StorageTek TIMBERWOLF™ 9740 Tape Library

General Information Manual

MT4002

September 2006

Revision D

TimberWolf 9740 Tape Library

General Information Manual

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Summary of Changes

This manual has model numbers 9740-03C and 9740-05C, and feature codes 2012, 2017 and 2018 removed. Refer to the systems assurance guide for the latest ordering numbers.

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Contents

Figures

Tables

About This Manual

This manual describes StorageTek's TimberWolf 9740 Library Storage Module (LSM). It includes:

- The advantages of automating tape backup and tape storage.
- The functions, features, and options of theStorageTek's TimberWolf 9740 LSM.
- The architectural concepts and terminology that are helpful when using the StorageTek's TimberWolf 9740 LSM.
- The various ways that the StorageTek's TimberWolf 9740 LSM will work with your computer environment. This includes the compatibility characteristics, software support, and interfaces of the 9740 LSM.

The StorageTek's TimberWolf 9740 Library Storage Module is also referred to as 9740, 9740 LSM, and 9740 library throughout this manual.

Intended Audience

This manual presents information for those involved in the planning and purchasing of a tape automation device. This could include MIS managers, storage administrators, system programmers, hardware support personnel, and performance specialists.

How This Manual is Organized

This manual contains the following chapters:

Chapter 1 **StorageTek's TimberWolf 9740 Solution** Introduces StorageTek's TimberWolf 9740 Automated Cartridge System.

Chapter 2 **Product Description** Describes StorageTek's TimberWolf 9740 TimberWolf library storage components and features.

Chapter 3 **System Architecture** Outlines the various connection configurations for StorageTek's TimberWolf 9740.

Chapter 4 **The Client/Server Environment** Describes StorageTek's single and multiple StorageTek's TimberWolf 9740 Library Storage Modules (LSMs) available in the client/server environment.

Chapter 5 **The Enterprise Environment** Describes StorageTek's single and multiple TimberWolf 9740 LSMs available in the enterprise environment.

Appendix A **Operation and Specifications** Describes StorageTek's TimberWolf 9740 communication interfaces, performance capabilities, and machine specifications.

Glossary Provides definitions for terms related to StorageTek's TimberWolf 9740 that may or may not be found in this manual.

■ Publication Information

Related Publications

The following list contains the names and part numbers of StorageTek manuals that provide additional information about the StorageTek's TimberWolf 9740 Automated Cartridge System, 9840, DLT, TimberLine and RedWood drives.

To order any document in the following list, contact StorageTek Software Manufacturing and Distribution Phone System at ☎ 1-800-436-5554. You will be prompted to respond to menu choices. Or, send a fax to ☎ 1-303-661-7367.

- ✦ *How to Request Help or Software Enhancements*

TimberWolf 9740 Library Storage Module Publications	*Part Number*
TimberWolf 9740 Hardware Operator's Guide	*95693*
TimberWolf 9740 Systems Assurance Guide	MT 5001

Note: Refer to http://www.storagetek.com/StorageTek/doc/software for a full list of ACSLS and HSC documentation references.

Other Documentation	*Part Number*
Small System Computer Interface	ISO 9316:1989

TimberLine 9490 Documentation	*Part Number*
TimberLine 9490 Operator's Guide	310710201
TimberLine 9490 System Assurance Guide	ML0041

9840 Documentation	*Part Number*
User's Reference Manual	95739
General Information Manual	MT 4004
Planning and Migration Guide	MT 6004
System Assurance Guide	MT 5003

RedWood SD-3 Documentation	*Part Number*
RedWood SD-3 General Information Manual	ML0515
RedWood SD-3 Operator's Guide	310507601
RedWood SD-3 Planning and Migration Guide	ML0526
RedWood SD-3 System Assurance Guide	ML0527

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Production Information

Document number is MT 4002 C. It contains 88 pages plus front cover and back cover.

Printed and bound by Storage Technology Corporation.

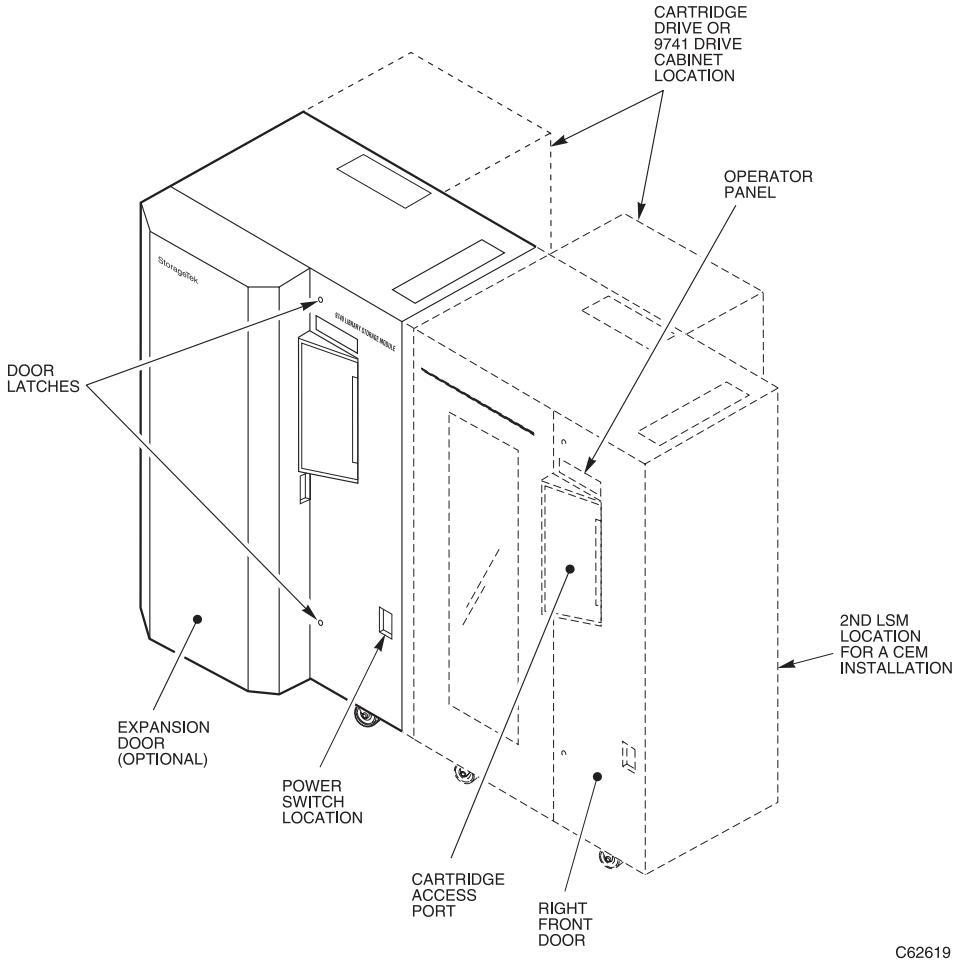
StorageTek's TimberWolf 9740 Solution

1

The StorageTek's TimberWolf 9740 Library Storage Module (LSM) is part of the Nearline family of automated cartridge systems, featuring the proven technology of the Powderhorn 9310 and the TimberWolf 9710.

As a solution for mid-range client/server and enterprise mainframe users, the TimberWolf 9740 offers an exceptional combination of high performance and high-capacity storage — nearly 25 TB uncompressed — in a small footprint cabinet. Up to six of the TimberWolf LSMs can be connected to form an ACS that can have a capacity of nearly 150 TB uncompressed. See Figure 1-1.

Figure 1-1. StorageTek's 9740 Library Storage Module (LSM)



StorageTek's Automation Strategy

Automation enables you to implement storage management 24 hours a day, seven days a week, by reliably controlling information with a system requiring little human intervention. Automated storage management keeps track of backup data sets so that the information manager does not have to. Less dependency on operators results in fewer errors — and your resources can be directed to more important tasks.

StorageTek delivers integrated solutions — products and services that take the guesswork out of complex system integration.

StorageTek's 9740 Library Storage Module resolves problems facing the midrange market. It provides businesses with a quality automated storage system yielding high performance that is cost effective and flexible in changing environments.

9740 Advantages

In summary, the 9740 is an integrated and complete solution that provides:

- Fully automated storage management.
- Reliable backup and recovery, storage and retrieval of vital company information.
- Connectivity for multiple platforms using proven technology that delivers exceptional performance.
- Investment protection and flexible configurations which meet the customer's needs of today and the challenges of tomorrow.

Together these elements offer benefits for growing organizations seeking to improve their ability to store greater amounts of information while ensuring consistent and reliable retrieval in a cost effective manner. Data is delivered

quickly and accurately to provide your company the advantage in today's competitive marketplace.

Proven Technology

The 9740 is ideal for customers seeking a quality storage device. It is designed from proven library technology with many critical components — the vision system, hand, and cell arrays — robotics adopted from the successful WolfCreek 9360.

Reliability

The simple design of the 9740 yields exceptional reliability. High-quality components and half the parts of existing libraries provides the highest reliability our library products offer to date. The simple design also contributes to quick installation time.

Investment Protection

StorageTek's TimberWolf 9740 also provides investment protection because it offers a growth path in capacity. Configuration flexibility enables you to order a unit with either a 326-cartridge or 494-cartridge capacity. The 326-cartridge unit is expandable to the larger 494-cartridge capacity unit. Up to six 9740 LSMs can be connected on one ACS through the cartridge exchange mechanism (CEM) for a maximum capacity of 2,964 cartridges.

As a result, re-investment in another storage system can be postponed. The feature that expands the cartridge capacity to 494 adds only 10 inches to the front of the LSM. The 9740 provides a compact storage solution, taking up a small floor space, which saves company resources.

Flexibility

The 9740 provides superior flexibility for future storage growth by offering more configurations without attaching additional hardware to the system.

Tape drive choices for the 9740 include:

- One to 10 9840 drives
- One to 10 Quantum Digital Linear Tape (DLT) drives

- One to 10 9840 drives and/or DLT drives
- Two or four TimberLine 9490 drives
- One to four RedWood SD-3 drives
- One to four TimberLine 9490 and/or RedWood SD-3 drives (in a RedWood frame).

Client/Server Connectivity

The 9740 offers numerous connectivity options to meet the customer's needs. It attaches to the host using StorageTek's UNIX-based Automated Cartridges System Library Software (ACSLS) or SCSI-2, enabling connectivity to devices from several vendors. Because the StorageTek's TimberWolf 9740 supports new or expanded configurations as your business needs shift, it is truly a long-term storage investment.

Enterprise Host Connectivity

The 9740 attaches to the enterprise mainframe host using up to four independent links per 9740 LSM (16 maximum 3270 links per 9740 ACS). StorageTek's Host Software Component (HSC) provides the robotic control, maintains records of the cartridges stored within the ACS in a control data set, and interfaces between the operating system and the ACS.

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Product Description

2

In the client/server and enterprise environments, the TimberWolf 9740 can be configured in both single and multiple Library Storage Modules.

■ Library Storage Components

The library storage components consist of the storage cells, cartridge access port (CAP), access door, and an advanced rotational robotics.

The robot retrieves specific tape cartridges from the LSM storage cells, and performs tape mounts and dismounts automatically. This eliminates a function that used to be done exclusively by humans, checking console mount messages, walking to a tape library full of tapes, and mounting the tape by hand.

When the read and write operations are complete, the robot dismounts the cartridge and puts into a storage cell in the LSM. Again, there is no need for human intervention in the procedure. See Figure 2-1.

Capacity

StorageTek's TimberWolf 9740 is available with either 326- or 494-cartridge capacities.

The LSM ships with two serial (RS232) interface connections, associated hardware, internal input/output cables, and a 14-cartridge access port.

Dedicated cleaning cartridge slots are provided for each type of tape cartridge the 9740 LSM accepts.

Features–Standard

Cartridge Locations

The 9740 is designed with three cell arrays. Each cell can contain a 1/2" cartridge. To prevent cartridges from dislodging, cartridge storage cells are tilted 10 degrees from horizontal.

The cell arrays are arranged in 10- to 14-cell columns, and the columns are arranged in a circle around the robot. Two of the panels contain 12 arrays each; the third contains the remainder of the cartridges and has space allocated for one to 10 cartridge tape subsystems.

The 9740 entry level basic configuration contains slots for 326 cartridges. The 9740 larger configuration adds another 168 cartridge slots in twelve 14-cartridge cell arrays.

Proprietary Vision System

StorageTek developed a high-resolution vision system that performs more accurately than bar code readers that are little more than grocery store scanners. the vision system uses targets for calibrating the position and identity of a cartridge within the cartridge cell arrays.

Cartridge Access Port (CAP)

The StorageTek 9740 LSM features a cartridge access port that facilitates large batch jobs, such as payroll. The CAP makes exchanges quick and easy — with a capacity of 14 cartridges — without interrupting operations.

Robot

The robot is a specially designed mechanism that operates speedily and reliably. Controlled by the library control software, it accurately picks up, moves, and delivers cartridges. A command to mount a tape activates the 9740 robot. The robot's hand-camera assembly extracts a cartridge from or inserts a cartridge into a designated cartridge storage cell, CAP, or cartridge tape unit. While the robot's fingers grasp the cartridge and hold it, even if a power failure occurs, the robot delivers the cartridge to the designated location.

The robot moves directly to the exact location of the requested cartridge. The robot uses a calibration system that eliminates the need for precise alignment of the arm mechanism and it corrects changes in physical dimensions relative to the library over time. See Figure 2-1.

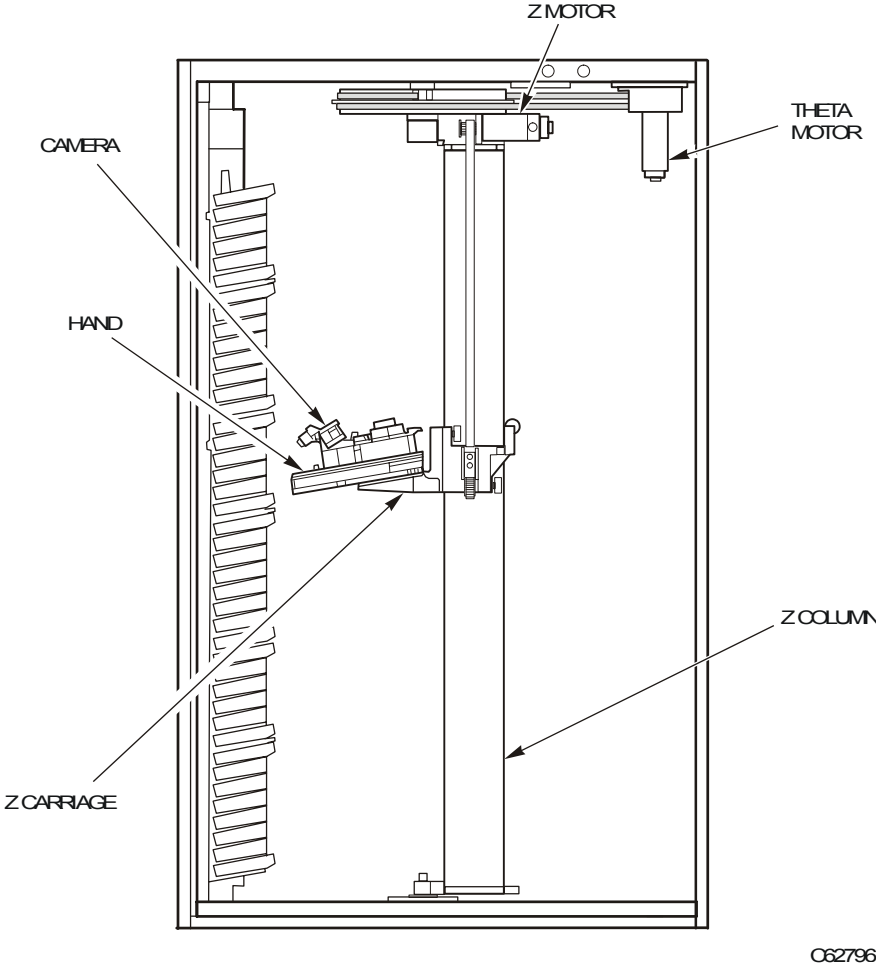
Robotics Interface (Control Path)

Each 9740 LSM contains two serial RS-232 and RS-423 ports over which robotic commands may be sent to direct the robot to select a certain cartridge from its storage location and place it into a particular tape drive, or the reverse.

Hand-Camera Assembly

The hand-camera assembly uses a proprietary vision system to read bar code labels on the cartridges and to calibrate out any mechanical variation of the system. The robot calibrates by looking at the target marks at specific positions in the library. Once the master target is verified, this position is locked into memory. This process occurs only when the 9740 is powered off, a cartridge is entered into the 9740, or when the 9740 has been initialized. From this point on, the robot uses the master target to locate cartridges.

Figure 2-1. 9740 Robot Hand-Camera Assembly)



Features–Selectable

All of the following selectable items are packed separately from the base library and must be installed and configured.

Drive Mounting

The library can be attached to StorageTek's 9840 drives and/or Quantum's DLT drives in a 9741 drive cabinet, StorageTek's TimberLine 9490 drives, and/or StorageTek's RedWood SD-3 drives.

9840 and DLT Drive Mounting Hardware:

The 9741 frame can house between one and ten 9840 drives, one and ten DLT drives, or a combination of both.

TimberLine Drive Mounting Hardware:

Several TimberLine drive mounting hardware feature selections are available. The feature you select depends on the quantity of TimberLine drives that will be installed in the 9740 library. Each kit contains slides, drive mounting tray, hardware to affix the drive to the tray, and a drive power cord.

RedWood Drive Mounting Hardware:

Just as with the other drives, the RedWood drive mounting hardware feature selection provides several options. The feature you select depends on the quantity of RedWood tape subsystems which will be installed in the 9740 library. Each kit contains one RedWood tape drive, slides, drive mounting tray, drive actuator mechanism, drive chassis, power supply for the RedWood, cooling, hardware to affix the drive to the tray, and a drive power cord.

Cartridge Exchange Mechanism (CEM)

The cartridge exchange mechanism (CEM) enables a mount request to be accomplished even though all CTUs or drives in the source LSM are busy. You can couple up to six LSMs in a single automated cartridge system.

The CEM is entirely gravity driven; cells in adjacent LSMs are connected with the CEM components.

There must be at least one drive attached to each LSM on an ACS.

Access Door

The access door provides a means of entry into the library for maintenance for both the 9740 326-cartridge model, and the 9740 494-cartridge model. A key lock controls door access to secure your data. It also provides access to the cartridge tape units in the unlikely event of a robot failure.

The 326-cartridge model contains a "flat" door with a window for observing the robotic movements; the 494-cartridge model does not have a window, but contains 168 additional cartridge slots.

SCSI

Communication to the robotics is available over a SCSI for a single LSM, in single host client/server environments only. To take advantage of this feature, you must order a card and hardware kit. The card is capable of both single ended and differential alternatives. The configuration of the card, when shipped, is set for differential, and must be reconfigured for single ended. Both single ended and differential terminators are supplied in the kit.

❖ **Note:**
Installation of the SCSI disables the serial interface.

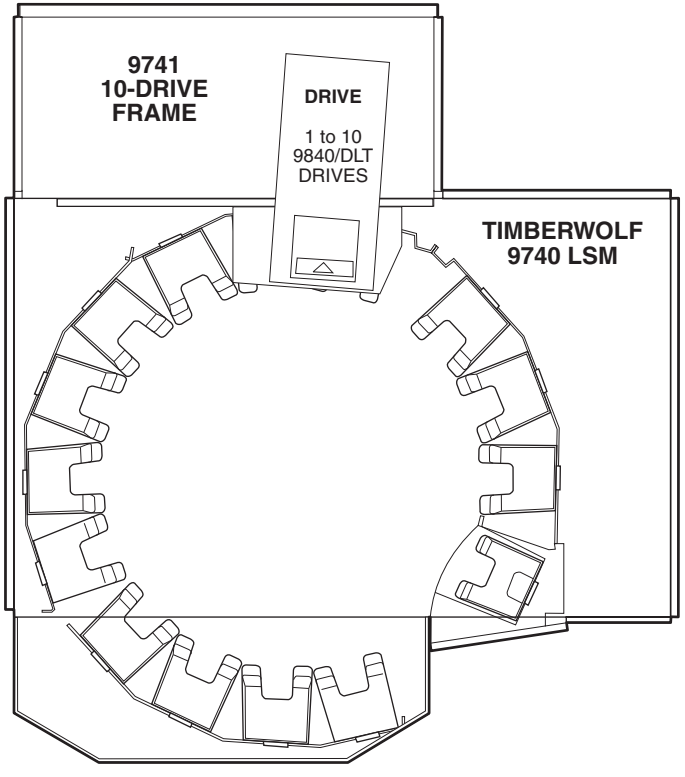
CEM/3270 Host Interface (PRI Card)

The PRI card is a serial or 3270 host interface that enables communication between from two to six LSMs and provides the serial control path interface to the host. The PRI card is required in LSMs that are configured with (CEM) and for any LSM used in an enterprise mainframe environment.

Power Cables

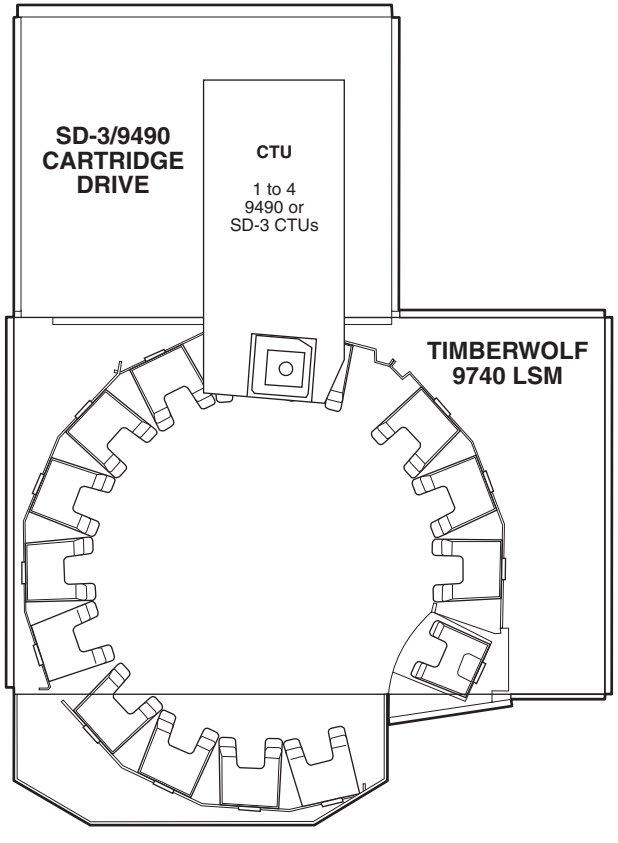
Two power cords are available to power the 9740 and six additional drives, one for domestic and one for international AC power sources. The following figure displays the library storage components for the 9740 494-cartridge model in the client/server environment.

Figure 2-2. TimberWolf 9740 in Client/Server Environment (top view)



The following figure displays the library storage components for the 9740 494-cartridge model in the enterprise environment.

Figure 2-3. TimberWolf 9740 in Enterprise Environment (top view)



■ Drive Configurations

Table 2-1 describes the flexibility available with the various drive 9740 LSM drive configurations.

Table 2-1. Drive Configurations

Environment	Client/Server				Enterprise Mainframe			
Drive Attributes	9840	DLT		Mixed 9840/ DLT	TimberLine 9490		Red-Wood SD-3	Mixed Timber-Line/ Red-Wood
		4000	7000		M32	M34	SD-3 H31-H34	SD-3 M11, M12, M13, M21, M22, M31
Drive Frame	9741				M32	M34	SD-3	
Number of drives to connect	1-10	1-10	1-10	1-10	2	4	1-4	1 9490, 1 SD-3 1 9490, 2 SD-3 1 9490, 3 SD-3 2 9490, 2 SD-3 3 9490, 1 SD-3
Cartridge Capacity (uncompressed)	20 GB	20 GB	35 GB	N/A	200 MB, 400 MB, 800 MB, or 1.6 GB		10, 25, 50 GB (cart-ridge)	N/A
Transfer Speed in MB/sec (uncompressed)	10	1.5	5.2	N/A	6		11.25	N/A
Capacity (TB) per 9740 LSM (494 cartridges, uncompressed)	9.88	9.88	17.29	N/A	.79	.79	24.7	N/A

Table 2-1. Drive Configurations (Continued)

Environment	Client/Server				Enterprise Mainframe			
Capacity (TB) per ACS (six 9740 LSMs, 2,964 cartridges, uncompressed)	59.28	59.28	103.74	N/A	4.74	4.74	148.2	N/A

Note: The 9840 drive does not support Term Power. It must be supplied from the Host Bus Adapter Card. Also, 9740 libraries with 9840 drives must have the minimum firmware level of 1.9.52 (P/N 308389604) installed to properly support the drives.

9840 Drives

With the advent of the 9840 Tape Drive, StorageTek maintains its leadership position in tape drive technology. The 9840 is the first tape product specifically designed to span the enterprise, from mainframe environments to a wide variety of client/server environments. Coupled with StorageTek's family of automated cartridge systems, the 9840 enables high-performance automation in the mainframe environment and introduces it to the client/server environment.

This high-performance tape drive system enables a new class of "random" retrieval, recall, and high-capacity applications. The 9840 embodies the next generation of high-end tape drives by combining high storage capacity, dense data compression, and fast data access in a small package. When matched with the right applications, this combination of features enhances Nearline solutions and adds more value to the industry's leader of information storage.

Table 2-2. 9840 Features and Benefits

Features	*Benefits*
Mainframe-class R.A.S.	Ensures 24 x 7 operation
Common cartridge form factor	Compatible with Nearline libraries
Compatible with Nearline libraries	Co-exists with other Nearline drives
Physically small	More workload capacity per LSM
Midpoint Load	Improves search/data access
1 x 1 architecture	Enhances information throughput
10 MB/sec. sustained throughput	Saves processing time
15.5 sec. to load, initialize, and search	Fast access to first byte of data
20 GB native cartridge capacity	Consolidation for high-capacity applications
Lempel-Ziv (LZ-1) data compression (4:1)	Increases cartridge capacity

❖ **Note:**
For more information about the 9840 drive, please see the *9840 General Information Manual,* MT 4004.

Quantum Digital Linear Tape (DLT) Drives

The Quantum DLT drive is a 5 1/4-in. form-factor, half-inch, magnetic cartridge tape drive that uses data streaming as well as data compression and compaction. The design includes a dual-channel (with the DLT4000) or a quad-channel (with the DLT7000) read/write head, (LZ-1) data compression, and tape mark directory to maximize data throughput and minimize data access time.

Quantum DLT7000 1/2-inch cartridge tape drives feature a native transfer rate of more than 5 MB per second, with a native capacity of 35 GB.

The DLT4000 tape drives offer a combination of 20 GB native per cartridge and a native transfer rate of 1.5 MB per second.

The 9741 drive cabinet can hold from one to 10 DLT drives. Each DLT drive consists of a separate controller and tape drive that does not affect operations of other DLT drives in the frame.

Table 2-3 lists the specifications of the DLT drive.

Table 2-3. DLT Specifications

	DLT4000	*DLT7000*
Number of tracks	128, 64 pairs	208, 52 quads
Cartridge tape	DLT Tape III, IIIxt, IV	DLT Tape III, IIIxt, IV
Tape speed	2.8 m (110 in.) per second (read/write) 3.8 m (150 in.) per second (search/rewind)	4.1 m (160 in.) per second (read/write) 4.4 m (175 in.) per second (search/rewind)
Data capacity (per cartridge tape)	20 GB (DLT Tape III, formatted native) 40 GB (DLT Tape IV, 2:1 compression)	35 GB (DLT Tape III, formatted native) 70 GB (DLT Tape IV, 2:1 compression)
Transfer rate	1.5 MB/sec (user native) More than 3.0 MB/sec (user compressed, write)	5.2 MB/sec (user native) Up to 10 MB/sec (user compressed)

Table 2-3. DLT Specifications

	DLT4000	*DLT7000*
Buffer size	2 MB	8 MB
Read/Write speed	98 in./sec	160 in./sec
Rewind Speed	150 in./sec	175 in./sec
Search speed	150 in./sec	175 in./sec
Rewind Time	70 to 140 sec	60 to 120 sec
SCSI interface	8-bit SCSI-2, single ended or differential alternative	16-bit SCSI-2, fast/wide bus, single-ended or differential alternative

❖ **Note:**
For more information about the 9840 Drives, TimberLine 9490 drives, and RedWood SD-3 drives, see "Publication Information" on page -15 for references to product manuals.

StorageTek's TimberLine 9490 Cartridge Subsystem

StorageTek's TimberLine 9490 Tape Cartridge Subsystem is the first and only tape subsystem that combines ultra-high performance tape drive technologies with an industry-unique, totally parallel 1-by-1 controller drive architecture that enables simultaneous read or write with *all* controller transport units (CTUs).

With the 9490, you get faster "mechanicals" including load time, search and rewind time and faster data transfer times. This reduces elapsed processing times for all traditional storage applications such as batch processing, disk dumps and database (log tape) recovery.

TimberLine's new KeepSafe transport helps you exploit the cost-effective benefits of using different lengths of tape. In fact, TimberLine automatically recalibrates to the sensitivities of either standard thickness "short" media, enhanced capacity cartridge tape (ETape) thin media, or extended enhanced (EETape) ensuring re-use durability and long archival life.

TimberLine improves recovery times for both IMS and DB3 database log tapes because read-backwards performance in either 18- or 36-track mode is vastly superior to that of traditional drives. For small to medium-sized blocks, TimberLine internally decompresses the data and transfers it *backwards*. This reduces processing time because you don't have to invoke host error recovery.

The 9490 is the first and only tape drive to fully exploit 17 MB/sec native ESCON fiber-optic technology. In fact, with ESCON connectivity, TimberLine's individual control units are more than twice as fast as other traditional tape drive architecture. It also fully supports the older 10MB/sec. ESCON channel as well as the 20MB/sec SCSI-2 fast and wide channel.

StorageTek's RedWood SD-3 Helical Cartridge Subsystem

StorageTek's RedWood's high performance is based on TimberLine's remarkable totally parallel 1-by-1 architecture. By combining this revolutionary architecture with an ultra-high capacity storage platform, RedWood SD-3 shatters tape storage tradition by delivering the new standard in cartridge tape subsystem innovation and leadership.

RedWood SD-3 provides an exponential increase in per-cartridge capacity while simultaneously shrinking unit storage costs to a fraction of what you pay per megabyte using traditional storage solutions. Redwood also offers the first capacity/performance-based storage strategy that creates revolutionary new archive and random-access application opportunities across your business enterprise.

RedWood also employs KeepSafe and VolSafe technology. VolSafe is a patented architectural innovation exclusive with RedWood, defines a mode that the tape media

to be written once — and only once. This enables RedWood to emulate a write once read many (WORM) device.

The RedWood combines improved durability of the standard 1/2-inch wide tape cartridge and offers levels of storage density/capacity never before attained from tape.

The RedWood features 83.88 mm/sec read/write capability and 39.0 sec for 10GB capacity, 56.0/sec (25GB) and 89.0/sec (50GB) capacity maximum rewind. The loading process to the beginning of the tape is 17 seconds. Average search time (to midpoint) is 21.0 sec (10GB), 33.0 sec (25GB) and 53.0 (50 GB).

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System Architecture

3

Total System Architecture

One to six StorageTek TimberWolf 9740 LSMs comprise an ACS that backs up, restores, and archives data. The library functions as a warehouse of cartridges, and the tape drives, whether StorageTek's 9840 and/or Quantum's DLT, StorageTek's TimberLine 9490, or StorageTek's RedWood SD-3, attach to the 9740 LSM to provide storage and retrieval.

Connectivity Methods

As indicated in Chapter 1, "StorageTek's TimberWolf 9740 Solution," there are several interface options to integrate the 9740 into your environment. Whether you have a single host, multiple hosts, or a network of various platforms, the 9740 has an option to create the connection.

Separate Control and Data Paths

The 9740, like all StorageTek libraries, offers separate control and data paths. This enables multiple hosts to *share* control, while retaining the performance benefits of individual data paths.

- The control path processes hardware allocation and selection requests. The control path consists of the host CPU, an interface card and cable, and the controller. It provides communication between the central

processing unit (CPU) and the library controller.

- The data path transfers data between the CPU and cartridge tape units. The data path consists of the host CPU, the cartridge tape I/O driver (CTIOD), an interface cable, and the cartridge tape units.

High Performance Hardware Components

- 9740 hardware components include the storage cells, cartridge access port (CAP), access door, and robot tape handler. The CAP enables multiple cartridges to be entered into or ejected from the library without stopping the robot.
- The library accepts one to 10 9840 drives, one to 10 DLT drives, one to 10 DLT and/or 9840 combinations; or two to four TimberLine 36-track controller transport units (CTUs), one to four RedWood helical scan drives, or one to four TimberLine and RedWood drives.

Operation Components

The 9740 LSM operates using a combination of human and machine interfaces. The human interface involves an interface panel located on the front of the unit. The machine interfaces involve an operating system communications software, tape management system, and robotics control software.

Interface Panel

The interface panel, located on the front cover of the 9740 LSM, allows system operators to obtain LSM status, configuration, diagnostic sequences, and error information.

Operating System

It is important to ensure that the specific version of host operating system that you have is one supported by the StorageTek's 9740 TimberWolf LSM at the time of installation. Your customer services engineer will help you determine the appropriate operating system.

Communications Software

Communications software is required on both "sides" of your configuration — your clients (hosts) and either the library's controller or the server. Communications software is often part of the host's operating system, but other times must be purchased and installed as a separate license.

In a direct attached environment, microcode for RS-232 or RS-423 serial connection is normally imbedded in the operating system of the CPU. When using SCSI, you may need additional drivers. You do not need additional software for the 9740 side, as both serial and SCSI are included in the controller's microcode.

In a server attached environment, communications software is required to facilitate conversation between the host CPUs and the server. This software must be resident on both the server and the clients. Client/server environments may require the purchase of TCP/IP for the clients but is automatically included with the Sun SPARC server when it is purchased from StorageTek.

Tape Management Software

Tape management software (TMS) provides numerous benefits and enables a seamless interface to the library for the customer. For instance, when a customer issues a command such as a "backup," the tape management software in the background sends a request to the library through the Client Services Component (CSC) to:

- Allocate a tape drive
- Mount the required tape
- Perform the job
- Dismount the tape
- Deallocate the device.

The TMS enables you to install a library without disrupting current operations. In addition, tape management software keeps track of what data

resides on what tape for each host using the library. This index or catalog feature is the foundation for accurate data retrieval — whether by an operator or by automated archive and recall programs.

StorageTek teams with many independent software vendors to provide integrated solutions for a variety of platforms. Your marketing representative can provide you with a list of currently supported providers.

Robotics Control Software

Robotics control software converts requests from various tape management software packages into standardized commands that the 9740 controller or the server understands.

This control software can be integrated into the tape management software or sold as a separate component.

The Client/Server Environment

4

Client/Server Configurations

StorageTek's TimberWolf 9740 LSM is designed for use in the client/server environment in several configurations. The stand-alone configuration gives you ultimate flexibility and portability; the multiple library configuration gives you extended storage and retrieval capacity in a compact footprint.

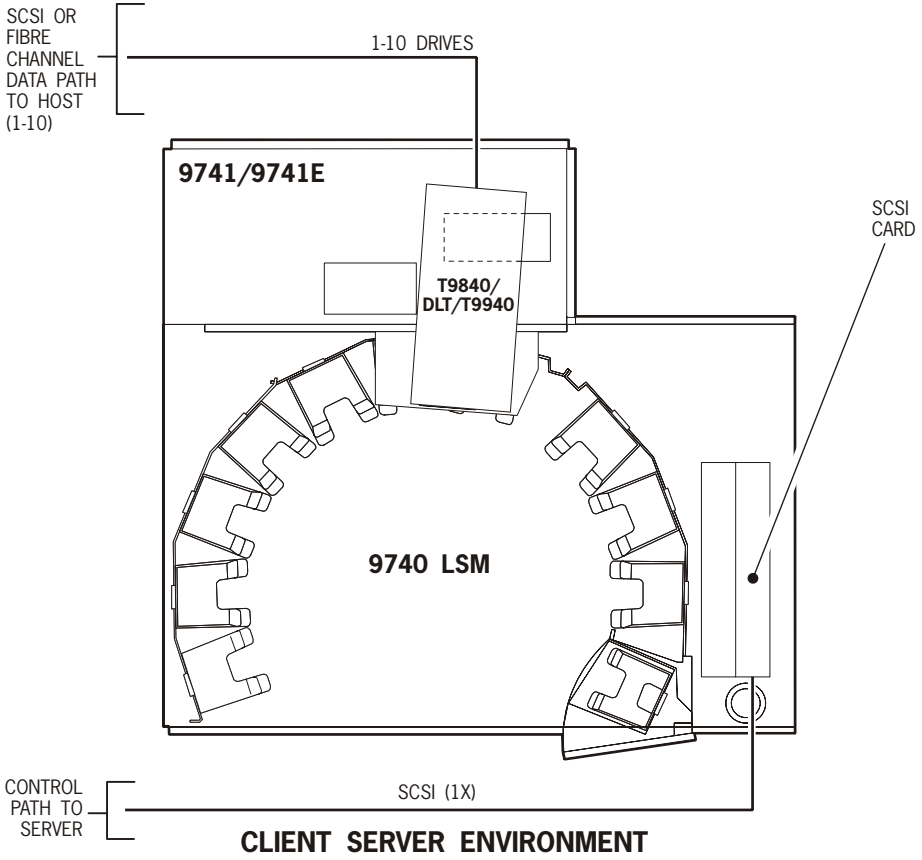
As a stand-alone machine with a SCSI-2 interface to the host, it is useful as a back-up and restore solution with a single type of tape device, with a capacity of between one and 326 cartridges or up to 494 cartridges. It then can be expanded into a multiple library configuration.

As a multiple library using Sun Server serial RS-232 connection and ACSLS, the TimberWolf 9740 transforms into a powerful Nearline product able to use any combination of 9840 and/or DLT drives in an array of up to six 9741 cabinets attached by CEMs. This configuration allows for a maximum storage capacity of 2,964 cartridges.

The Single LSM Configuration

The single LSM configuration contains a 9740 with a 9741 cabinet (see Figure 4-1).

Figure 4-1. Client/Server Environment ACS: One LSM



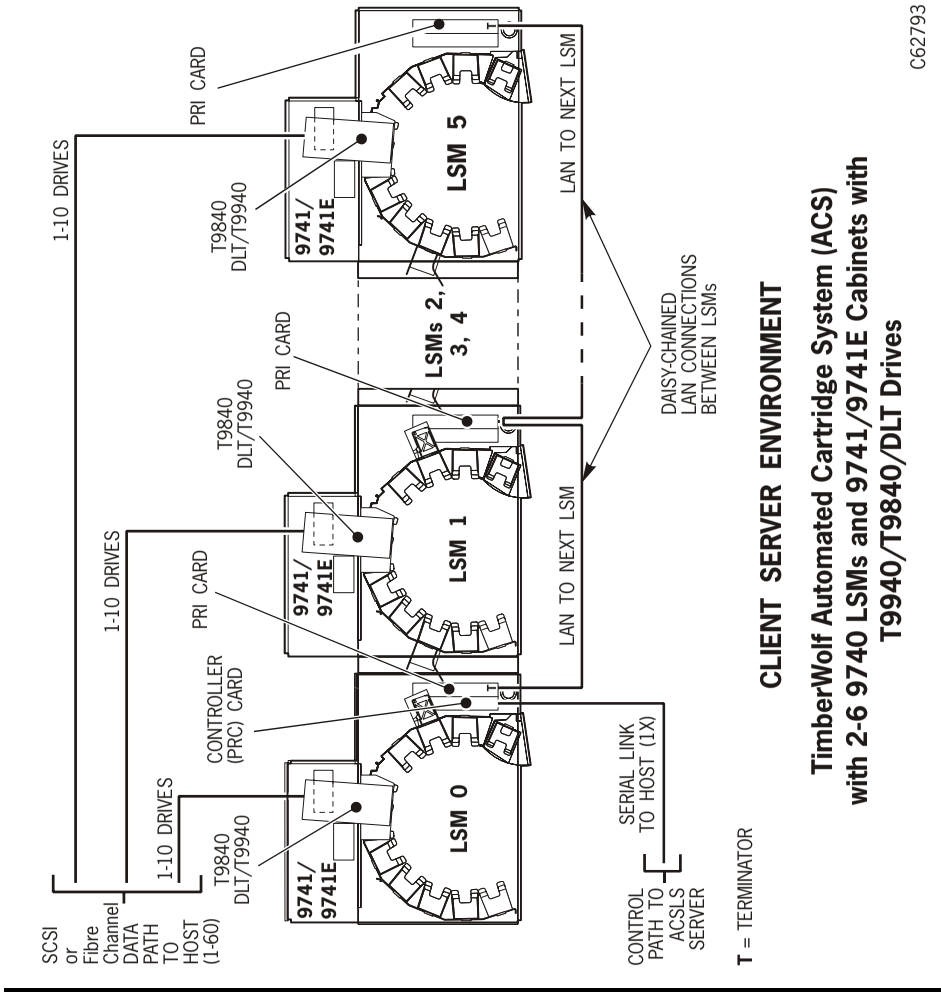
TimberWolf Automated Cartridge System (ACS) with one 9740 LSM and 9741/9741E Cabinet with T9940/T9840/DLT Drives

C62795

The Multiple LSM Configuration

The multiple LSM configuration becomes an ACS, and consists of between two and six 9740 LSMs with 9741 cabinets attached, connected via separate Cymes (see Figure 4-2).

Figure 4-2. Client/Server Environment ACS: Multiple LSMs



■ Client/Server Control Path

The control path in a client/server environment involve both hardware and software in an indirect attach relationship.

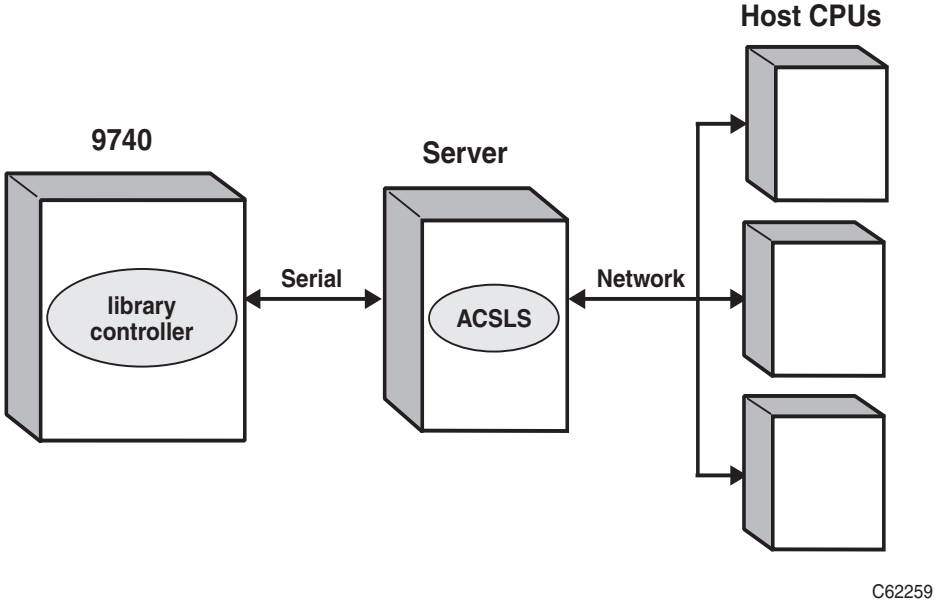
Control Path Hardware

Client/server platforms support the SCSI interface for the direct attach control path. When the customer has multiple homogeneous or heterogeneous hosts in a network configuration, the 9740 connects *indirectly* to the hosts via a UNIX-based server.

In an indirect control environment, Automated Cartridge System Library Software (ACSLS) enables multiple "clients" to use the library at the same time. The server can be a RISC/6000 or any AIX server running the AIX operating system, or a Sun SPARC running Solaris. Please contact your local marketing team to determine which server can be used with which platforms. Some hosts (clients) are limited to specifically using the Sun or the RISC/6000, others can use either.

The control path between the 9740 library controller, the server containing the ACSLS software, and the host CPUs, is shown in Figure 4-3.

Figure 4-3. Server Attach Control Path Connection



Control Path Software

The control path software manages communications with the 9740. It is responsible for monitoring and directing tape cartridges and processing administrative functions.

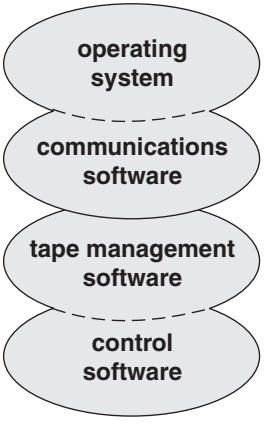
When the control path is a direct attachment, the software resides on the client host and the 9740 controller. When the control path is an indirect attachment, the software is divided between the server, the client hosts, and the library's controller.

Software components that control the library include the following elements:

- The host's operating system
- Communications software
- Tape management software (TMS)
- Robotics control software
- Client system component (server attach only)
- ACSLS (server attach only).

Figure 4-4 is a diagram showing the interaction between the several software components.

Figure 4-4. Software Components



Additional Server Attach Software Requirements

Client System Component (Server Attach Only)

In a server environment, software is required on each host to enable it to act as clients to the server. The client system component (CSC) is generally written by the host manufacturer — for example, Tandem writes the Tandem CSC, DEC writes its CSC, etc. The exception is with IBM processors.

In addition, a variety of other open systems' tape management products may provide the robotics control component for the RISC/6000. Check with your marketing representative for a current list of supported partners for all client/server platforms.

Automated Cartridge System Library Software (ACSLS)

ACSLS is required for any server attach connection. It runs on the server and enables multiple clients to share the library. This software acts as the director when multiple, simultaneous requests are made. It tracks which volumes belong to which host, handles security when one host attempts access to another host's tape volume, and maintains volumes as either "data" or "scratch." ACSLS is the robotics control software to provide library management.

Remember, even though ACSLS knows a tape is a "data" tape belonging to host X, it does *not* know what specific data is on that tape. The tape management software maintains that database.

Typical Control Path Requests

The following functions are examples of process requests which are made over the control path. The names may vary depending upon the type of software that is installed on the CPU. Although the names vary, the functions are similar. Remember, data actually transfers over the data path,

it is resource allocation and selection requests which utilize the control path.

- **Mount** - A mount request is used to move a cartridge from a storage cell or cartridge access port (CAP) and insert it into a specified cartridge tape unit.
- **Dismount** - A dismount request is used to remove a cartridge from a drive and return it to a storage cell or CAP.
- **Enter** - An enter request is used to add cartridges to the database. It is the process of moving cartridges from a CAP to an unoccupied storage cell.
- **Eject** - An eject request is used to move cartridges from their storage cells to a CAP.
- **Audit** - An audit request is the process of performing a physical inventory of one or more library cells. After the audit is complete, the database is updated to reflect all observed changes in cell storage within the scope of the audit selection. An audit request can also be used to repair a corrupted database. Following are the audit functions:
  - ✦ Display scratch pool content.
  - ✦ Display library content.

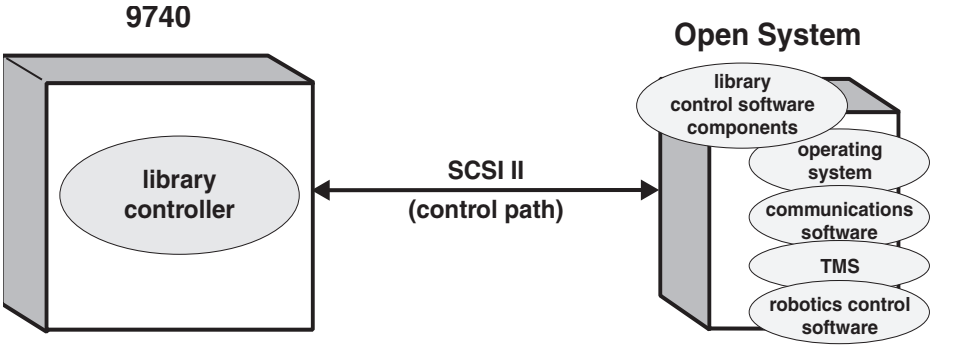
Control Path Connections

Let's take a look at how various hosts make their control path connections.

Single Host Direct Attach

Single hosts connect directly to the 9740 library. The operating system, communications software, tape management software, and the robotics control component all reside on the client CPU. See Figure 4-5.

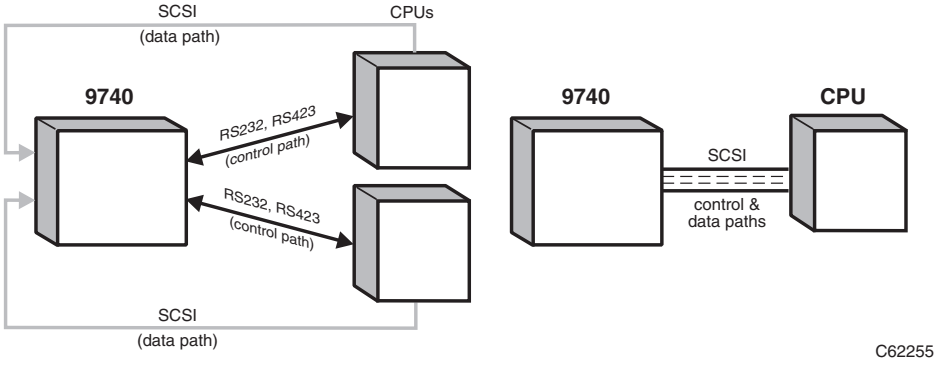
Figure 4-5. Single Host Connection for an Open System



Single or Dual Host Direct Attach

A direct attach configuration can be either SCSI or RS-232 or RS-423 for the control path. The 9740 has two separate RS-232 or RS-423 control paths allowing it to be managed by two separate hosts. Direct attach SCSI allows for only one host. See Figure 4-6.

Figure 4-6. Example of Single and Dual Host Connections



❖ **Note:**
When selecting SCSI as the control path, one SCSI interface can be used for both the control path and the data path connections. The paths remain logically separate, but they share the SCSI resource.

Multiple Hosts

There are two types of multiple host attachments – direct attach and server attach.

Multiple Host Server Attach

To connect the 9740 to multiple hosts attached to a network, a server with ACSLS software is required to interface between the hosts and the 9740.

Client/server systems connect via an Ethernet local area network to a Sun SPARC, RISC/6000, or any AIX server, and then through a SCSI II BUS to the LSM. The Ethernet protocol is TCP/IP.

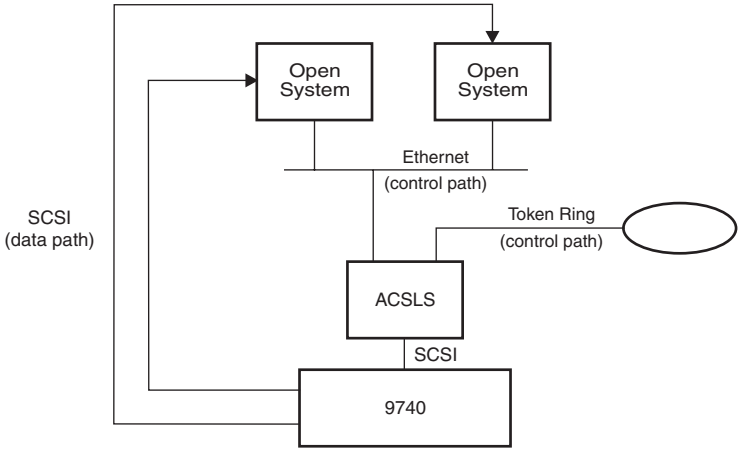
Some of the open system hosts that will be supported by the 9740 are NCR, DEC, Bull, UNISYS, Cray, RISC/6000, Hewlett-Packard (HP), SUN, and SGI.

As you have seen, the 9740 offers a multitude of connectivity options for the control path. This flexibility gives you the peace of mind knowing that whatever computing platforms you have today, whatever applications or platforms you require tomorrow, the 9740 will continue to meet the challenge.

Networked Heterogeneous Processors

The 9740 can support multiple heterogeneous processors when they are part of a network. This network would include a server running StorageTek's ACSLS solution. For client/server environments, the connections would be over Ethernet. Each processor would have a direct data path connection. See Figure 4-7.

Figure 4-7. Networked Heterogeneous Processors



Data Paths

The data path consists of the host CPU, the cartridge tape input/output (I/O) driver (CTIOD), an interface cable and the cartridge tape units. The data path is always a direct connection from the tape drives within the 9740 to the client CPU. Through this path, data is transferred to and from the hosts attached to the 9740.

Data Path Hardware

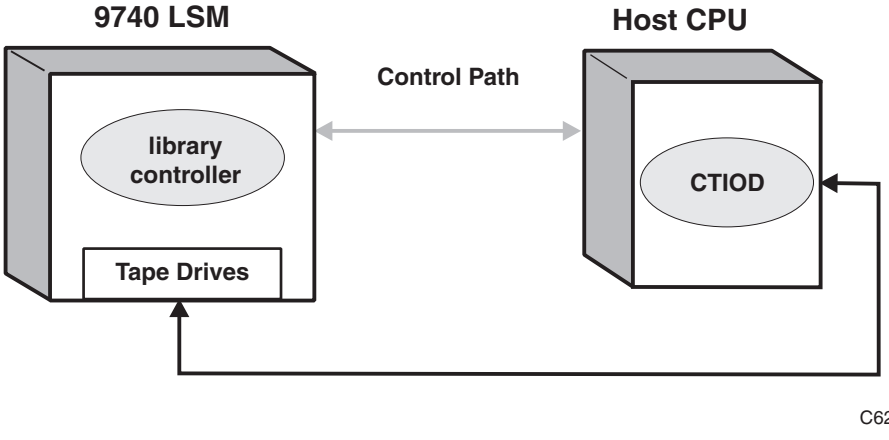
The tape drives attach to the client CPU and perform the actual read/write operations.

The data path for client/server configurations to the drives is created using SCSI II (small computer system interface) fast and wide (single-ended or differential). The 9840 drive also supports an ESCON data path.

Data Path Software

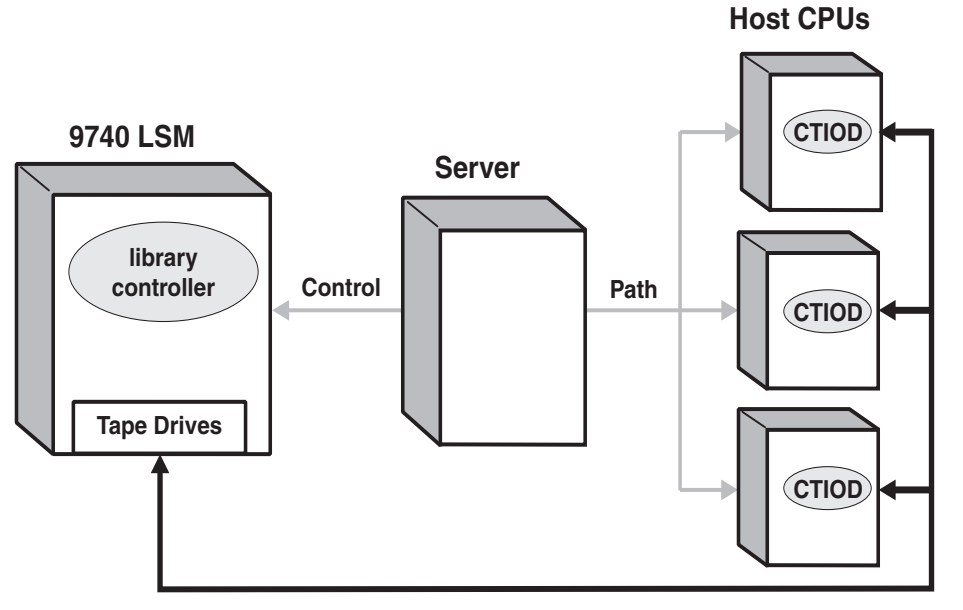
The CTIOD is software that resides on the client operating system. The software issues commands (read, write, and rewind) to the cartridge tape unit. Most cartridge tape I/O drivers are imbedded in the operating system of the host; however this is not always the case, and you may have to obtain additional licensed code. The CTIOD must be installed for a 36-track SCSI drive. See Figure 4-8 and Figure 4-9.

Figure 4-8. Example of the Client/Server SCSI Data Path Direct Connection



❖ **Note:**
There is a maximum number of 10 SCSI data paths.

Figure 4-9. Data Path with ACSLS Connection



The Enterprise Environment

5

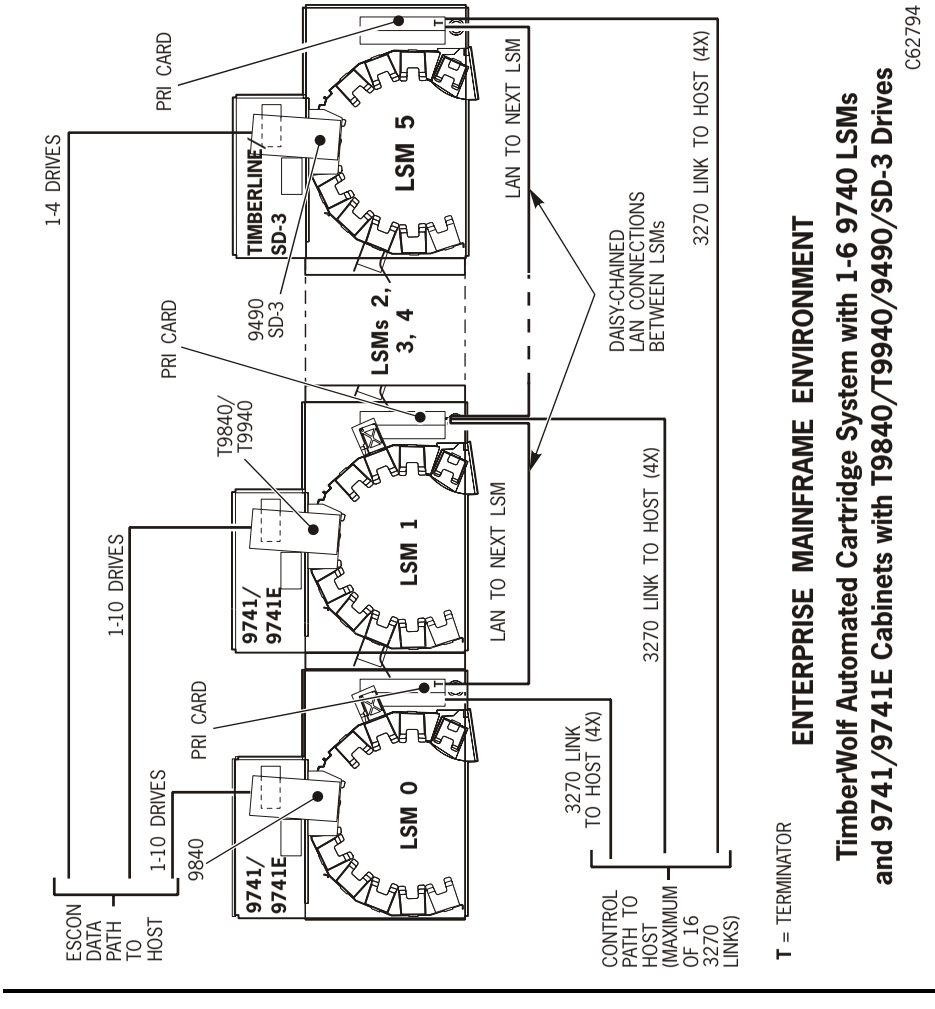
Enterprise Configurations

The StorageTek TimberWolf 9740 LSM is designed for use in the enterprise environment in stand-alone configuration or the multiple library configurations.

As a stand-alone machine with a serial interface to the host, it is useful as a back-up and restore solution with a single type of tape device, with a capacity of between one and 326 cartridges, or up to 494 cartridges. It then can be expanded into a multiple library configuration.

As a multiple library connected by CEMs, the 9740 allows for libraries containing 9741 cabinets with 9840 drives, and/or 9490 and/or SD-3 drives attached directly to the 9740 LSMs. Again, the 9740 LSM can be transformed into a powerful Nearline storage solution that allows for a maximum storage capacity of 2,964 cartridges. See Figure 5-1.

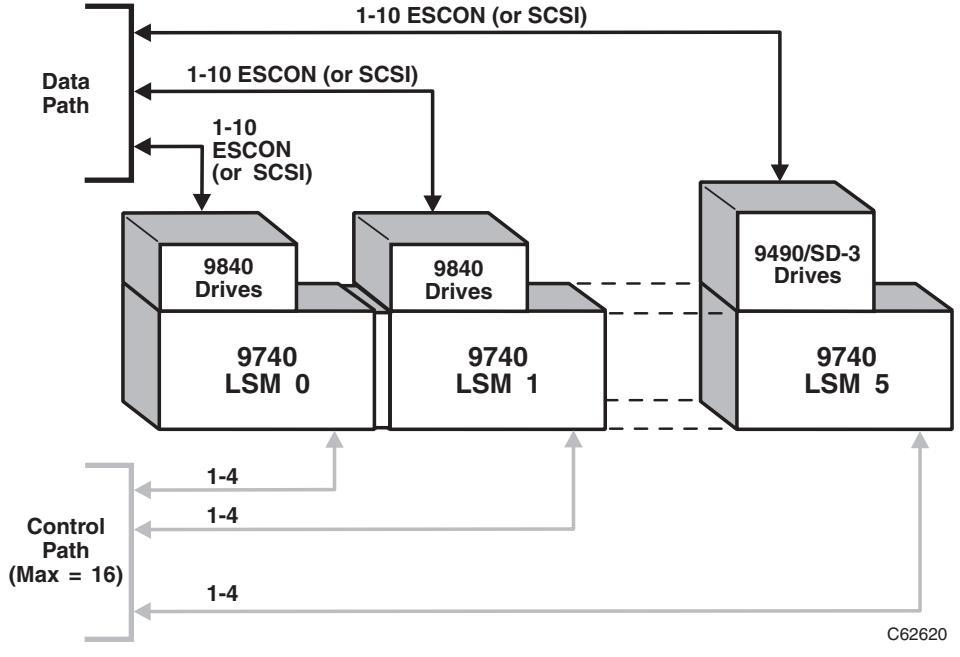
Figure 5-1. Enterprise Mainframe Environment ACS: One or More LSMs



■ Control and Data Paths

The control and data paths in an enterprise environment involve both hardware and software. See Figure 5-2.

Figure 5-2. Example of the Enterprise ESCON Control Path and Data Path Connection



The control path consists of one to sixteen 3270 links to the HSC host. The data path can be either ESCON or SCSI.

Host Software Component (HSC)

HSC is the overall manager of the library in a mainframe/enterprise environment. It is the interface between the MVS/SP operating system, and each ACS.

HSC also intercepts mount/dismount messages to determine if a required cartridge being called for in a mount message is listed in the control data set. HSC then influences MVS or JES3 to allocate a drive, either library or nonlibrary, to satisfy the mount, depending on the location of the cartridge.

HSC translates them into move requests. It then routes those move requests to the PRI, or controller, card.

One HSC utility identifies and locates all the scratch cartridges in the library by interfacing with the user's specific tape management software.

Operation and Specifications

A

■ Introduction

This chapter contains general information about 9740 operation, performance, and specifications.

■ Operation

Communications between the 9740 and the operator is supplied by two interfaces through an operator panel and a customer service engineer (CSE) port.

Operator Panel

An operator panel is used to communicate LSM status, configuration, diagnostic sequences, and error information. The operator panel is also used to enter or eject tape cartridges from the 9740. Error information supplies fault system codes (FSCs) to aid the customer services engineer in fault determination.

The operator panel has only a small number of switches and indicators which are simple and clear. An operator can learn how to use the 9740 operator panel quickly.

The operator panel consists of the following switches and indicators:

- IPL switch - boots the system, downloads the operating software from the floppy drive to the 9740 processor, and audits the contents of the LSM.
- MENU switch - calls up a menu of operator/customer service engineer (CSE) options.
- EXECUTE switch - after entering the correct console command, unlocks the CAP.
- LCD display - displays machine status, provides menu information, and prompts the operator to perform certain functions.
- PROCESSOR ACTIVE LED - indicates that the processor is active.
- INTERFACE ACTIVE LED - indicates that an input/output operation is being performed across a host interface.
- SERVICE REQUIRED LED - lights when the LSM requires service.

Remote Diagnostics Interface Port

The 9740 also has a interface port that makes diagnostic information constantly accessible to the customer services engineer. The remote diagnostics interface port can communicate LSM status, configuration, diagnostic sequences, and error information to a customer services engineer in a remote location. This enables the engineer to either resolve the problem remotely or to arrive on site informed and more prepared.

Exchanges Per Hour

The 9740 performs up to 350 exchanges per hour. The maximum performance rate is host system and drive dependent. An exchange is one cycle in which a cartridge is moved by the robot. In one cycle, a cartridge is retrieved from a cell and mounted in a drive and then dismounted from the drive and returned to a cell.

Installation Time

Installation time is estimated to be about two hours, depending upon the number of drives. Installation time excludes the time to relocate adjacent equipment, and to mount and cable the internal tape drives.

Reliability

The reliability rating is remarkably high. The mean time between failures (MTBF) for the 9740, excluding tape drives and external software, is 70,000 hours - the same reliability as StorageTek's mainframe-class libraries. This is based on 100 mounts per drive per day, an average of three drives per library, or 300 exchanges per day.

The mean time to repair (MTTR) the 9740 is 1/2 hour.

Field Upgrades

The 9740 has a flexible design, allowing it to be upgraded at the customer's location.

- CTUs can be added to the library to increase performance.
- Cartridge storage cell arrays can be added to increase capacity.
- Additional 9740 LSMs (up to six total) can be added to form an ACS with increased capacity.
- The system arrangement can be reconfigured to allow more hosts to attach to the 9740.

Most upgrades can be made in just a few hours. Adding hosts may take longer, depending upon the number and type of hosts to be added to the system arrangement.

Accessibility

The 9740 can eject many cartridges through the CAP. The CAP offers superb accessibility by allowing up to 14 cartridges to be entered or ejected from the library storage manager as needed. This feature saves time when many cartridges need to be entered or removed from the library.

Your data is always accessible. In the unlikely event of a robot failure, the 9740 is also designed so that cartridges can be manually mounted into and dismounted from the cartridge tape unit.

Even though the 9740 is so convenient, it can also be secure. Tape cartridges are secured in the library by locking the access door with a key.

Error Recovery and Calibration

The 9740 robotics are totally self-calibrating. There are no operator adjustments. The robot automatically returns online in the event of a power failure. A cartridge that was in the process of being moved when a power failure occurred will be returned to its previous location when the power returns.

Automated Drive Cleaning

When a drive must be cleaned, the drive will signal the library. The robot will then automatically load the dedicated cleaning cartridge into that drive. After the cleaning operation is completed, the robot will automatically return the cleaning cartridge to its dedicated cell. This operation typically takes less than 30 seconds.

Cartridge Exchange Operations

The StorageTek TimberWolf 9740 LSM differs from the PowderHorn 9310 library in several ways. One of those differences is the methodology it uses for moving cartridges between LSMs.

TimberWolf libraries are connected in a linear path. Up to two CEMs can be connected per LSM in a linear path. That leaves only one possible path for any transfer.

The HSC and ACSLS software strategy is to give preference to a drive within the same LSM, but there is no guarantee that a drive in the same LSM is available, and a drive in another LSM will not be selected, even if a CEM failure prevents the transfer. The user always has the option of specifying the particular drive to use when mounting a cartridge, and can select a drive within the same LSM as a work-around until the CEM is working properly again.

Performance

Following two simple steps achieves optimal performance in the LSM:

MNTD Float and MNTD SCRDISM

First, in the HSC, turn on MNTD Float and MNTD SCRDISM. This allows any cartridge that was brought in from another LSM via a CEM to be left in the LSM where it was mounted in a drive. The cartridge does not have to be returned to the original LSM if there is an available slot, and speeds operation by cutting in half the number of CEM transfers necessary.

Cartridge Loading

Secondly, do not completely fill the LSMs. This ensures that there are free cells available that the cartridges may "float" into.

■ Specifications

Power

Table A-1. 9740 Power Specifications

Power Cable	**US/Canada** 100 VAC UL/CSA power cable **International** 200-240 VAC HAR power cable
Input Voltage Range *Nominal Voltage*	100 or 240 VAC 100-254 VAC
Power Configuration	**US/Canada** 120 VAC, Single phase, 47-63 Hz, 20 A Service, 3 wire **International** 200-240 VAC, Single phase, 47-63 Hz, 10 A Service, 3 wire
Power Consumption *Maximum heat output*	200 W 683 Btu/hr

Environmental Specifications

Table A-2. Environmental Specifications

Temperature	
Operating	15º C to 32ºC (59º to 90ºF)
Storage	10º C to 40ºC (50º to 104ºF)
Transit	-40º C to 60ºC (-40º to 140ºF)
Relative Humidity	
Operating	20% to 80% (non-condensing)
Storage	10% to 95% (non-condensing)
Transit	10% to 95% (non-condensing)
Wet Bulb Maximum	
Operating	29.2ºC (84.5ºF)
Storage	35ºC (95ºF)
Transit	35ºC (95ºF)
Altitude	
Operating	0 to 3.05 km (0 to 10,000 ft.)
Storage	0 to 3.05 km (0 to 10,000 ft.)
Transit	0 to 15.24 km (0 to 50,000 ft.)

Dimensions

Table A-3. Dimensions

9740 326-Cartridge Unit	
Height	183 cm (72.0 in.)
Width	117 cm (46.0 in.)
Depth no drives	77.7 cm (30.3 in.)
Depth with 9490 drives	137 cm (54.0 in.)
Depth with SD-3 drives	150 cm (59.0 in.)
Depth with 10-drive frame	120 cm (47.3 in.)
Weight	340 kg (750 lbs)
9740 494-Cartridge Unit	
Height	183 cm (72.0 in.)
Width	117 cm (46.0 in.)
Depth no drives	87.7 cm (40.3 in.)
Depth with 9490 drives	163 cm (64.0 in.)
Depth with SD-3 drives	175 cm (69.0 in.)
Depth with 10-drive frame	146 cm (57.3 in.)
Weight	435 kg (960 lbs)

Performance Specifications

Table A-4. Performance Specifications

Exchanges per hour	350
CEM transfer time (mechanical, see note)	3 seconds (typical)
Note: The CEM transfer time includes only the mechanical cycle time through the CEM. The total time to transfer a cartridge from a slot or drive in one LSM, to a receptacle in an adjacent LSM, depends upon the host and applications software it is running, plus other activity within the ACS.	

Glossary

A

ACS Automated Cartridge System.

ACSLS Automated Cartridge System Library Software.

C

Cartridge An encased volume of removable storage media (typically IBM compatible 34XX tape cartridge).

Cartridge Access Port (CAP) A device that allows you to enter/eject multiple cartridge(s) into/out of the library storage manager without stopping the robotics movement.

Cartridge Tape Unit An electromechanical device that moves the tape on a cartridge over a head that writes data on and reads data from the tape.

Cell A receptacle in the library storage manager for storing a single cartridge. Also referred to as a slot.

Channel A device that connects the host and the library.

Client/Server A computational architecture that involves client processes requesting service from server processes.

Client System Component (CSC) Software that provides an interface between the Tape Management Software and ACSLS.

controller transport unit (CTU) The functional area, within a cartridge drive, that contains control logic and an associated electromechanical device for threading tape from a cartridge, moving the tape across a read/write head, and writing data onto or reading data from the magnetic tape.

CSE Customer Services Engineer.

D

DASD Direct Access Storage Device.

DLT Digital Linear Tape.

E

Ethernet A local communication network that uses coaxial cable as a passive medium to interconnect different kinds of computer products at a local site without requiring switching logic or control by a central computer. Ethernet has a bandwidth of 10Mbps and throughout of 3.5 Mbps.

F

Fault Symptom Code Error or information code generated by functional or diagnostic software that may directly be used to indicate the field replaceable unit (FRU) that is probably causing the error.

Footprint The amount of floorspace that the 9740 uses.

H

HSC Host Software Component.

J

JES2 Job Entry Subsystem 2.

JES3 Job Entry Subsystem 3.

L

Library A library is composed of library storage components, cartridge tape units, and software that controls and manages the LSM.

Library Storage Components A structure that contains the actual storage components for the cartridges as well as the electrical and mechanical assemblies that move the cartridges.

LSM Library Storage Manager.

M

Mean Exchange Between Failures (MEBF) One mount is defined as moving the hand to a slot and retrieving a cartridge, moving to a drive and inserting the cartridge, and verifying the cartridge is inserted properly.

One dismount is defined as moving the hand to a drive and retrieving a cartridge, moving to a slot and inserting the cartridge.

One exchange is defined as one mount and one dismount.

The MEBF of a 9740 subsystem, excluding the tape drives and external software, is 200,000 exchanges.

MIPS Millions of Instructions Per Second.

MVS Multiple Virtual System.

S

SCSI Small Computer Systems Interface.

SP System Product.

T

Token Ring A local communication network which interconnects computers at a local site creating a local area network (LAN). Token Ring networks can also be bridged so that a computer can be remote, but appear as if it were local. Token Ring has a bandwidth of either 4 or 16 Mbps.

U

UNIX A family of operating systems originally developed by AT&T Bell Labs (now UNIX Systems Laboratories, Inc.) for the Digital PDP-7 computer. Today UNIX runs on a wide variety of computers.

V

VM Virtual Machine.

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