.PB0
CU Rear Tray 1	ISP Clock Battery	PB-1	399	921	CU.1.PB1
CU Front Tray 2	IFF2 Card 0	IFF0	2B	43	CU.2.IFF0
CU Front Tray 2	IFF2 Card 1	IFF1	29	41	CU.2.IFF1
CU Front Tray 2	IFF2 Card 2	IFF2	36	54	CU.2.IFF2
CU Front Tray 2	IFF2 Card 3	IFF3	34	52	CU.2.IFF3
CU Front Tray 2	ACMI3 Card 0	ACMI0	2C	44	CU.2.ACMI0
CU Front Tray 2	ACMI3 Card 1	ACMI1	28	40	CU.2.ACMI1
CU Front Tray 2	ACMI3 Card 2	ACMI2	37	55	CU.2.ACMI2
CU Front Tray 2	ACMI3 Card 3	ACMI3	33	51	CU.2.ACMI3
CU Front Tray 2	ANV3 Card 0	ANV0	25	37	CU.2.ANV0
CU Front Tray 2	ANV3 Card 1	ANV1	26	38	CU.2.ANV1
CU Front Tray 2	AVM4 or AVM16 Card 0	AVM0	23	35	CU.2.AVM0
CU Front Tray 2	AVM4 or AVM16 Card 1	AVM1	24	36	CU.2.AVM1
CU Rear	CU Frame	FRM	1D	29	CU.1.FRM

Table A-4. VSM5-VTSS FRU Identifiers (Continued)

Physical Location	FRU Common Name	FRU Silkscreen	FRU Number (Hex)	FRU Number (Decimal)	FRU Location ID (Unit.Tray.Slot)
Logic Power Supply Fans					
CU Rear Tray 1	LPS0 Fan 0	FAN-0	3BD	957	CU.1.FAN0
CU Rear Tray 1	LPS0 Fan 1	FAN-1	3BE	958	CU.1.FAN1
CU Rear Tray 1	LPS1 Fan 2	FAN-2	3BF	959	CU.1.FAN2
CU Rear Tray 1	LPS1 Fan 3	FAN-3	3C0	960	CU.1.FAN3
Card Cage Impellers					
CU Rear Tray 2	Card Cage Impeller 0	IMP0	38A	906	CU.2.IMP0
CU Rear Tray 2	Card Cage Impeller 1	IMP1	38B	907	CU.2.IMP1
CU Rear Tray 2	Card Cage Impeller 2	IMP2	38C	908	CU.2.IMP2
CU Rear Tray 2	Card Cage Impeller 3	IMP3	38D	909	CU.2.IMP3
Physical Array Disk Drive Tray 0					
DA Rear Physical Drive Tray 0 (Logical Tray DA0.0)	Array Drive Module 0	DRV0	8C	140	DA.0.DRV0
	Array Drive Module 1	DRV1	8D	141	DA.0.DRV1
	Array Drive Module 2	DRV2	8E	142	DA.0.DRV2
	Array Drive Module 3	DRV3	8F	143	DA.0.DRV3
	Array Drive Module 4	DRV4	90	144	DA.0.DRV4
	Array Drive Module 5	DRV5	91	145	DA.0.DRV5
	Array Drive Module 6	DRV6	92	146	DA.0.DRV6
	Array Drive Module 7	DRV7	93	147	DA.0.DRV7
DA Rear Tray 0	Drive Tray 0 Fan	FAN-0	44C	1100	DA.0.FAN
DA Front Tray 0	Tray Interface Monitor	IFES 0	51	81	DA.0.IFES
Physical Array Disk Drive Tray 1					
DA Rear Physical Drive Tray 1 (Logical Tray DA0.1)	Array Drive Module 0	DRV0	96	150	DA.1.DRV0
	Array Drive Module 1	DRV1	97	151	DA.1.DRV1
	Array Drive Module 2	DRV2	98	152	DA.1.DRV2
	Array Drive Module 3	DRV3	99	153	DA.1.DRV3
	Array Drive Module 4	DRV4	9A	154	DA.1.DRV4
	Array Drive Module 5	DRV5	9B	155	DA.1.DRV5
	Array Drive Module 6	DRV6	9C	156	DA.1.DRV6
	Array Drive Module 7	DRV7	9D	157	DA.1.DRV7
DA Rear Tray 1	Drive Tray 1 Fan	FAN-1	44D	1101	DA.1.FAN
DA Front Tray 1	Tray Interface Monitor	IFES 1	52	82	DA.1.IFES

Table A-4. VSM5-VTSS FRU Identifiers (Continued)

Physical Location	FRU Common Name	FRU Silkscreen	FRU Number (Hex)	FRU Number (Decimal)	FRU Location ID (Unit.Tray.Slot)
Physical Array Disk Drive Tray 2					
DA Rear Physical Drive Tray 2 (Logical Tray DA0.2)	Array Drive Module 0	DRV0	A0	160	DA.2.DRV0
	Array Drive Module 1	DRV1	A1	161	DA.2.DRV1
	Array Drive Module 2	DRV2	A2	162	DA.2.DRV2
	Array Drive Module 3	DRV3	A3	163	DA.2.DRV3
	Array Drive Module 4	DRV4	A4	164	DA.2.DRV4
	Array Drive Module 5	DRV5	A5	165	DA.2.DRV5
	Array Drive Module 6	DRV6	A6	166	DA.2.DRV6
	Array Drive Module 7	DRV7	A7	167	DA.2.DRV7
DA Rear Tray 2	Drive Tray 2 Fan	FAN-2	44E	1102	DA.2.FAN
DA Front Tray 2	Tray Interface Monitor	IFES 2	55	85	DA.2.IFES
Physical Array Disk Drive Tray 3					
DA Rear Physical Drive Tray 3 (Logical Tray DA0.3)	Array Drive Module 0	DRV0	AA	170	DA.3.DRV0
	Array Drive Module 1	DRV1	AB	171	DA.3.DRV1
	Array Drive Module 2	DRV2	AC	172	DA.3.DRV2
	Array Drive Module 3	DRV3	AD	173	DA.3.DRV3
	Array Drive Module 4	DRV4	AE	174	DA.3.DRV4
	Array Drive Module 5	DRV5	AF	175	DA.3.DRV5
	Array Drive Module 6	DRV6	B0	176	DA.3.DRV6
	Array Drive Module 7	DRV7	B1	177	DA.3.DRV7
DA Rear Tray 3	Drive Tray 3 Fan	FAN-3	44F	1103	DA.3.FAN
DA Front Tray 3	Tray Interface Monitor	IFES 3	56	86	DA.3.IFES
Physical Array Disk Drive Tray 4					
DA Rear Physical Drive Tray 4 (Logical Tray DC0.0)	Array Drive Module 0	DRV0	F0	240	DA.4.DRV0
	Array Drive Module 1	DRV1	F1	241	DA.4.DRV1
	Array Drive Module 2	DRV2	F2	242	DA.4.DRV2
	Array Drive Module 3	DRV3	F3	243	DA.4.DRV3
	Array Drive Module 4	DRV4	F4	244	DA.4.DRV4
	Array Drive Module 5	DRV5	F5	245	DA.4.DRV5
	Array Drive Module 6	DRV6	F6	246	DA.4.DRV6
	Array Drive Module 7	DRV7	F7	247	DA.4.DRV7
DA Rear Tray 4	Drive Tray 4 Fan	FAN-4	450	1104	DA.4.FAN
DA Front Tray 4	Tray Interface Monitor	IFES 4	53	83	DA.4.IFES

Table A-4. VSM5-VTSS FRU Identifiers (Continued)

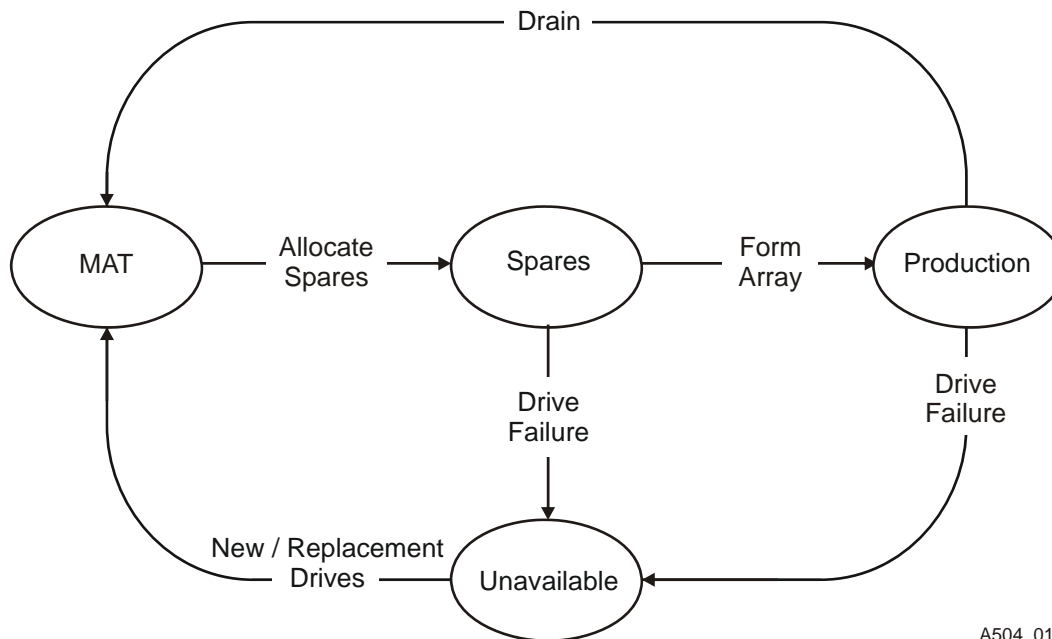
Physical Location	FRU Common Name	FRU Silkscreen	FRU Number (Hex)	FRU Number (Decimal)	FRU Location ID (Unit.Tray.Slot)
Physical Array Disk Drive Tray 5					
DA Rear Physical Drive Tray 5 (Logical Tray DC0.1)	Array Drive Module 0	DRV0	FA	250	DA.5.DRV0
	Array Drive Module 1	DRV1	FB	251	DA.5.DRV1
	Array Drive Module 2	DRV2	FC	252	DA.5.DRV2
	Array Drive Module 3	DRV3	FD	253	DA.5.DRV3
	Array Drive Module 4	DRV4	FE	254	DA.5.DRV4
	Array Drive Module 5	DRV5	FF	255	DA.5.DRV5
	Array Drive Module 6	DRV6	100	256	DA.5.DRV6
	Array Drive Module 7	DRV7	101	257	DA.5.DRV7
DA Rear Tray 5	Drive Tray 5 Fan	FAN-5	451	1105	DA.5.FAN
DA Front Tray 5	Tray Interface Monitor	IFES 5	54	84	DA.5.IFES
Physical Array Disk Drive Tray 6					
DA Rear Physical Drive Tray 6 (Logical Tray DC0.2)	Array Drive Module 0	DRV0	104	260	DA.6.DRV0
	Array Drive Module 1	DRV1	105	261	DA.6.DRV1
	Array Drive Module 2	DRV2	106	262	DA.6.DRV2
	Array Drive Module 3	DRV3	107	263	DA.6.DRV3
	Array Drive Module 4	DRV4	108	264	DA.6.DRV4
	Array Drive Module 5	DRV5	109	265	DA.6.DRV5
	Array Drive Module 6	DRV6	10A	266	DA.6.DRV6
	Array Drive Module 7	DRV7	10B	267	DA.6.DRV7
DA Rear Tray 6	Drive Tray 6 Fan	FAN-6	452	1106	DA.6.FAN
DA Front Tray 6	Tray Interface Monitor	IFES 6	57	87	DA.6.IFES
Physical Array Disk Drive Tray 7					
DA Rear Physical Drive Tray 7 (Logical Tray DC0.3)	Array Drive Module 0	DRV0	10E	270	DA.7.DRV0
	Array Drive Module 1	DRV1	10F	271	DA.7.DRV1
	Array Drive Module 2	DRV2	110	272	DA.7.DRV2
	Array Drive Module 3	DRV3	111	273	DA.7.DRV3
	Array Drive Module 4	DRV4	112	274	DA.7.DRV4
	Array Drive Module 5	DRV5	113	275	DA.7.DRV5
	Array Drive Module 6	DRV6	114	276	DA.7.DRV6
	Array Drive Module 7	DRV7	115	277	DA.7.DRV7
DA Rear Tray 7	Drive Tray 7 Fan	FAN-7	453	1107	DA.7.FAN
DA Front Tray 7	Tray Interface Monitor	IFES 7	58	88	DA.7.IFES

■ Array Drive Module Status Descriptions

The *Disk Drive / Array Status* screen displays the status of each VTSS array drive as a two-character code. The first character defines the partition a specific drive is associated with; the second character defines the current state of the drive. For example, a status of 'P.A' indicates that a drive is in production partition ('P') and active ('A'). The four types of drive partitions are:

- Production Partition (P) – contains drives that are usable for storing and retrieving production data
- Media Acceptance Test Partition (M) – a holding partition; contains drives that can be assigned to the spares partition
- Spares Partition (S) – a holding partition; contains drives that can be used primarily for three functions: array formation; drive reconstruction; and draining an array, an entire array unit, an entire drive tray, or a single drive.
- Unavailable Partition (U) – any slot or drive not under control of the user, including slots that do not have an array drive installed, slots that contain array drives but are not active, and slots that contain broken array drives.

Figure A-8. Array Drive Module States and Relationships



A504_015

Table A-5. Array Drive Module Status Descriptions

Drive Module Status	Status Code	Meaning/Description
Production Partition		
Production: Active	P.A (PA)	Drive is active.
Production: Broken	P.B (PB)	Drive is inactive and marked as broken. After its data is moved to a spare, broken drive is removed from Production partition and put in 'Unavailable: Broken' (U.B) state.
Production: Copy	P.C (PC)	Drive is receiving data from drain of Production drive.
Production: Draining	P.D (PD)	Drive is being drained.
Production: Initialize Array	P.I (PI)	Drive is part of array initialization process.
Production: Pending Drain	P.P (PP)	Drive is awaiting drain, but drain cannot start because: <ul style="list-style-type: none"> • Broken-to-spare data reconstruction is in progress • Another drive in the array is being drained • The number of spares is inadequate (occurs if number of spares was reduced after drain request was accepted).
Production: Reconstruction	P.R (PR)	Data from broken drive is being reconstructed on spare drive, which moves to 'P.A' state when reconstruction finishes.
Production: Unknown Drive State	P.? (P?)	Drive is broken but cause is unknown. Usually means data is being reconstructed to a spare, but may indicate other unknown state. After its data is moved, the broken drive moves from the Production partition to an 'Unavailable: Broken' (U.B) state.
Media Acceptance Test (MAT) Partition		
MAT: Active	M.A (MA)	Drive is active and available for allocation as a spare.
MAT: Fenced	M.F (MF)	Drive is fenced because GFR function is in progress.
MAT: Drive Not Ready	M.? (M?)	Drive is not active due to diagnostic error. After failure is isolated, broken drive is removed from MAT partition and put in 'Unavailable: Broken' (U.B) state.
Spares Partition		
Spare: Active	S.A (SA)	Drive is available to form arrays, reconstruct data, or receive data from drain operation.
Spare: Fenced	S.F (SF)	Drive is fenced for drive test.
Spare: Pending Drain	S.P (SP)	Drive is awaiting drain pending completion of drive test.
Spare: Drive Failure	S.? (S?)	Drive is not active for unknown reason (possible failure). After failure is isolated, broken drive is removed from Spares partition and put in 'Unavailable: Broken' (U.B) state.
Unavailable Partition		
Unavailable: Broken	U.B (UB)	Drive is broken.
Unavailable: Isolated	U.I (UI)	Drive is isolated from the SSA loop configuration.
Unavailable: No Active Drive Module	U.N (UN)	No active drive is sensed in this slot.
Unavailable: Slot Not Installed	U.S (US)	No drive is installed in this slot.

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FICON Channel Extension Guidelines

B

This appendix provides information about FICON channel extensions for the VSM system. Content includes:

- [“Definition of Terms”](#) on page B-76
- [“General Channel Extension Considerations”](#), including:
 - [“Understand Channel Extension Performance Limitations”](#) on page B-77
 - [“Channel Extenders Are Invisible to Other Devices”](#) on page B-77
 - [“Channel Extenders Can Cause Timing Problems”](#) on page B-77
 - [“Channel Extenders Can Insert Fake I/O Errors”](#) on page B-77
 - [“Avoid RECLAIMs and DRAINs on Channel-Extended RTDs”](#) on page B-77
 - [“Avoid RECALLs on Channel-Extended RTDs”](#) on page B-77
 - [“Avoid Syncsort Apps That Use Long Chains on Channel-Extended VTDS”](#) on page B-77
- [“FICON Topologies”](#) on page B-78
- [“Placement of Extension Equipment”](#) on page B-78
- [“Interoperability Testing”](#) on page B-78
- [“FICON Channel Extension – Sample Configurations”](#) on page B-79
- [“McData/CNT Channel Extension Interoperability”](#), including:
 - [“Set Buffer-to-Buffer Credits at Director Ports”](#) on page B-81
 - [“Set Extension-Attached Director Ports to Fixed Speeds”](#) on page B-81
 - [“Set Extension Ports to Fixed Speeds When Extending a VTSS-to-VTSS Channel Link \(CLINK\) or a VTSS-to-RTD Link”](#) on page B-82
 - [“ISL Failover Is Supported Only in Shuttle Mode”](#) on page B-82
 - [“Avoiding Host Protocol Timeouts”](#) on page B-82
 - [“Performance Considerations”](#) on page B-82
- [“Cisco Systems Channel Extension Interoperability”](#) on page B-83.

Note: Always consult your selected vendor’s release documentation for their extension products, and guidelines for proper application of those products.

■ Definition of Terms

The following terms are used in this appendix:

- Front-end – any equipment between a host and a VTSS
- Back-end – any equipment between a VTSS and RTD
- Channel extension – a configuration of equipment that exceeds the maximum distance allowed by native FICON protocol, implemented by adding a pair of channel extenders.
- Channel extender – a piece of equipment that can lengthen the maximum distance allowed between two pieces of FICON-capable equipment. Channel extenders are used in pairs, usually with a WAN network between them. Some channel extenders have FICON director/switch capabilities, and hence are also labeled as FICON switches.
- FICON director or FICON switch – a piece of equipment that is capable of acting like an electronic ‘patch panel’. Directors are used to reduce the number of cables required to achieve connectivity between multiple pieces of equipment. Note that some vendors sell FICON directors/switches that also can function as channel extenders (when appropriate cards have been added).
- Cascading switches – a hardware configuration which includes at least one FICON director/switch connected to another FICON director/switch. In the IBM native FICON protocol, cascading can involve no more than two switches; however, most switch vendors allow more than two switches in a cascaded configuration.
- ISL – inter-switch link; a link between two switches. ISLs can be channel-extended.
- Direct attach – any connection between two pieces of equipment that does not go through a FICON director/switch. The connection could, however, still include channel extenders (which are invisible to the FICON protocol).
- RTD – Real Tape Drive; a physical tape drive linked to a VTSS box, as opposed to a host. Note that if a FICON director/switch is used between the tape drive and VTSS, the drive could function as a RTD at one point in time, and as a conventional tape drive at another time; this would require varying the drive offline from VTCS and online to MVS.
- Conventional tape drive – a tape drive linked to a host, as opposed to a VTSS box. Note that if a FICON director/switch is used between the tape drive and VTSS, the drive could function as a conventional tape drive at one point in time, and as a RTD at another time; this would require varying the drive offline from MVS and online to VTCS.
- Cluster – a pair of VTSS boxes connected by one or more CLINKs. Depending on the direction of the CLINKs, a cluster can be uni-directional or bi-directional. Clustering is used to provide hardware fallback in case one of the VTSS boxes becomes inoperative. VTVs can be replicated between the two VTSS boxes in normal mode (over the CLINKs), allowing one box to take over from the other in case of an outage.
- CLINK – Cluster LINK; a connection between two VTSS boxes in a cluster. Each CLINK allows data to flow in only one direction. For bi-directional clustering, at least one CLINK in each direction must be used. A CLINK connection between two VTSS boxes can include FICON directors/switches and channel extenders.
- VTD – Virtual Tape Drive; a virtual (as opposed to physical) tape drive that exists within a VTSS, as defined by the VTCS (Virtual Tape Control System) host software. A VTD is a transport in a VTSS that emulates a physical 3490E tape drive to a MVS system. Data that are ‘written’ to a VTD actually are written to the disk buffer (VTSS). A VTSS has 64 VTDs that perform virtual mounts of VTVs.

■ General Channel Extension Considerations

Understand Channel Extension Performance Limitations

Channel extension usually involves using a WAN (wide-area network), which possibly operates at slower-than-FICON speeds. At the very least, the addition of channel extenders will cause additional overhead, and will slow down tape I/O processing.

Channel Extenders Are Invisible to Other Devices

By its nature, channel extension must look to end devices (hosts, switches, VTSSs, and/or RTDs) as if those were connected to each other without channel extenders; hence, channel extenders are invisible to FICON devices. Neither software on the host (HSC/VTCS) nor microcode in a VTSS or RTD can sense the existence of a channel extender.

Channel Extenders Can Cause Timing Problems

Since channel extenders can cause delays, adding channel extenders to a configuration that works may cause I/O timeouts or other I/O problems. If channel extenders are used for both tape and disk I/O, the disk I/O can cause further delays for tape I/O, for example.

Channel Extenders Can Insert Fake I/O Errors

Some channel extension products attempt to streamline tape I/O in various ways, including simulating responses from tape drives or VTSSs. On occasion, a channel extender will encounter a problem, which must be reported back to the issuer of the tape I/O. Since a channel extender is invisible to end devices, it has no way to report errors itself; instead, a channel extender will report a fake I/O error coming from a RTD or VTSS, when the channel extender was actually the source of the problem. These types of errors can be very difficult to diagnose, and may require personnel from multiple vendors for resolution.

Avoid RECLAIMs and DRAINs on Channel-Extended RTDs

Most current channel extension products will attempt to streamline tape write I/O but not read I/O. This means users should avoid long operations that require large amounts of read I/O over channel extenders. There are many different back-end and front-end scenarios to consider, but one that should definitely be avoided is doing DRAIN and RECLAIM operations over channel extenders. DRAINs and RECLAIMs tend to perform many tape read I/Os on input MVC cartridges (as well as tape writes to output MVC cartridges).

Avoid RECALLs on Channel-Extended RTDs

Most current channel extension products will attempt to streamline tape write I/O but not read I/O. This means users should avoid long operations that require large amounts of read I/O over channel extenders. RECALL operations cause data to be copied from a MVC cartridge mounted on a RTD back into a VTSS box. If the path between a VTSS and RTD includes channel extenders, such a recall may be very slow. Automatic recalls (which are triggered by a job on the mainframe needing data not available in a VTSS) especially can hold up critical work on the mainframe.

Avoid Syncsort Apps That Use Long Chains on Channel-Extended VTDs

Some Syncsort applications that use long chains (specifically when using sort work files allocated to virtual tape) will not run when using channel extenders between the host and the VTSS (i.e., a remote VTSS), due to protocol timeouts that can occur from WAN delays. The application should be evaluated, and dedicated conventional tape drives should be considered for Syncsort applications. If VSM is required, consider running the Syncsort application on local VTSS, rather than a remote (channel-extended) VTSS. Alternatively, if possible, the best option is to configure shorter chains.

■ FICON Topologies

See “[Placement of Extension Equipment](#)” below to determine proper placement of extension equipment for the following FICON topologies:

1. Host-to-VTSS (front-end link to VTDs)
 - a. direct-attach connection
 - b. single FICON director/switch connection
 - c. cascaded directors/switches connection
2. VTSS-to-RTD (back-end link to RTDs)
 - a. direct-attach connection
 - b. single FICON director/switch connection
 - c. cascaded directors/switches connection
3. VTSS-to-VTSS (CLINKs)
 - a. direct-attach connection
 - b. single FICON director/switch connection
 - c. cascaded directors/switches connection
4. Host-to-conventional tape drive (no VTSS nor VSM involved)
 - a. direct-attach connection
 - b. single FICON director/switch connection
 - c. cascaded directors/switches connection

■ Placement of Extension Equipment

VSM allows many different ways of connecting hosts with VTSS boxes and RTDs, with or without FICON directors/switches. The number of combinations and permutations is too large to list here. Use the sample configurations shown on the following pages as a guideline for where to place channel extension equipment.

■ Interoperability Testing

Supported directors and configurations for VSM-VTSS systems with channel extensions are listed in the Interop Tool on the Sun Sales Support website at <https://extranet.stortek.com/interop/interop>.

The Interop Tool provides connectivity information for all currently supported products sold through Sun, regardless of whether the product is Sun branded or third-party branded. While the tool does validate compatibility, it does not validate the final configuration, the system, or whether the configuration will perform in the end user’s environment. Consult with Sun support personnel to validate all configurations before ordering equipment.

■ FICON Channel Extension – Sample Configurations

Figure B-1. Host-to-VTSS Channel Extension – Direct Attachment

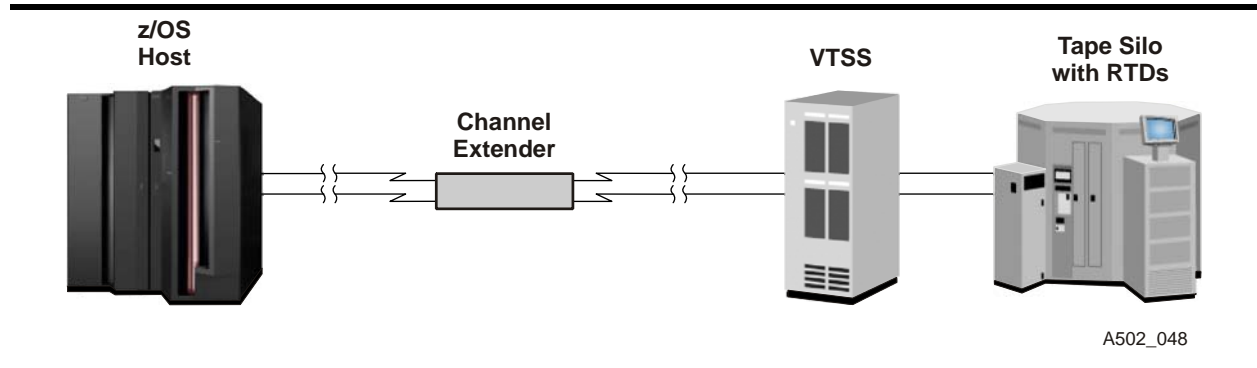


Figure B-2. Host-to-VTSS Channel Extension – Behind Single FICON Switch / Director

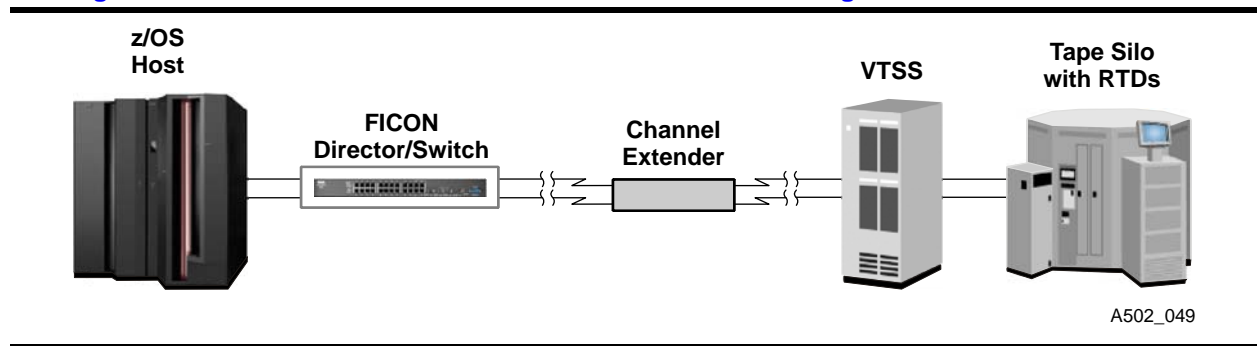


Figure B-3. Host-to-VTSS Channel Extension – Between Cascaded FICON Switches / Directors

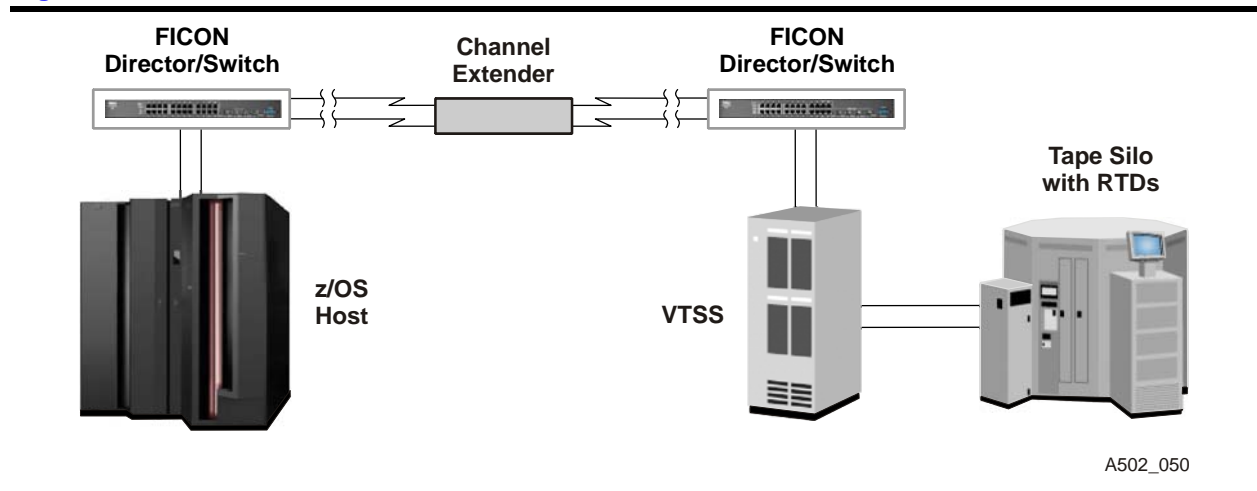


Figure B-4. VTSS-to-RTD Channel Extension – Direct Attachment

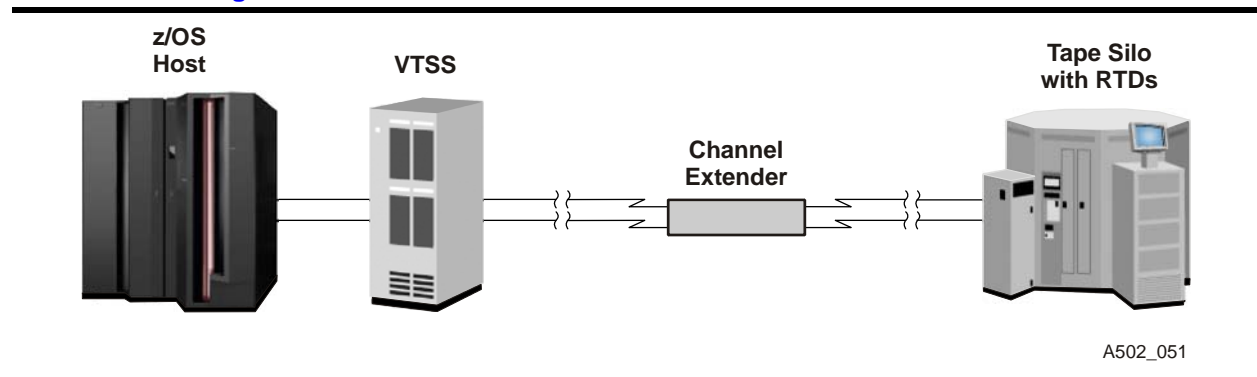


Figure B-5. VTSS-to-RTD Channel Extension – Between Cascaded FICON Switches / Directors

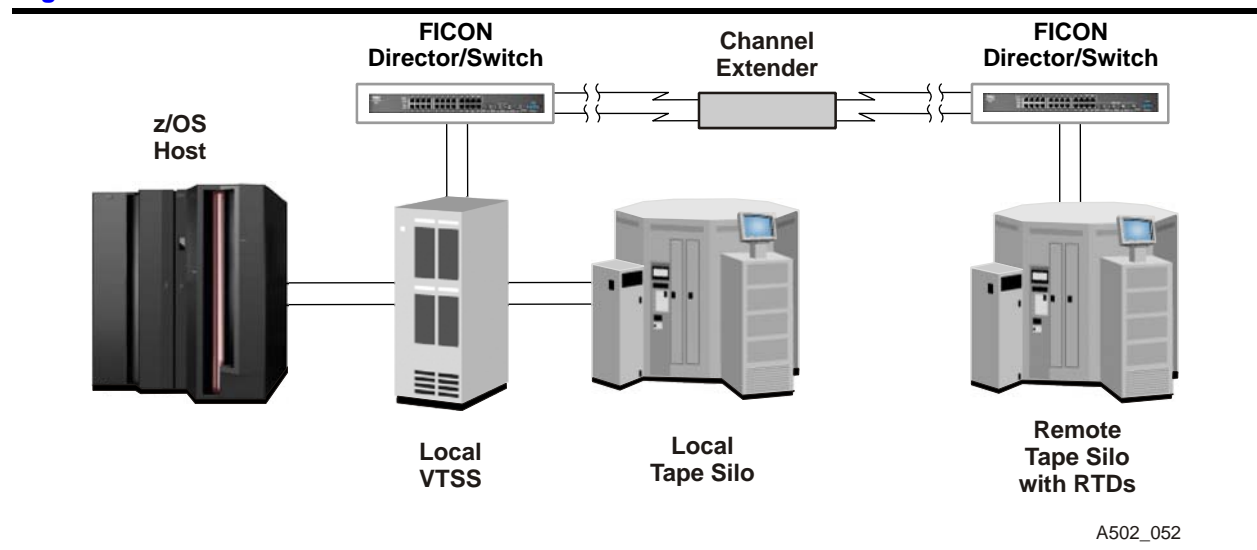
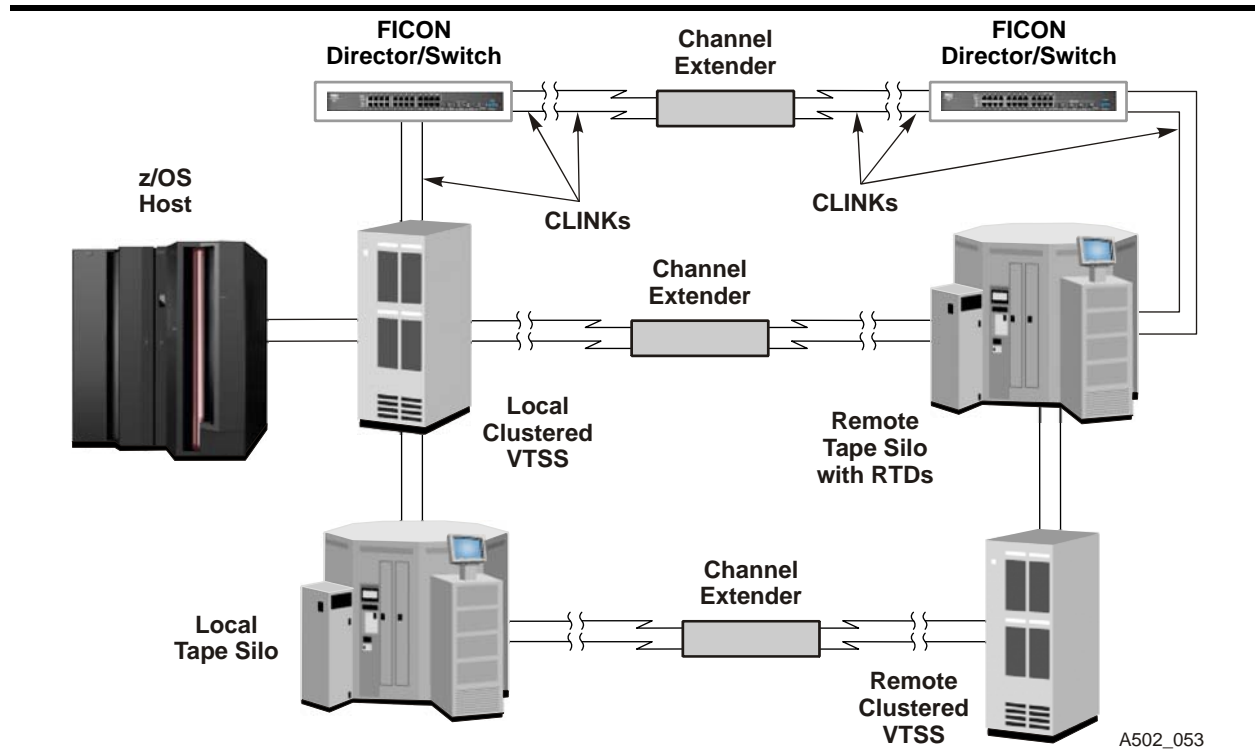


Figure B-6. VTSS-to-VTSS Channel Extension – Between Cascaded FICON Switches / Directors



■ McData/CNT Channel Extension Interoperability

The following interoperability and configuration information and guidelines apply when using McData/CNT USD-X and Edge3000 channel extenders with a VSM-VTSS.

Set Buffer-to-Buffer Credits at Director Ports

In FICON fabric topology, configure buffer-to-buffer (BB) credits on all director ports that are part of all channel-extended end-to-end paths to 'extended distance', i.e., ≥ 60 BB credits. This includes host ports, CU ports, and ISL¹ ports that carry I/O on a channel-extended path, regardless of which link is physically extended. For example, consider a single director configuration with three CHPIDs configured to perform I/O with two CU ports, where one CU port is channel-extended. In this case, four director ports should have their BB credits set to 'extended distance': Each of the three F_Ports attached to the three hosts, and the F_Port attached to the extension equipment that extends to the CU port.

Set Extension-Attached Director Ports to Fixed Speeds

When channel extension is added to a FICON link, the result is two FICON links which are coupled by the two channel extension chassis through a WAN. The link speed setting on at least one side of the pair of FICON links must be set to a fixed speed to avoid exposure to an issue where the link may not initialize once a fibre/SFP² cable is attached, or where the link may not reinitialize after a loss of synchronization during operations.

1. Inter-switch link; the fibre channel link providing connectivity between two switches
2. Short form factor pluggable connectors

The FICON directors on the supported list provide a port configuration option for link speed. The VSM port runs in auto-speed mode (currently unconfigurable). The recommendation is to set all FICON director ports attached to extension equipment to a fixed speed, and to set the attached extension ports to a fixed speed, as follows:

- Set the FICON director port to '1Gbps-ONLY' for attachment to the USD-X channel extender. Also set the speed of the attached USDX port to '1Gbps-ONLY'.
- Set the FICON director port to '2Gbps-ONLY' for attachment to the Edge3000 channel extender. Also set the speed of the attached Edge3000 port to '2Gbps-Only'.

Note: Setting the FICON director port to '1Gbps-ONLY' for the Edge3000 channel extender attachment is also valid when the WAN link in 1Gbps Ethernet. In this configuration, also set the attached Edge3000 port to '1Gbps-ONLY'.

Set Extension Ports to Fixed Speeds When Extending a VTSS-to-VTSS Channel Link (CLINK) or a VTSS-to-RTD Link

When channel extension is added to a FICON link, the result is two FICON links which are coupled by the two channel extension chassis through a WAN. The link speed setting on at least one side of the pair of FICON links must be set to a fixed speed to avoid exposure to an issue where the link may not initialize once a fibre/SFP cable is attached, or where the link may not reinitialize after a loss of synchronization during operations.

McData channel extension equipment on the supported list provides a port configuration option for link speed, which defaults to auto-speed. McData service personnel may perform this configuration change to a fixed speed.

The recommendation is to set a least one attached extension port per extended link to a fixed speed, as follows:

- Set the speed of the attached USD-X channel extender port to '1Gbps-Only'.
- Set the speed of the attached Edge3000 channel extender port to '2Gbps-Only'.

Note: Setting the attached Edge3000 port to '1Gbps-Only' is also valid when the WAN link in 1Gbps Ethernet.

ISL Failover Is Supported Only in Shuttle Mode

McData does not support ISL failover when the extension equipment is configured for FICON emulation. If extension equipment is configured in FICON shuttle mode, then ISL failover can be used. Due to distance limitations, shuttle mode is seldom used.

Avoiding Host Protocol Timeouts

Host protocol timeouts may occur due to WAN delays that increase the time for the VTSS to process multiple outstanding 'CU busy' signals. To avoid these timeouts:

- Vary on no more than 16 devices over a channel-extended path to a single VTSS port
- Configure the USD-X or Edge3000 channel extender to support 32 simultaneous emulations by setting the number of emulation control blocks (ECBs) to 32.

Performance Considerations

Consult McData recommendations regarding performance considerations and modes of operation (i.e., emulation versus shuttle). McData channel extenders emulate write commands, and use shuttle mode (WAN 'pass-through') for read commands. When planning for channel extension, consider the job mix (specifically, the read workload) in combination with performance requirements, as performance may be significantly affected with the shuttle mode over certain distances.

■ Cisco Systems Channel Extension Interoperability

The following interoperability and configuration information and guidelines apply when using Cisco Systems channel extension equipment with a VSM-VTSS.

Note: This qualification is for distances up to 200km without any performance penalty. Cisco is planning a performance improvement beyond the current 200km limit, which will be tested by Sun once that code level is delivered. No timeline has been established for completion of the >200km distance qualification.

Note: These guidelines apply to VSM4-VTSS models VSMA-734, VSMB-734, VSMC-734, and VSMD-734. Tests are pending to ensure the guidelines are applicable for model VSME-734 (VSM4 'lite'), and for VSM5-VTSS models VSMB-465, VSMC-465, and VSMD-465.

- Supported Cisco channel extenders:
 - MDS 9506 (up to 200km)
 - MDS 9509 (up to 200km)
- Mandatory code base levels:
 - MDS 9506/9509 – 2.1.2b
 - VSM4 – D01.02.02.04 or higher

Customers should consult fabric vendor guidelines and DWDM¹ vendor guidelines to assure valid configurations (i.e., distances, fibre and SFP cable types, settings, etc.).

1. Dense wavelength division multiplexer, e.g. the McData FSP 2000

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Glossary

A

AC. Alternating current. Current in which the direction is reversed, or alternated, 60 times per second (50 times per second in some countries). Contrast with direct current.

acceptance test. A formal test done by a system end-user to determine if a system works according to specifications and should be accepted.

access density. A measure of I/O activity; the number of I/O operations per gigabyte of functional capacity per second.

access privileges. The extent to which a user may operate a system resource on a host, network, or file server. In many cases, permission to access a host, network, or file server, view its contents, and modify or create files is limited by a system administrator to maintain security.

ACMI. VSM-VTSS cache memory interface card.

AC power redundancy (ACPR). An AC power system that provides dual AC power sources to prevent power interruptions and loss of access to data. If one power source fails, the other (redundant) source supplies all power to a subsystem until the failed unit is replaced.

ACS. Automated Cartridge System. Also library or tape library. A system that automatically mounts cartridges in tape drives in response to requests from host software.

ACSLs. Automated Cartridge System Library Software; Automated Cartridge System Library (Unix) Server.

actuator-level buffer (ALB). Solid-state memory associated with an actuator in a storage device. In VSM, ALBs minimize rotational latency in disk drives and allow non-synchronous data transfer between the front-end cache and back-end disk array drives.

address. (1) A hexadecimal number that represents an identifying location for a device or an area of storage; for example, a memory register, disk sector, or network node. (2) An identifier for a communication port. (3) The act of communicating with a storage device.

ADC. Analog-to-digital converter.

ADT. Automatic data transfer.

AFO. Americas Field Operations. Acronym for all Sun StorageTek U.S./Canada field operations.

AIX. Advanced Interactive eXecutive. The IBM version of Unix.

ALB. See actuator-level buffer.

algorithm. A detailed, ordered set of instructions for solving a problem. When used in computer programming, term refers to instructions given to a computer.

allocated array cylinder. An array cylinder that contains current or non-current user data.

alphanumeric. A system of notation which utilizes alphabetic letters, numbers, and special characters.

AME. Advanced Manufacturing Engineering. At Sun StorageTek, an engineering group that manufactures product prototype machines, typically through the EPE phase of a product development cycle.

AMT. Automatic migration threshold. User-defined percentage values that determine when virtual tape volume migration begins and ends. VTV migration begins when the VTSS buffer reaches the high AMT and ends when the buffer reaches or falls below the low AMT. These thresholds apply to all VTSSs.

analog. A means of representing data in continuously variable physical quantities, in contrast to digital representation of data in discrete units (binary digits 1 and 0). Analog systems handle information that is represented by continuous change and flow, such as voltage or current. Contrast with digital.

ANSI. American National Standards Institute. An organization that establishes procedures by which accredited organizations create and maintain voluntary industry standards in the U.S., including those for the computer industry. ANSI is the U.S. member of the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO).

ANV. VSM-VTSS nonvolatile memory storage card.

APL. Assembly parts list.

application. A software program designed to perform a specific task or group of tasks, such as word processing, communications, or database management.

array. A group of storage devices controlled in such a way as to provide higher data transfer rates, higher data availability, and data redundancy. An array is typically treated as a single volume by a host operating system.

array architecture. A class of magnetic disk architecture in which several physical devices emulate (typically) fewer virtual devices of (typically) higher capacity and performance.

array cylinder. A collection of all physical cylinders in a dual-redundancy array with the same physical address (CC, **). VSM allocates back-end space in units of array cylinders, which are either free or allocated.

array track. A collection of all physical tracks in a dual-redundancy array that have the same physical track address (CC, HH).

ASAL. Alternate Sector Assignment List.

ASCII. American Standard Code for Information Interchange. A protocol for displaying characters and transferring data between computers and associated equipment. ASCII codes are numbers from 0 to 255. Numbers 0 to 32 are non-printing control codes; 33 to 127 are for letters and punctuation; 128 to 255, called extended characters, can be used for a variety of purposes, but are most commonly used for accented letters, graphics, and other special characters.

ASIC. Application-specific integrated circuit. A customized microchip designed for use on a particular circuit board, or for a specific application.

ASM. Application Storage Manager. A Sun StorageTek high-performance file system with hierarchical storage management (HSM) functionality, available for Solaris and NT platforms.

ASU. Advanced Site Unit. Hardware component of the Sun StorageTek Service Delivery Platform (SDP) remote support software.

asynchronous. Not synchronized; not occurring at regular, predetermined intervals. Asynchronous transmissions send one data character at a time, at irregular intervals, rather than in one steady stream; a start bit and a stop bit notify the receiver when the transmission begins and ends. Contrast with synchronous.

ATA. Advanced Technology Attachment. Official name for the disk drive interface standard commonly known as Integrated Drive Electronics (IDE).

ATM. Asynchronous transfer mode. A networked technology based on transferring data cells or packets of a fixed size.

attenuation. (1) The tendency for a signal to become weaker and more distorted as its transmission distance increases. (2) The loss or reduction of signal magnitude, normally measured in decibels (dB).

AVMn. VTSS volatile memory storage cards; AVM4 cards have 4 MB capacity; AVM16 cards 16 MB.

B

back-end storage. The data storage portion of a storage subsystem. In VTSS, the disk arrays.

background. A mode of operation where tasks are performed on a low-priority basis to minimize the impact on overall system performance. Contrast with foreground.

backup. The process of producing a copy of a data set for purposes of possible future recovery. Although tape is the most common storage medium for backups, disk is equally usable, although more expensive.

bandwidth. The amount of data that can be sent through a network connection, measured in bits per second (bps). High bandwidth allows fast transmission or high-volume transmission.

base memory. Solid state memory in a controller that stores the functional track directory (FTD) and other internal tables required for subsystem operations. Base memory is not part of user-available cache.

battery backup unit (BBU). A system of batteries that automatically supplies power to nonvolatile storage if AC power is disrupted, to protect nonvolatile cache data. A VTSS battery backup system has redundant batteries that provide at least 72 hours of backup power.

battery charger unit (BCU). A VTSS device that continuously charge a battery used to provide backup power.

baud rate. The transmission rate of a serial data stream over communications lines, most often (but not always) measured in bits per second (bps). Baud is a measure of the number of signal-state changes per second; for example, voltage or frequency changes.

BBU. See battery backup unit.

BCU. See battery charger unit.

BER. Bit error rate.

beta test. The second test phase for new software (after Alpha testing), wherein software is made available to users who evaluate it in what is expected to be typical operating conditions.

binary. A numbering system which has 2 as its base and uses 0s and 1s for its notation. Binary code is used by computers because it works well with digital electronics and Boolean algebra. In binary (base 2) numbering, the number one is written as 1, the number two is written as 10, and the numbers three to ten are written as 11, 100, 101, 110, 111, 1000, 1001, 1010, etc.

bit. A binary digit of 0 or 1; a unit of computer information equivalent to the result of a choice between two alternatives (yes/no, on/off, etc.). Contrast with gigabit, kilobit, megabit.

block. Also called a packet. (1) A contiguous section of bits considered as a whole, especially in memory. On a disk, a block is the data in one sector; in a modem data transfer, a block is the bits between checksums. (2) A group of bits transmitted as a unit and treated as a unit of information; usually consists of its own starting and ending control delimiter, a header, text to be transmitted, and check characters at the end used for error correction. Block sizes are usually a multiple of 512 bytes.

BOM. Bill of material.

bps. Bits per second. The number of bits of data that can be transmitted in one second.

Bps. Bytes per second. The number of bytes of data that can be transmitted in one second.

browser. A text- or graphic-based client program, such as Netscape Navigator or Microsoft Internet Explorer, that allows users to read hypertext documents on the World Wide Web, and navigate between them.

buffered subsystem. A storage subsystem that provides separation between front- and back-end operations so data transfer synchronization is not required.

bus. A parallel electrical pathway, usually part of a circuit board, that both connects and is shared by the parts of a computer system (CPU, support circuitry, memory, cards, etc.). Typically, the lines in a bus are dedicated to specific functions, such as control, addressing, and data transfer.

byte. A group of adjacent binary digits (bits) that a computer processes as a single unit, or 'word.' Frequently written as an eight-digit binary number or two-digit hexadecimal number. One letter of the alphabet in ASCII code takes one byte. Contrast with gigabyte, kilobyte, megabyte.

C

CAB. Customer Advisory Board. At Sun StorageTek, a group of customers who advise a corporate design team about the features and functionality they would like to have engineered into upcoming products.

cache. A block of memory that temporarily collects and retains data before it is sent to a host or destaged to back-end disk arrays, allowing quicker retrieval of frequently-used data to improve overall system performance. In VSM, all data is accessed through cache.

cache fast write (CFW). In VTSS, a write command function wherein host data is written directly to volatile cache memory without using nonvolatile storage (NVS), and then is subsequently scheduled for destaging to back-end disk arrays.

CAM. Central Archive Manager.

CAP. Cartridge access port of a Sun StorageTek library unit.

CBT. Computer-based training.

CCR. Channel command retry. A channel procedure, initiated by a controller, that causes a channel command to be repeated without breaking the command chain.

CCW. Channel command word.

CD-R. Compact Disc-Recordable.

CD-ROM. Compact Disc Read-Only Memory. An optical disc that may contain computer data, audio data, graphics, and other information, and is interchangeable between different types of computers. Storage capacity is typically about 680 MB per disc.

CDS. Control data set. An HSC database containing all configuration and volume information, used by host software to control functions of automated libraries.

CEI. Configured end item.

CFE. Composite Failure Event. In VTSS, a structure formed for each discrete failure domain.

CFT. Controlled field test.

change journal. In VSM, the record of changes to the functional track directory (FTD) that is kept in nonvolatile storage (NVS) and is then written to the disk arrays (VTSS). VSM uses the change journal to reconstruct the FTD in the event of a failure.

channel. (1) A point-to-point link whose primary task is to transport data from one point to another. (2) A path for transfer of data and control information between a disk drive and array controller. (3) A device that connects a host and main storage with the I/O control units.

channel image. A software image that logically presents itself as a single physical channel, regardless of how the physical connection is made. Each channel image appears to be an independent single physical channel, although all channel images on a specific I/O interface share the same facilities and physical paths. A VSM5-VTSS presents up to 16 control unit images to each of 1 to 28 host systems.

channel interface. Controller circuitry that attaches host channels.

check0. An error condition detected within a VTSS processor card that affects the integrity of the processor. If a second check 0 is detected within the same processor during recovery, the processor hard-stops (a 'double check 0' condition), making the operation or condition unrecoverable by the failing processor.

check1. An error condition that affects a control bus or shared memory bus but leaves processor cards functional. Check1 may affect all processors on a bus, since the bus is locked until the condition is cleared.

check2. An error condition detected in the non-processor logic cards.

checksum. A value that accompanies data transferred between points to ensure the data is transferred correctly. Checksum is computed by adding up the bytes or words of a data block. On the receiving end, checksum is computed based on the data received and compared with the value that was sent with the data. If the two numbers match, the data is considered to be correct.

CHPID. Channel-path identifier. A value assigned to an installed channel path that provides for its discrete recognition by a VTSS.

circuit breaker. A switch that automatically interrupts an electrical circuit when there is an overload of current or other abnormal condition.

CKD. See count-key data.

client. A system which is able to operate independently but has some degree of dependence on another system. Frequently refers to computers on a LAN. A client is a recipient of services in a client/server application. Clients can be workstations, PCs, or other servers.

client/server. A system architecture in which one or

more programs (clients) request computing or data services, such as data storage, processing, or transmission, from another program (server).

clink. clustered link. An ESCON port used to link a master and slave VTSS in a clustered configuration.

clock speed. In storage systems, the frequency at which the system clock oscillates, as measured in MHz. The faster the clock, the more quickly the system can transmit information.

clustering. (1) In VSM, the process of writing a virtual tape volume (VTV) onto two discrete VTSSs. (2) A technique for configuring two or more servers as a single processing system using software and hardware to allow sharing of storage, processing, and other resources under a single management domain, thereby providing greater data accessibility and higher reliability.

CM. Configuration Management. (1) Identification and management of physical product configurations through documentation, records, and data. (2) An organization within Sun responsible for applying these disciplines through a formal EC process.

cold boot. The act of switching a computer, storage system, etc. Completely off, then switching it back on again. Contrast with warm boot.

cold swap. To remove and replace a system component (typically one such as a logic board that has no redundant backup) after system operations have been stopped and power has been disabled. Contrast with hot swap.

collected free space. Array cylinders that are collected and completely free of user data.

collocation. A process that attempts to keep all data belonging to a single client node on a minimal number of sequential-access media volumes within a storage pool. Used to minimize the number of volumes that must be accessed when a large amount of data must be restored.

command line interface. A user interface in which commands are keyed onto a command line instead of through a Graphical User Interface. Contrast with GUI.

compaction. The elimination of inter-record gaps normally associated with count-key data DASD that allows less disk storage space to be used, reducing net capacity load in VTSS units.

compression. The process of encoding data using algorithms so that it uses less storage space and/or increases the rate, or speed, of data transmission.

Configuration Control Document (CCD). A Sun document which defines model numbers, family ID codes, feature codes, part numbers, etc. for a specific product, and which identifies the configured end items (CEIs) available for use in the product.

Configuration Status Monitor (CSM). In VTSS, a part of the Failure Management System (FMS) that monitors FRU configurations in the controller, performs FRU validation, and coordinates diagnostic fencing.

controlled power-down (CPD). An orderly sequence of steps that shuts off AC power to a system without jeopardizing customer data.

controller. A system control module or storage control unit. Also called a control module or control unit. See also disk array controller.

control region. VTSS data path control. Hardware in a multipath controller that is associated with a data path and which transfers data between the cache and disk arrays and between cache and host channel(s).

control unit address. The base channel address to which a control unit can respond.

conversion. A process that changes the basic capability of a unit in a system and may be a disruptive, requiring a customer to turn over use of the unit to a CSE. Conversions may require special tools and higher-level skills of a technical specialist. Contrast with upgrade.

count-key data (CKD). A recording format that writes variable-length records. Contrast with fixed-block architecture.

CPAT. Corporate Product Acceptance Testing.

CPD. Central parts depot.

CPD. See controlled power-down.

CRC. See Customer Resource Center.

CRU. Customer-replaceable unit. Any item, module, or unit on a system that a customer can replace without assistance from a CSE.

CSA. Canadian Standards Association. A group serving industry, government, and consumers which develops product testing and certification standards and codes. The Canadian counterpart of Underwriters Laboratories.

CSE. See Customer Service Engineer.

CSL. Cartridge scratch loader; cartridge stacker/loader.

CSL. See Customer Services Logistics.

CSM. See Configuration Status Monitor.

CSR. Control Status Register.

CSRC. A Sun StorageTek internal tool managed by the NPDC that allows remote connection, operator panel access, and remote file download capability for virtual disk systems including VTSS.

CTR. Cache track recovery.

CTS. Corporate Technical Standard(s).

Customer Resource Center (CRC). A Sun StorageTek website (www.support.storitek.com) that provides resources including product documentation, tools and services, and customer training information.

Customer Service Engineer (CSE). A technical engineer who interacts with the end-user customers and is responsible for fixing product problems and maintaining product performance in customer accounts.

Customer Service Manager (CSM). A member of the Sun StorageTek management team with first-line technical management responsibility for addressing problems in customer accounts.

Customer Services Logistics (CSL). An organization within Sun StorageTek responsible for coordinating delivery of spare parts to field depots worldwide.

cyclic redundancy check (CRC). A check performed on data to see if an error has occurred in the transmitting, reading, or writing of data.

D

DAC. See disk array controller.

DACD. Disk array controller display. FRU designation for a VTSS local operator panel.

DASD. Direct-access storage device. (1) A storage device (typically a magnetic disk) in which data access times are effectively independent of the location of the data on the device. Conversely, in a serial-access stor-

age device (e.g., a magnetic tape), data must be accessed serially, such that data at the end of the tape spool take much longer to access than data on the tape which is passing immediately over the read/write head. (2) A device in which the media is always available to the read/write head without requiring mounting by an external agent.

data compression. See compression.

data striping. The process of writing large blocks of data across multiple drives and array groups to enhance data protection capabilities.

data transfer rate. The speed at which data can be transferred. Measured in bits per second (bps) for a modem, and in megabytes per second (MBps) for a hard drive or fiber channel.

database. A collection of data arranged for ease and speed of retrieval.

dB. Decibel.

DBU. Disk buffer utilization. The ratio of used to total VTSS buffer capacity.

DC. Direct current. An electric current flowing in one direction only. Contrast with alternating current.

DCN. Document Change Notice.

DDR. Defect discovery rate.

DDR. Dynamic device reconfiguration.

DDSR. Deleted Data Space Release. A VTSS ExPR software function that informs a controller when functional volume datasets or minidisks are deleted, so that physical disk space occupied by deleted data can immediately become free space, thereby reducing DBU.

decibel (dB). In data transmission terms, a unit that measures the ratio of the difference in power between two electric signals.

decompress. To restore a compressed file to its original size.

dedicated connection. In an ESCD, a connection between two ports that is not affected by information in link frames. A dedicated connection restricts the ports from communicating with other ports, and appears as one continuous link.

deinstallation. Physically disconnecting a subsystem with the intent of removing it from a customer site. Contrast with relocation.

destage. In VSM, the non-synchronous write of new or updated data from cache or nonvolatile storage (NVS) to the VTSS disk arrays.

Detailed Manufacturing Instruction. A document containing a step-by-step description of the correct way to assemble an item, including illustrations if necessary.

device. A single physical HDA.

device reconstruction. A VTSS automatic background function that recreates and rewrites data from a failed device to a spare device using the functional track recovery (FTR) facility.

DFE. Distributed Fabric Element.

DFT. Direct field transfer.

Diagnostic Manager (DMGR). In VTSS, a facility that administers, controls, and coordinates all diagnostic activity within the VTSS environment through the diagnostic submonitors (DSMs).

digital. Information stored in binary form that a computer recognizes. For computing use, text, graphics, and sound are stored as digital bits represented by a 0 or 1. Contrast with analog.

dimmed text. Dimmed or grayed-out text that appears on a GUI menu and indicates an option is unavailable because the system is not in the mode to use that function, or because software for that function is not installed. Available options are typically displayed in undimmed black text.

director. A logical entity that interfaces host channels to a disk device. See also multipath storage director.

disk array. See dual-redundancy disk array.

disk array capacity. Formatted physical capacity of an array, exclusive of capacity on redundancy/parity drives or spare drives.

disk array controller. In VTSS, a control unit that implements storage management functions and provides interface intelligence between hosts or network devices and VTSS arrays.

disk drive. An electromagnetic mechanical device that provides physical data storage on magnetic disk media.

DLF. See Download Facility.

DLT. Digital Linear Tape.

DMA. Direct Memory Access.

DMGR. See Diagnostic Manager.

DNS. Domain Name Server.

download. To receive files or data from one storage device or computer to another. Contrast with upload.

Download Facility (DLF). A VTSS facility that formats event log data and connects to a RRC PC to offload event log and MIM information as directed by the VTSS PSA facility and subsystem internal timers.

drain. A process that gradually moves data stored from an individual drive, drive array, or entire array unit to allow for eventual nondisruptive deinstallation of the drive(s) or unit.

drive reconstruction. See device reconstruction.

driver. A software routine that controls or regulates a hardware device.

DSP. Digital signal processor.

dual copy. A function of VTSS nonvolatile storage that maintains two functionally identical copies of designated disk volumes in a logical subsystem, and automatically updates both copies each time a write operation is issued to a logical volume.

dual-redundancy disk array. In VSM, a logical grouping of physical disk storage devices on a VTSS. In an array five disk drives are reserved for user data, and two are used for redundancy/parity data. Dual-redundancy arrays allow for real time automatic recovery of data on up to two failed devices within an array.

duplex. Bidirectional; a two-fiber or two-element cable that provides two-way data transmission, i.e., it can simultaneously send and receive data. Contrast with simplex.

duplexing. In VSM, the process of writing a virtual tape volume (VTV) on two discrete multi-volume cartridges (MVCs).

Dynamic Configuration. A VTSS feature that allows channel interfaces and up to 1024 functional volumes to be defined and/or altered. Allows the functional configuration of a VTSS to be determined by user requirements rather than by available physical devices.

Dynamic Director. A VTSS feature that allows dynamic switching of ESCON director links between the VTSS and RTDs for optimum system performance.

dynamic mapping. A VTSS mapping technique that dynamically alters the correspondence between a functional track and its location on physical devices, thereby avoiding 'update-in-place', a major performance bottleneck in conventional RAID architectures. See also mapping. Contrast with fixed mapping.

E

earth grounding. An electrical connection to the earth that is used to drain electrostatic charge from personnel and equipment.

EC. Engineering Change.

ECA. ESCON channel adapter.

ECAM. Extended Control and Monitoring. A VTSS communications protocol that permits communication between ExPR and the VTSS.

ECAM device. A functional host device number over which ExPR-based communication takes place between a controller and host CPU(s).

ECAMT. Extended Control and Monitoring for Tape.

ECAMT device. A functional device over which VTCS communication between the VTSS disk array controller and the host CPU(s) takes place.

ECC. See error correction code.

ECN. Engineering Change Notice.

EDAC. Error detection and correction. A system that detects and corrects errors during data transfers.

EEPROM. Electronically Erasable Programmable Read-Only Memory.

electromagnetic interference (EMI). Leakage of radiation from a high-frequency energy transmission source that can cause interference to equipment or radio services. National and international regulatory agencies set limits for EMI emissions. Class A limits apply to equipment for industrial use; Class B limits apply to equipment for non-commercial residential use.

EPO. Emergency Power Off. A safety switch on a machine or in a data center that allows a user to immediately power down a machine or a data center power supply by cutting off the external source power.

EMI. See electromagnetic interference.

EMIF. ESCON Multiple Image Facility

enterprise. A large-scale, organization-wide computer network that may include web-based, client-server, and mainframe computing technologies.

Enterprise Systems Connection (ESCON). (1) A set of fiber optic-based products and services developed by IBM that allows devices within a storage environment to be dynamically configured. (2) A channel-to-control unit I/O interface that uses optical cables as a transmission medium.

environmental stress screening (ESS). A method of causing weak components in a machine to fail by applying environmental stresses much greater than normal product environmental specifications, including temperature extremes, temperature shock, and vibration.

EPE. Early/External Product Evaluation

ERP. See [error recovery procedure](#).

error correction code (ECC). One or more bytes containing sufficient information about a given amount of data to permit reconstruction of a predefined number of (lost) bits of that data. A code that detects and corrects error bursts by using check bytes.

error log. An accumulation of data by a unit under test for transmission to a RRC PC for analysis and problem determination.

error recovery procedure (ERP). One of a set of standard procedures used by a host system I/O supervisor to handle errors that are sent with a unit check status by a control unit, and are described by sense data.

ESA. Enterprise Systems Architecture.

ESCD. See [ESCON Director](#).

ESCON. See [Enterprise Systems Connection](#).

ESCON channel. A fiber optic device that connects a host and main storage with the I/O control units.

ESCON Director (ESCD). A device that provides connectivity capability and control for attaching any two ESCON links to each other.

ESD. Electrostatic discharge.

ESS. See [environmental stress screening](#).

event log. Data collected and stored in a machine log by a subsystem.

event record. One of six record types in an event log file. The record is logged out at the time of a device failure or other event, and contains all data to reconstruct an event for failure analysis.

EVT. Engineering Validation Test. At Sun StorageTek, a testing phase where a debugged system is validated for functionality and compliance to specification.

ExLM. Expert Library Manager

ExOM. Expert Online Manager

ExPR. Expert Performance Reporter. A VTSS host software product that collects performance data and generates reports about Sun StorageTek Nearline ACSs and VTSS status and performance.

Extended Capacity. A VTSS feature that allows users to define subsystem functional capacity in excess of its physical capacity.

extended operator panel. An ExPR facility that allows operator interaction with and control of a VTSS through a host operator console in lieu of a local operator panel.

extent. Also called [logical disks](#). A set of contiguously addressed blocks in a storage entity (physical disk drive, virtual disk drive, array, etc.). A storage entity may have one or more extents of varying sizes. Multiple, possibly non-adjacent, extents may be part of the same mapping scheme in a virtual disk system.

external storage. Storage devices that are not embedded inside a server. Typically, a host bus adapter (HBA) is used to connect a RAID subsystem to a server.

E

F-Port. Fabric Port. The access point of fabric where an N-Port is physically connected. See also [fabric](#), [N-Port](#).

fabric. (1) In Fibre Channel (FC), a structure that allows addressing of ports on a FC network to be done independently of the physical location or address of a target port. Fabric switches are responsible for passing packets of data to the target port regardless of which FC loop or switch the port physically resides on. Multiple fabric switches can be connected to create large networks with up to 224 addressable ports. In a FC fabric architecture, both physical and logical communication channels (threads) are interwoven from port to port (end to end) within a storage system. A fabric of linked switches on a network allow any port on any switch to provide full-speed access to any other port on the network (subject to bandwidth availability). (2) The facility that connects multiple N-Ports. See also [F-Port](#).

FACT. File Activities Task.

Fault Symptom Code (FSC). A machine-specific alphanumeric code representing a unique state, condition, or error type associated with an operational event. FSCs are generated by a system support facility to indicate an area or component that is the most likely cause of a problem.

fault tolerance. The ability of a system to keep working in the event of hardware or software faults, usually achieved by duplicating key components of the system.

FBA. See [fixed-block architecture](#).

FC. See [Fibre Channel](#).

FC-AL. Fibre Channel-Arbitrated Loop. One of the possible physical topologies of Fibre Channel used to simplify configurations and reduce costs. In a FC-AL, the Fibre Channel is connected in a loop with devices all connecting to the loop. A FC-AL allows for up to 126 nodes in a loop, allocates bus bandwidth evenly among all nodes, and substantially reduces I/O latency by dedicating a loop's capacity during data transmissions.

FCBE. Fibre channel back end.

FCC. Federal Communications Commission. A U.S. government regulatory agency that defines electronic emissions standards for electronic equipment.

FDID. Functional device identifier.

FDT. Functional device table.

fence. The separation of a logical path or physical component from the remaining operating portion of a subsystem, supporting continuous operation and deferred nondisruptive servicing.

fiber optics. A means of transmitting data digitally through ultrathin glass or silica fibers using pulses of laser light.

fiber-optic cable. A cable made of ultrathin glass or silica fibers which can transmit data using pulses of laser light. Fiber-optic cables have several advantages over copper cables: they have much less signal loss; they allow information to be transmitted at higher speeds and over longer distances; they are not affected by external electrical noise; and they are better for transmissions which require security.

fiber-optic connector. One of several types of devices used to join pairs of optical fibers together. Some types are: ST connectors, SMA connectors, MIC connectors, and SC connectors.

Fibre Channel (FC). An ANSI-standard serial interface used to provide high-speed data transfers between workstations, servers, desktop computers, peripherals and, more recently, as a channel for attachment of storage devices. FC allows concurrent communication between connected elements. FC topologies include Fibre Channel-Arbitrated Loop (FC-AL), point-to-point, and switched fabric.

FICON. Fibre CONnection. An IBM S/390-based channel architecture that provides up to 256 channels in a single connection, each having a capacity of 100 MB per second.

file. A set of related records treated as a unit.

fixed-block architecture (FBA) device. A disk storage device that stores data in blocks of fixed size; these blocks are addressed by block number relative to the beginning of the particular file. Contrast with [count-key data device](#).

fixed mapping. A mapping technique where the location of a mapped object is a fixed, computable function of the identity of the mapped object and a description of the mapping scheme. See also [mapping](#). Contrast with [dynamic mapping](#).

foreground. A mode of operation where tasks are performed on a high-priority basis as soon as possible, depending on available resources. Contrast with [background](#).

F_Port. Fabric port. Also written as [F_PORT](#).

FLOGIN. Fabric login.

FL_Port. Fabric port with loop capability.

free space. Back-end disk array storage space that does not contain user data.

free space collection. In VSM, an automatic background task that relocates data from fragmented VTSS disk cylinders and collects the resulting free space into empty cylinders, making write operations more efficient.

free space directory. In VSM, an internal microcode structure that contains the free space list and free cylinder list.

front end. The portion of a VTSS controller data path that passes data between channels and cache.

FRU. Field-replaceable unit. The smallest self-contained part or component in a system that can be individually replaced during a service or repair action.

FSC. See [Fault Symptom Code](#).

FTD. See [Functional Track Directory](#).

FTR. See [Functional Track Recovery](#).

full-duplex. A communications channel that transmits data in both directions at once. Contrast with [half-duplex](#).

functional. In VTSS, a view or description of stored data encompassing physical and/or logical elements. Contrast with [logical](#), [physical](#).

functional allocated space. A user-allocated portion of functional volume space; i.e., datasets as defined in a VTOC, or minidisks as defined in a VM directory.

functional capacity. The amount of data that can be stored on a VTSS, as viewed by a host.

functional device. See [functional volume](#).

functional device identifier (FDID). A unique numeric identifier (an integer from 1 to 1023) for a functional vol-

ume image as known to a VTSS.

functional device ID mapping. The correlation between the FDID and the host system identification for a specific functional volume image. See also [mapping](#).

functional free space. The unallocated and/or unused portion of the space on a functional volume as defined in the VTOC or VM directory.

functional stored space. The used portion of functional allocated space for a specific functional volume.

functional-to-logical mapping. The relationship between functional devices and logical devices. See [mapping](#). See also [fixed mapping](#), [dynamic mapping](#).

functional track record. A record stored on contiguous sectors in an allocated array cylinder.

Functional Track Directory (FTD). A VTSS internal mapping table that contains one entry for each functional track associated with the functional volumes currently defined by the user.

functional track recovery (FTR). In VSM, an automatic process of recovering data from a physical track in a VTSS disk drive that is unreadable due to a media defect or failed device, accomplished by reading and processing data and redundancy information at corresponding physical track locations on remaining devices in an array.

functional volume. A logical object in a data storage pool that is used to store data; a data carrier that is mounted or demounted as a unit; a volume image that a host system receives when the 'read device characteristics' channel command word is issued.

G

GA. General Availability. A Sun StorageTek term indicating a date after which a product is generally available to all customers.

Gb. Gigabit. A unit of data capacity equal to one billion (1,000,000,000 or 10^9) bits. One gigabit is equal to one thousand megabits or one million kilobits. Also abbreviated [gbit](#) or [Gbit](#). Contrast with [bit](#), [kilobit](#), [megabit](#).

GB. Gigabyte. A unit of data capacity roughly equal to one billion (1,000,000,000 or 10^9) bytes. One gigabyte is equal to one thousand megabytes or one million kilobytes. Also abbreviated as [gbyte](#), [Gbyte](#). Contrast with [byte](#), [kilobyte](#), [megabyte](#), [petabyte](#), [terabyte](#).

Gbps. Gigabits per second (billion bits per second).

GBps. Gigabytes per second (billion bytes per second).

GFI. Guided Fault Isolation.

GFR. Guided FRU Replacement. A utility in the VTSS support facility that defines and coordinates FRU replacement, and manages FRU isolation and FRU swaps.

ground. A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth. The position or portion of an electrical circuit at zero potential with respect to the earth. A conducting connection to such a position or to the earth. A large conducting body used as a return for electrical currents and as an arbitrary zero of potential.

GUI. Graphical user interface. A generic name for any computer interface that substitutes graphics for characters on a computer screen or console, and which usually works with a navigational device such as a mouse or trackball. Contrast with [command line interface](#).

H

half-duplex. A communications channel that transmits data in either direction, but only one direction at a time. Contrast with full-duplex.

handshake. (1) A signal exchanged between two software components that uses characters inserted into a data stream to indicate when to start or stop sending data. (2) A voltage or pulse signal exchanged between two hardware components to establish a valid connection between two computers.

HBA. Host bus adapter. A printed circuit board that acts as an interface between a host microprocessor and disk controller to relieve the host of data storage and retrieval tasks, to improve data throughput performance.

HDA. Head disk assembly. A sealed enclosure containing the mechanical parts of a disk drive, including read/write heads, disk platters, and other non-electronic components.

HDI. Head disk interference.

head crash. Mechanical interference that causes a disk head and platter to make physical contact with each other in a way that disables, or 'crashes,' the head and HDA. Head crashes can be caused by rough handling, sudden power loss, and particulates or other contaminants on the surface of a disk.

hexadecimal. A base of 16 counting method (0 to 9, A to F) for the first position.

HIC. Human interface controller.

host path. In VSM, a communication path with four logical paths between a host and VTSS logical devices.

hot-pluggable. In VSM, capability that allows a CSE to remove and replace FRUs while power to the FRU is maintained. This feature allows hardware maintenance actions and hardware upgrades to proceed without disrupting subsystem availability. See also hot swap.

hot swap. To remove and replace a system component (typically one with a redundant backup) while system power remains on and system operations continue. See also hot-pluggable. Contrast with cold swap.

HSC. Host Software Component. The portion of the Sun StorageTek Automated Cartridge System (ACS) that serves as an interface between the host operating system(s) and the rest of the automated library.

HSM. Hierarchical Storage Manager.

HSSDC. High Speed Serial Data Connector.

HTTP. Hyper Text Transfer Protocol, Hyper Text Transport Protocol. The protocol most often used to transfer information from World Wide Web servers to browsers.

Hz. Hertz. The number of cycles per second in an electromagnetic wave; one hertz equals one cycle.

I

ICE*n*. Iceberg Channel ESCON card used in VSM4-VTSS and earlier units.

IEC. International Electrotechnical Commission. An organization in Geneva, Switzerland that sets international standards for the electrical and electronics fields. IEC created the Joint Technical Committee for information

technology with ISO.

IEEE. Institute of Electrical and Electronic Engineers. A worldwide professional organization that sets standards for telecommunications and computing applications.

IFCMB. VTSS Iceberg Fibre Channel Motherboard

IFES. VTSS Iceberg Fibre-channel Enclosure Services card

IFF. VTSS Iceberg Fibre-channel Freezer card

IFMZ. Iceberg Fiber-channel Mezzanine card; sub-component of IFES card.

IFPB. Iceberg Fiber-channel Port Bypass card; sub-component of IFES card.

IML. Initial microcode load, a.k.a. initial microprogram load. The loading of an operating instruction set, typically from external media such as a floppy diskette, into the microprocessor control store of a machine.

impedance. (1) The combined effect of resistance, inductance, and capacitance on a signal at a given frequency. (2) The total opposition (resistance or reactance) that a circuit offers to the flow of alternating current (AC), using ohms (Ω) as the unit of measure. A lower ohm value indicates a better-quality conductor.

interface. (1) A shared boundary where two or more systems meet. (2) The means by which communication is achieved at this shared boundary. An interface can be between hardware and hardware (such as sockets and plugs, or electrical signals), hardware and software, software and software, human and computer (such as a mouse or keyboard and display screen).

interoperability. Ability to communicate, execute programs, and transfer data across a variety of hardware and software platforms from different manufacturers.

interrupt. A temporary suspension of a process. Two main sources of interrupts are: a signal from outside the computer, such as someone touching the keyboard or mouse (hardware interrupt); or a machine instruction such as a request for input or output (software interrupt).

intranet. A local-area network that functions like the Internet, using web browser software to access and process information for employees, and which is located on computers within a company. An intranet may or may not be connected to the Internet through web servers.

I/O. Input/output. The movement of data between a host system and another device.

IPL. Initial program load. See initial microcode load.

IPX*n*. Power PC functional microprocessor card.

IS. Information systems; information services.

ISO. International Organization for Standardization. A voluntary organization comprised of the national standards organizations of many countries which is responsible for creating international standards in many areas, including computers and communications. ANSI (American National Standards Institute) is the U.S. member of ISO. ISO produced OSI (Open Systems Interconnection), a seven-layer model for network architecture.

ISP*n*. VSM*n*-VTSS Iceberg Support Processor card.

IT. Information technology.

ITCC. Iceberg Tray Cable Crossover.

J

jack. A connector into which a plug is inserted.

JBOD. Just a Bunch of Disks. A term used to describe a data storage cabinet that contains only disk storage devices, without an internal control unit. A JBOD typically attaches to a host system, which provides control functions and intelligence.

journal. A log (stored in a dataset) that contains a record of completed work and changes to the control dataset since the last backup was done.

K

Kb. Kilobit. A unit of data capacity equivalent to 1024 (10^3) bits.

KB. Kilobyte. A unit of data capacity equal to 1024 (10^3) bytes. Also abbreviated kbyte, Kbyte.

Kbps. Kilobits per second (thousand bits per second).

KBps. Kilobytes per second (thousand bytes per second).

kg. Kilogram. A unit of weight equal to one thousand grams (2.2 pounds).

kHz. Kiloherz. A unit of frequency equal to 1000 cycles per second.

km. Kilometer. A unit of distance equal to one thousand meters (0.62 mile).

L

LAN. Local area network. A grouping of two or more computers connected by cable which use an operating system and application software to allow direct sharing of hard disks, printers, files, etc.

LBA. See logical block address.

LCD. Liquid crystal diode. Also called liquid crystal display. A display technology that uses rod-shaped molecules (liquid crystals) that flow like liquid and bend light.

LED. Light-emitting diode. A semiconductor chip that emits visible or infrared light when activated.

link. (1) A point-to-point pair of conductors (optical fibers) that physically interconnects a control unit and a channel, a channel and a dynamic switch (e.g., a director), a control unit and a dynamic switch, or, in some cases, a dynamic switch and another dynamic switch. (2) In an ESCON environment, the physical connection and transmission medium used between an optical transmitter and optical receiver. A link consists of two conductor paths, one for sending and the other for receiving, providing a duplex communication path.

link address. An address assigned during IML that identifies a channel or control unit and allows it to send and receive frames, and to perform I/O operations.

LMS. Library Management Software.

LMU. Library Management Unit.

load. In VSM, the average percentage of VTSS disk array cylinder space that must be relocated to create empty array cylinders in the subsystem.

logical. In VTSS, a view or description of storage components (cylinders, devices, tracks, volumes, etc.) that is dynamic and independent of the physical location of those components. Contrast with functional, physical.

logical array. A grouping of devices into an array independent of physical device locations.

logical block address (LBA). A four-byte number used to identify a logical block on a SCSI drive. The address range is 0 to n , where n equals the number of blocks on a drive.

logical path. (1) A logical connection between a channel image and a control unit image. Every logical path has an associated physical path, but a physical path may 'contain' multiple logical paths. VSM4-VTSS can have up to 512 logical paths to 1 to 28 hosts. (2) A relationship between a channel and control unit that designates the physical path to be used for device-level communication between each entity, defined by a link address assigned to each entity.

LOGREC. Logical record. A data set maintained by a host system containing records of usage and errors encountered for various system components, primarily peripheral devices.

logical-to-physical mapping. The defined relationship between logical devices and specific physical devices. See mapping. See also fixed mapping, dynamic mapping.

logical sector recovery. A process of reading remaining ($n - 1$) physical sectors at a location within a parity group and combining these sectors, using parity generation, to produce the otherwise unreadable content of the n th physical sector, thereby allowing recovery of the logical sector involved. See also functional track recovery.

L_Port. Loop port. Also written as L_PORT.

LSF. Log-Structured File.

LTO. Linear Tape-Open.

LUN. Logical unit. The basic structure created in a RAID subsystem to retrieve and store data, comprised of an array of physical drive modules. The operating system views a LUN as a single drive rather than as the group of drives that comprise the array.

LPAR. Logical partition.

LSM. Library Storage Module.

M

machine address. An address that is permanently assigned to a specific storage location in a computer, by the maker of the machine.

mainframe. A large computer with ability to support hundreds or thousands of users simultaneously.

mapping. The way in which locations of functional, logical, and physical objects are related to one another. There are two types of mapping: functional-to-logical, and logical-to-physical; each can be either dynamic or fixed. See also dynamic mapping, fixed mapping.

MAT. See media acceptance test.

Mb. Megabit. A unit of data capacity equal to one million (1,000,000 or 10^6) bits. One megabit is equal to one thousand kilobytes.

MB. Megabyte. A unit of data capacity equal to one million (1,000,000 or 10^6) bytes. One megabyte is equal to one thousand kilobytes. Contrast with byte, gigabyte, kilobyte, petabyte, terabyte.

Mbps. Megabits per second.

MBps. Megabytes (million bytes) per second. A measure of the data transmission rate through a data path.

mean time between failures (MTBF). A figure that gives an estimate of equipment reliability. The higher the MTBF, the longer a piece of equipment should last. For example, if MTBF is 10,000 hours, the equipment should run, on average, for 10,000 hours before failing.

mean time to repair (MTTR). Average time from the beginning of troubleshooting activities (when a CSE starts work on a unit) until a subsystem (or part of it) is returned to full functionality and total customer control. Includes time used to verify fixes, but not logistics delays.

media acceptance test (MAT) partition. In VSM, a holding partition that contains VTSS disk array drives that can be assigned to the spares partition. Contrast with production partition, spares partition, unavailable partition.

megahertz (MHz). Mega Hertz. A unit of frequency equal to one million (1,000,000 or 10^6) Hertz, used to measure the clock speed of a computer processor.

migration. Movement of data from a VTSS to a RTD where VTVs are stacked onto MVCs. Migration is initiated by VSM when high AMT levels are reached. VTVs are selected for migration based on use and size, i.e. the least-recently used and largest VTVs are selected first. VSM provides ability to migrate VTVs on demand and to migrate multiple copies of a VTV.

MIM. Machine-initiated maintenance. A machine-detected error or condition that initiates a call-home sequence from the supported machine to the associated support center host. Error event and log data is available to the support representative for analysis. See also Service Delivery Platform, ServiceTek Plus.

MLC. Machine-Level Control.

modem. A modulator-demodulator, or device that allows a computer to receive and transmit data over standard telephone lines. A modem takes digital data and converts it to analog data, and the modem at the other end takes analog data and converts it back to digital.

motherboard. The main circuit board inside a computer, which contains a central processing unit, bus, memory sockets, expansion slots, and other components.

MPSD. MultiPath Storage Director. A logical entity that interfaces host computer channels to a disk device. In VTSS, the MPSD has two storage paths (control regions) capable of concurrent operation; both respond to the same channel addresses.

MRF. Machine-readable FRU. A FRU that contains a 256-bit (or greater) serial EEPROM that allows the FRU to be recognized and identified by the support facility.

MTBF. See Mean Time Between Failures.

MTTR. See Mean Time To Repair.

MVC. Multi-volume cartridge. A physical cartridge in a LSM that contains one or more VTVs (or none), but has been identified as a volume that can be selected for VTV stacking. This data is stored in the CDS.

MVS. Multiple Virtual Storage. The most commonly-used operating system for IBM mainframes; another common operating system is VM.

N

N-Port. Node port. In Fibre Channel, a hardware connection port in a point-to-point connection topology. An F-Port provides a physical connection point for an N-Port. See also F-Port.

NA. Not available.

N/A. Not applicable.

NAS. Network-attached storage.

NCKD device. A subsystem in which both virtual and real devices are native count-key data type.

NCKD. Native count-key data.

NCL. See net capacity load.

NCS. Nearline Control Solution.

Nearlink. In VSM, microcode used to give a CIP a 'channel' personality as opposed to a control unit personality so that the CIP port can be used to drive an RTD or clink. See real tape drive, clink.

net capacity load (NCL). The amount of physical back-end disk array storage space used by a VTSS to store the defined functional capacity.

NiCad. Nickel-cadmium; a type of compact long-life battery used in various applications.

node. In a data network, a point where one or more functional units interconnect data transmission lines.

Non-Disruptive Code Load (NDCL). A VTSS feature that allows microcode changes to be implemented without interrupting subsystem operations or affecting data availability.

nondisruptive installation. The physical installation of additional components or capabilities to a unit while normal operations continue without interruption.

nondisruptive removal. Physical removal of components or capabilities from a unit while normal operations continue without interruption.

nonvolatile storage (NVS). In VSM, a redundant solid-state repository in a VTSS disk array controller that retains its data when AC power is removed, achieved by switching to a battery-backup DC power system when its primary power source fails. In VTSS, NVS is used to temporarily store host data before it is destaged to the back-end disk arrays. Contrast with volatile memory.

NPDC. New Product Development Center.

N_Port. Node Port.

NLOGIN. Node Login.

NL_Port. Node Port on Loop.

NOS. Network Operating System.

NVS. See nonvolatile storage.

O

ODLI/ODL-I. Optical data link interface. In VSM, a fiberoptic interface between a VTSS front end and back end.

OFC. Open Fibre Control.

ohmmeter. A test instrument used to measure the resistance of a material, using ohms (Ω) as the unit of measurement.

open systems. Products designed to operate in a multi-platform computing environment.

operating system (OS). A program responsible for management of system resources.

outlet. A wall receptacle that is connected to a power supply and equipped with an electrical socket designed to accept a compatible plug.

P

packet. A unit of data formatted for transmission on a network. Each packet has a header containing its source and destination, a block of data content, and an error-checking code. The data packets for a specific message may take different routes to a destination, and the packets are reassembled on arrival.

PAD. Packet assembly/disassembly. See [packet](#).

PAL. Programmable Array Logic.

parallel. Side by side. A parallel interface transmits eight bits (one byte) of data at a time, over eight parallel lines, while a serial interface transmits only one bit at a time. A parallel cable can use eight channels to transmit one eight-bit byte at a time, or may transmit more than one byte at a time. Some of the eight channels may be used to transmit control signals instead of data. Contrast with [serial](#).

parity bit. A binary check digit inserted in an array of binary digits to make the arithmetic sum of all digits, including the check digit, always odd or even (as was predetermined).

parity checking. A method of verifying the integrity of data when it is transferred between entities (within a subsystem, between a subsystem and host, etc.).

parity generation. Application of a mathematical algorithm to ensure integrity of data transfers. Parity data is generated and sent along with the original data to be interpreted at the receiving end, validating the integrity of the data.

partition. Logical separation of devices, arrays, or groups of arrays within a VTSS to allow different functionality (media acceptance test, production, spares, and unavailable).

path. See [storage path](#).

PCAP. Physical Capacity Control.

PCI. Peripheral Component Interconnect.

PCM. Power control module; plug-compatible manufacturer.

PDU. Power distribution unit.

physical. In VTSS, a view or description of actual hardware or fixed locations, as opposed to conceptual or dynamic subsystem elements (functional tracks, logical paths, virtual volumes). Contrast with [functional](#), [logical](#).

P/N. Part number.

preventive maintenance (PM). Routine, scheduled action to prevent a machine from failing due to normal wear and tear.

privileged ECAM device. A device type used by ExPR to send messages to a VTSS to request a change in the subsystem state. At least one privileged ECAM device must be defined per subsystem; however, all functional volumes can be defined as privileged ECAM devices.

production partition. In VSM, a partition state of VTSS array drives used for storage of user data. Contrast with [media acceptance test partition](#), [spares partition](#), [unavailable partition](#).

PSA. Predictive Service Analysis. A VTSS Failure Management System function that receives failure reports from the support facility, performs problem analysis, and issues a suspect FRU list.

Program Configuration Document (PCD). A Sun StorageTek document that provides a description of architectural elements that comprise the internal structure of a product. A PCD includes, among other things, a listing of all available product configurations, including feature codes and part numbers used for ordering.

protocol. In command sequencing, the required commands in the proper order and timing to invoke a desired response. In data communication packets, a defined sequence of data patterns that follow a defined set of rules for data exchange and error correction.

PSSIB. Power system serial interface bus.

PTF. Program Temporary Fix. An interim patch, or 'fix', applied to a known defect in software or microcode.

Q

query. A request for data from a file or database, based on specified conditions.

queue. (1) A line or list of commands waiting to be processed. (2) A list constructed and maintained so that the next data element to be retrieved is the one stored first.

quiesce. To end a process by allowing operations to complete normally.

R

rack. A free-standing framework that holds equipment. VSM4-VTSS uses an industry-standard 19-inch rack for mounting the array drives and related components.

random access. A method of storing and retrieving information randomly, as on magnetic disk media. Any file or piece of information stored in a random-access format can be selected and accessed immediately in any order. Contrast with [serial access](#).

RAID. Redundant Arrays of Independent Disks.

RCSE. See [remote customer service engineer](#).

read. To acquire or interpret data from a storage device, a data medium, or another source.

read hit. An instance wherein data requested by a read operation is found in cache.

read miss. An instance wherein data requested by a read operation is not found in cache.

real tape drive (RTD). Physical transports (TimberLine 9490, RedWood SD-3, T9840x, T9940x) controlled by VSM. The transport has a data path to a VTSS and may optionally have a data path to MVS or to another VTSS.

recall. Movement of VTVs back to a VTSS from a MVC. VSM provides ability to recall VTVs on demand.

reclaim. A space-reclamation function performed by a MVC. VTCS uses the amount of fragmented free space on a MVC and the amount of VTV data that would have to be moved to determine if space reclamation is justified. VSM provides ability to reclaim MVCs on demand.

reconstruction. See [device reconstruction](#).

redundancy group. A logical grouping of devices that are protected against data loss from device failures by the use of redundancy information that is stored across the entire group of devices. VTSS dual-redundancy arrays are redundancy groups that provide data protection against two simultaneous device failures.

relative humidity. The amount of moisture in the air, as compared with the maximum amount of humidity that the air could contain at the same temperature; expressed as a percentage.

relocation. The process of physically moving VTSS units within a same site or immediate area without the use of packing materials. Contrast with deinstallation.

remote customer service engineer (RCSE). A Global Services RRC person who receives customer and CSE calls, performs preliminary diagnostic tasks, evaluates failure situations, and dispatches CSEs to customer sites for repairs and maintenance.

remote diagnostics. See Service Delivery Platform.

remote maintenance. See Service Delivery Platform.

Remote Resolution Center (RRC). A Sun StorageTek Global Services group that is available 24 x 7 x 365 to handle customer requests for service and to provide technical support and remote problem resolution. Comprised of Tier 1, Tier 2, Tier 3 (subject-matter experts), critical-situation (CRITSIT) management, and out-of-cycle or performance management organizations.

resistance. (1) The property of an electrical conductor that specifies the ability of an electrical current to flow through it, using ohms (Ω) as the unit of measurement. (2) The parameter describing the current-limiting property of an object. (3) The ratio between potential difference applied across an object, and the resulting current through the object.

RRC. See Remote Resolution Center.

RTD. See real tape drive.

S

SAN. Storage area network. A storage networking configuration that optimizes communications between various hosts, applications, and disk or tape storage systems.

SAP. Systems Applications and Products.

scalability. An ability to easily change in size or configuration to suit changing conditions.

SCSI. Small Computer System Interface. A high-speed interface that can connect to computer devices (hard drives, CD-ROM drives, tape drives, scanners, printers, etc.). SCSI can connect up to seven devices; each one is given an identification number from zero (0) to seven (7), which is set with a manual switch. Newer versions of SCSI can connect up to 15 devices. The SCSI cable transfers eight bits at a time, in parallel.

SDP. See Service Delivery Platform.

SE. See systems engineer.

serial. One at a time. A serial interface transmits one bit of data at a time over one line. Contrast with parallel.

serial access. A method of storing and retrieving information in sequence, as on magnetic tape media. To access file or piece of information, magnetic tape must be wound or unwound to the point where the data is stored. Contrast with random access.

server. Computer hardware and software that is attached to a network and which automatically stores, processes, and transmits data or information that is generally accessed by many people using client programs. See also client/server.

Service Delivery Platform (SDP). A Sun StorageTek

maintenance and reporting system that allows field machines to connect, via LAN/Ethernet over the Internet, or via modem over a telephone line, to a call-handling machine at the RRC. SDP automatically notifies the RRC of machine failures, trends, and status, and whether a machine is inoperable, degraded, subject to potential failure, or ready to offload event data. SDP also allows remote personnel to perform maintenance and diagnostic tasks on a linked machine, thereby reducing on-site service requirements.

severity code. A code that classifies the seriousness of an error condition.

SFL. Suspect FRU list.

SFP. Small form-factor packaged. A small-form connector type.

Siebel. A software tool used by Sun StorageTek that standardizes and automates certain tasks in the sales and ordering process, and which tracks customer orders in a centralized database.

SIM. Service Information Message. In VSM, a message generated by a host system console after it has received sense information from a VTSS indicating a need for service, repair, or customer action, or for the purpose of communicating status information.

simplex. Unidirectional; a single-fiber or single-element cable that provides one-way data transmission. Contrast with duplex.

slot. Part of the physical location designator for each FRU in a unit. See unit.tray.slot.

SMS. System-Managed Storage.

SN. Serial number.

SNMP. Simple Network Management Protocol. The Internet standard protocol for network management software. Using SNMP, programs called agents monitor devices on a network (hubs, routers, bridges, etc.). Another program collects the data from the monitoring operations into a database called a management information base (MIB). This data is used to check if all devices on the network are operating properly.

Solaris. A UNIX-based operating system and window system for Sun SPARC computers, formerly called SunOS. It includes Open Look and Motif GUIs, OpenWindows (the Sun version of X Windows), DOS and Windows emulation, and ONC networking, and is often used for server operating systems.

spare. A VTSS device physically located in the VTSS but not logically associated with an array. Spares are used to automatically reconstruct and logically replace failed devices.

spares partition. A partition state for extra (spare) VTSS disk array devices that are not used to store user data, nor included in a redundancy group, but that are available for automatic reconstruction of failed devices in redundancy groups. Contrast with media acceptance test partition, production partition, unavailable partition.

SSA. Serial Storage Architecture.

SSID. Subsystem identifier.

storage cluster. A VTSS functional partition that exists on a cluster motherboard, comprised of a multipath storage director, shared memory, and a support facility.

storage path. Also called a control region. Hardware within a controller that transfers data between the channels and disk storage devices. See multipath storage director.

support facility. VTSS functionality provided by ISP cards and support facility software that enables human interface with a VTSS for monitoring, communication, and testing.

synchronous. (1) Synchronized by a common timing signal. (2) Occurring with a regular or predictable time relationship. Synchronous transmissions send strings of data characters at regular intervals without the need for start and stop bits required for asynchronous transmissions, making them faster than asynchronous transmissions. Contrast with asynchronous.

system engineer (SE). A person who works with customers and marketing representatives to provide system solutions to customer needs and requirements.

T

tape drive. An electromagnetic mechanical device that provides physical data storage on magnetic tape media.

TB. See terabyte.

terabyte (TB). A unit of data capacity equal to 1000 gigabytes or 1,000,000 megabytes.

TMS. Tape Management System.

track. A channel where information is stored on magnetic or optical media. On magnetic disk media, tracks are defined in concentric rings. A combination of two or more sectors on a single disk media track makes a cluster or block, the minimum unit used to store information. On magnetic tape media, tracks run parallel to the length of the tape, or diagonally for helical scan tracks.

tray. A part of the physical location designator for each FRU in a unit. See unit.tray.slot.

TUV. Technischer Ueberwachungsverein (TUV). A German regulatory association.

U

UL. Underwriters Laboratory. A U.S. non-government lab that certifies electrical product safety.

unavailable partition. In VSM, a partition state of VTSS disk devices that are unavailable for storage of user data because the devices are not installed or have failed. Contrast with media acceptance test partition, production partition, spares partition.

unidirectional. In only one direction; referring to a data channel that only transmits one way.

uninstall. To remove installed software or hardware from a system and restore modifications made to files.

unit. A part of the physical location designator for each FRU in a unit. See unit.tray.slot.

unit.tray.slot (U.T.S). In VTSS, an abbreviated label that designates the precise physical location of a FRU.

Unix. A multi-user, multitasking operating system written in C programming language and used on mainframes and workstations. There are multiple versions of Unix for use on different platforms. See also AIX, Linux.

upgrade. A nondisruptive addition of function or capacity to a VTSS. Contrast with conversion.

upload. To transmit files or data from one storage device or computer to another. Contrast with download.

UPS. uninterruptible power supply. A device that supplies auxiliary power to a system to ensure continuity of

operation in case the primary power supply (typically provided by a local utility company) is interrupted. Having a UPS as a backup power source allows time to save files and shut down systems in an orderly manner as needed, thereby avoiding the possible data loss that can result from a rapid and unanticipated loss of power.

URL. uniform resource locator, a.k.a. Internet address or Web address. The standardized addressing or naming system used for locating web sites over the Internet.

user programming interface. In VTSS, a software interface between a user application program and ExPR.

UTC. Universal Time Coordinated, a.k.a. Greenwich Mean Time (GMT). The mean solar time of the meridian of Greenwich, England, used as the basis for calculating standard time throughout the world.

U.T.S. See unit.tray.slot.

V

VAC. Volts AC.

VCF. VSM4-VTSS Iceberg Channel FICON card.

VCU. See Virtual Control Unit.

VDE. Verband Deutscher Elektrotechniker. The German counterpart of Underwriters Laboratory (UL).

VIP. Virtual Initialization Program. In VSM4, a proprietary software program contained on a floppy disk that enables the installation of approved system release level (SRL) microcode.

virtual address. A memory location in a system that uses virtual memory; when an application program needs the data at that location, it is paged in and accessed by means of an address in physical memory.

virtual control unit. In VSM, a software image that logically presents itself as a physical control unit. Each virtual control unit appears to be an independent physical control unit, although all virtual control units common to a single physical control unit share the same facilities and physical paths. VSM4-VTSS presents up to 16 virtual control unit images to 1 to 28 hosts.

virtualization. Software capability in a storage subsystem that presents the storage capacity of multiple physical devices to a host operating system as a single 'virtual' storage device, enabling the host to use that storage more efficiently.

VM. Virtual machine. (1) A computer or storage system that does not exist as a separate physical device, but is instead simulated by another computer or system. (2) A virtual data processing system in which multiple operating systems and programs can be run by a computer at the same time. Each user appears to have an independent computer with its own input and output devices.

VSM. Virtual Storage Manager. A storage system developed by Sun StorageTek that virtualizes tape volumes and transports in a disk buffer to improve capacity-utilization rates of tape media and tape transports, and to improve data retrieval speeds. VSM hardware includes VTSS(s) and RTDs; VSM software includes VTCS and VTSS microcode. By providing an image of a single, consolidated pool of tape storage to a host, VSM provides performance and data-management advantages over physical tape products, without requiring application changes.

VSMAT. Virtual Storage Manager Administration Tool.

VSMRL. Virtual Storage Manager Remote Library.

VTCS. Virtual Tape Control System. In VSM, primary host software that controls activity and coordinates operations between the host operating system and the VTSSs, VTVs, RTDs, and MVCs, as represented in front-end tape drives or libraries and back-end disk arrays. VTCS software operates in the same address space as the HSC, and communicates closely with it.

VTD. Virtual Tape Drive. A transport in a VTSS that emulates a physical 3490E tape drive to a MVS system. The data written to a VTD is really being written to the disk buffer (VTSS). A VTSS has 64 VTDs that do virtual mounts of VTVs.

VTSS. Virtual Tape Storage Subsystem. In VSM, a back-end disk array storage device (buffer) containing virtual tape volumes and transports. VTSS is a RAID 6+ hardware device with microcode that enables emulation of 256 transports. The RAID device can read and write 'tape' data from/to disk, and can read and write the data from/to an RTD. Using data compression algorithms and other proprietary techniques, a VTSS presents its physical storage capacity as a much larger pool of 'virtual' capacity (typically, a 4:1 ratio) to a tape storage device or host.

volatile memory. A repository that does not retain data when AC power is turned off. In VTSS, volatile memory temporarily stores data being sent from back-end disk arrays to a host. Contrast with nonvolatile storage.

VOLSER. VOLume SERial (number). A six-character alphanumeric name that identifies a disk volume to a host system.

volume. See functional volume.

VTOC. Volume table of contents. A table on a disk volume that describes each data set on the volume.

VTV. Virtual Tape Volume. A 'tape cartridge' image whose volume number is known to an MVS catalog and TMS (Tape Management System) as a tape data set.

W

warm boot. Also called warm start. The act of restarting a computer, storage system, etc. Without turning the power off. Contrast with cold boot.

work mat. A nonpermanent, removable island of material, typically made of conductive or dissipative layers or

composite materials, which is placed over a floor to drain static charges that are generated by groundable personnel or objects. See also wrist strap.

wrist strap. A device consisting of a grounding cord and conductive band that connects to a grounding outlet on a machine and makes electrical contact with the wearer's skin to drain static charges from the wearer to earth ground. See also work mat.

write. To make record data permanently or transitorily in a storage device or on a data medium.

write hit. An instance where data to be updated by a write operation is in cache. Contrast with read hit.

write miss. An instance where data to be updated by a write operation is not in cache. Contrast with read miss.

write operation. An output operation that sends a processed record to an output device or output file.

write-protect tab. A sliding device placed over a write-protect notch on a floppy disk to prevent recording of data over existing pre-recorded data on the disk.

WWTS. Worldwide Technical Support.

X

x-axis. The horizontal axis, representing width, in a two-dimensional (x-y) or three-dimensional (x-y-z) coordinate system. Contrast with y-axis, z-axis.

XOR. Exclusive OR. A method used to calculate parity information in RAID configurations.

XSA. Extended Storage Architecture.

Y

y-axis. The vertical axis, representing height, in a two-dimensional (x-y) or three-dimensional (x-y-z) coordinate system. Contrast with x-axis, z-axis.

Z

z-axis. The third dimension, representing depth, in a three-dimensional (x-y-z) coordinate system. Contrast with x-axis, y-axis.

Forms and Reference Notes

D

This appendix provides electronic forms and worksheets for recording information related to pre-installation planning tasks for a VSM5-VTSS at a specific location, including:

- Customer site details
- Customer personnel contact details
- Sun and QSP¹ personnel contact details
- System software reference information
- System hardware reference information
- Planning task-completion worksheets
- Planning and system assurance reference notes

Note: Forms in this appendix are designed for electronic text entry using a service laptop or desktop PC, and can be revised and printed as needed.

1. Qualified Service Provider; a third-party contractor certified and authorized by Sun to work with systems and equipment described in this guide.

Account Information

> [electronic form] <

Account (Company) Name	
Site Number	
Street Address	
City / State / Province / Region	
Zip or Postal Code / Country	
Other Account Details	

Host System Configuration Information

> [electronic form] <

Host Name	
Host Address	
Other Host Configuration Details	

VTSS Configuration Information

> [electronic form] <

VTSS Name	
License Key	
Time Zone Setting	
Other VTSS Configuration Details	

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Customer Personnel Contacts

> [electronic form] <

Account _____

Data Center Manager (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Network Administrator (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Site Engineer (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Facilities Manager (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Data Center Operator (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Delivery Dock Manager (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Other Contact (name / job role)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Other Contact (name / job role)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Other Contact (name / job role)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	

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Sun StorageTek / QSP Personnel Contacts

> [electronic form] <

Account _____

Account Representative (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
System Engineer (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
System Support Specialist (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Technical Support Specialist (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Professional Services Mgr. (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Customer Service Manager (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Customer Service Engineer (name)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Other Contact (name / job role)	
Phone Numbers (office / cell)	
E-Mail Address(es)	
Other Contact Information	
Other Contact (name / job role)	
Phone Numbers office / cell)	
E-Mail Address(es)	
Other Contact Information	

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Planning Worksheet 1 of 5

> [electronic form] <

Account _____ Completed By _____ Date _____

Site Readiness Planning Factors	Information to Note / Comments
1A. Installation teams defined?	1A.
1B. Installation schedule created?	1B.
1C. HVAC requirements compliance verified?	1C.
1D. Power requirements compliance verified?	1D.
1E. Flooring requirements compliance verified?	1E.
1F. Future expansion considered?	1F.
1G. Floor plans completed?	1G.
1H. Cable routing established?	1H.
1I. Delivery team identified?	1I.
1J. Doorway clearances verified for transit of VTSS cabinet(s) between dock and installation area?	1J.
1K. Delivery dock receiving time scheduled?	1K.
1L. Pallet jack / forklift availability verified?	1L.
1M. Incline compliance of ramp(s) verified?	1M.
1N. Elevator capacity verified?	1N.
1O. Pre-staging area readiness verified?	1O.
1P. Site and data center access arranged?	1P.
Additional Information to Note / Comments (Specify By Above Item Number):	

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Planning Worksheet 2 of 5

> [electronic form] <

Account _____ Completed By _____ Date _____

Delivery and Handling Factors	Information to Note / Comments
2A. Does the customer have a delivery dock? If NO, where will the VTSS cabinet(s) be delivered?	2A.
2B. Are there street or alley limitations that will hinder delivery of the VTSS cabinet(s)?	2B.
2C. Is the delivery dock available only during specific hours? If YES, what are the hours of availability?	2C.
2D. Which specific persons (by name) will be used to move and position the VTSS cabinet(s)? Note: A packaged and fully-populated VTSS cabinet weighs up to 445 kg (982 lbs.).	2D.
2E. Will a pallet jack or forklift with adjustable forks be available for moving the VTSS cabinet(s)?	2E.
2F. Is there a freight or public elevator available for moving the VTSS cabinet(s) to the staging and installation areas, or must stairs be used?	2F.
2G. Are there ramps along the path between the delivery dock and final installation area? If YES, have all ramp inclines been verified to be within specification to prevent tipping of the VTSS cabinet(s)? Note: Ramp incline angles must <u>NOT</u> exceed 10 degrees.	2G.
2H. Are floors along the transit path to the installation area rated to support the VTSS cabinet(s)?	2H.
Additional Information to Note / Comments (Specify By Above Item Number):	

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Planning Worksheet 3 of 5

> [electronic form] <

Account _____ Completed By _____ Date _____

Safety and Fire Prevention Factors	Information to Note / Comments
3A. Have all safety and fire-prevention codes and regulations been reviewed for this VTSS installation?	3A.
Hardware / Software Procurement Factors	Information to Note / Comments
3B. Has the VTSS configuration, including all features and optional upgrades, been defined?	3B.
3C. Has the VTSS configuration, including all features and optional upgrades, been ordered?	3C.
3D. Have needed lengths for power / ESCON channel / FICON channel / modem cables, etc. been determined?	3D.
3E. Have needed lengths for power / ESCON channel / FICON channel / modem cables, etc. been ordered?	3E.
3F. Have all required accessories and special tools been ordered?	3F.
Environmental Factors	Information to Note / Comments
3G. Does the installation area for the VTSS cabinet(s) comply with all environmental requirements?	3G.
3H. Does the installation area for the VTSS cabinet(s) provide required levels of ventilation and / or cooling (i.e., adequate clearances for air circulation, adequate air-flow for heat dissipation, etc.)?	3H.
3I. Does the installation area for the VTSS cabinet(s) contain features and materials that provide protection against electrostatic discharge (ESD)?	3I.
3J. Does the installation area for the VTSS cabinet(s) provide a stable environment free of extreme temperature and humidity fluctuations?	3J.
Additional Information to Note / Comments (Specify By Above Item Number):	

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Planning Worksheet 4 of 5

> [electronic form] <

Account _____ Completed By _____ Date _____

Physical Placement Factors	Information to Note / Comments
4A. Does the installation area provide sufficient floor space for all the hardware that comprises this VSM solution?	4A.
4B. Does the installation area provide adequate lighting and clearances for safety, operation, and maintenance of all the hardware that comprises this VSM solution?	4B.
4C. Does the installation area have raised flooring? If YES, are floor tile cut-outs needed?	4C.
4D. Does the installation area meet floor and floor-loading requirements for all the hardware that comprises this VSM solution?	4D.
AC Power Factors	Information to Note / Comments
4E. Does the installation area meet all power requirements for the hardware that comprises this VSM solution?	4E.
4F. Does the installation area have multiple separate circuits to supply the VTSS cabinet(s)? If YES, will the customer provide multiple circuits for redundancy?	4F.
4G. What type and quantity of power cords, if any, will the customer supply for the VTSS cabinet(s)?	4G.
4H. What type and quantity of power cords, if any, will Sun Microsystems supply for the VTSS cabinet(s)?	4H.
4I. Are source power circuits for the VTSS cabinet(s) isolated to protect against fluctuations from lightning, outages, etc.?	4I.
4J. Can source power circuits support the amperage (current) required for the VTSS cabinet(s)?	4J.
4K. Is new electrical wiring needed to accommodate all the hardware that comprises this VSM solution? If YES, will this require inspection or approval to meet local codes?	4K.
Additional Information to Note / Comments (Specify By Above Item Number):	

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Planning Worksheet 5 of 5

> [electronic form] <

Account _____ Completed By _____ Date _____

AC Power Factors	Information to Note / Comments
5A. Does the installation site have capability for grounding the VTSS cabinet(s)?	5A.
5B. Is the installation site close enough to source power connectors / outlets to accommodate the power cord lengths ordered for the VTSS cabinet(s)?	5B.
5C. Are power cable routing paths readily accessible to facilitate cable connection / disconnection and servicing?	5C.
Host System and Application Software Factors	Information To Note / Comments
5D. What host operating system software will be used with this VSM solution configuration? Requirements: (1) MVS 5.2.2 or higher. (2) All versions of OS390.	5D. (1) _____ (2) _____
5E. What application software release levels (SRLs) will be installed for use with this VSM solution configuration? Requirements: For back-end FICON (1) VTCS. (2) NCS 6.1 or higher (includes HSC 6.1).	5E. (1) _____ (2) _____
5F. What patches, if any, are needed for host and application software to run properly with this VSM solution configuration? Key: (1) = VTCS. (2) = NCS. (3) = MVS. (4) = OS390.	5F. (1) _____ (2) _____ (3) _____ (4) _____
Remote Support Factors	Information To Note / Comments
5G. What components will the customer provide to enable remote event notification functionality for this VSM solution?	5G.
5H. What components will Sun Microsystems provide to enable remote event notification functionality for this VSM solution?	5H.
5I. What cable types and lengths are needed to attach a modem, SDP device, or other remote monitoring components to the VTSS cabinet(s)?	5I.
Additional Information to Note / Comments (Specify By Above Item Number):	

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Software Information

> [electronic form] <

Account _____

Use this electronic form to record key information (product names, versions, release levels, serial numbers, etc.) for all software¹ used with this VSM solution configuration, as a quick reference when reporting problems, validating service entitlements, etc.

1. Including: VSM application software (VTCS, NCS, HSC), library software (ACSLs, Library Station), and MVS host system software.

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Hardware Information – Tape Devices

> [electronic form] <

Account _____

Use this electronic form to record key information (product names, model numbers, serial numbers, etc.) for all tape device hardware¹ used with this VSM solution configuration, as a quick reference when reporting problems, validating service entitlements, etc.



NOTE:

To ensure accurate notations, identify tape devices by product name and type (e.g., 9940B tape drive, SL8500 tape library, etc.) and by the unique designation used for the device within the VSM solution configuration (Tape Drive 1, Tape Library 1, etc.).

1. May include: T9840B-C, T9940B, and T10000 tape drives; Timberline 9490 and 9490-M44 cartridge subsystems; SL8500, Nearline 4410, PowderHorn 9310, WolfCreek 9360, and Timberwolf 9740 tape libraries.

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Hardware Information – Switches / Routers

> [electronic form] <

Account _____

Use this electronic form to record key information (product names, model numbers, serial numbers, etc.) for all external switches, routers, or other hardware used with this VSM solution configuration, as a quick reference when reporting problems, validating service entitlements, etc.

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Hardware Information – SDP and Modem Devices

> [electronic form] <

Account _____

Use this electronic form to record key information (product names, model numbers, serial numbers, etc.) for all Service Delivery Platform (SDP) and remote service modem hardware used with this VSM solution configuration, as a quick reference when reporting problems, validating service entitlements, etc.

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Notes / Additional Information

> [electronic form] <

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Notes / Additional Information

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