IBM Enterprise Storage Server™

Host Systems Attachment Guide
2105 Models E10, E20, F10, and F20

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> **Note:**
>
> Before using this information and the product it supports, read the information in "Safety and environmental notices" on page xiii and "Notices" on page 151.

Contents

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Safety and environmental notices

This section contains information about:
- Safety notices that are used in this guide
- Environmental guidelines for this product

To find the translated text for a danger or caution notice:
1. Look for the identification number at the end of each danger or caution notice. In the following examples, look for the numbers **1000** and **1001**.

   DANGER

A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury. **1000**

   CAUTION:
   A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury.

   1001
2. Find the number that matches in the *IBM Storage Solution Safety Notices* book, GC26-7229.

Product recycling

This unit contains recyclable materials. Recycle these materials at your local recycling sites. Recycle the materials according to local regulations. In some areas, IBM provides a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

Disposing of products

This unit may contain batteries. Remove and discard these batteries, or recycle them, according to local regulations.

About this guide

This guide provides information about:

- Attaching the IBM Enterprise Storage Server (ESS) to an open system host with small computer system interface (SCSI) adapters
- Attaching the ESS to an open system host with fibre-channel adapters
- Connecting Enterprise Systems Connection (ESCON®) cables to your System/390® host system

This guide also contains an overview for the IBM Subsystem Device Driver™ and information for Copy Services command-line interface, command descriptions, command parameters, and error messages. Use this publication along with the publications for your host system.

Who should use this guide

Customers or IBM service support representatives can use this manual to attach the Enterprise Storage Server to a host system.

Frequently used terms

The following terms appear in this publication to describe the IBM Enterprise Storage Server (ESS) and its configuration. Also see the "Glossary" on page 163 for additional terms and definitions.

Term	Definition
array	An arrangement of related disk drive modules (DDMs) that you have assigned to a group. Also referred to as a rank. For the ESS, an array is a group of up to eight DDMs.
cluster	A partition of a storage server that is capable of performing all functions of a storage server. When a cluster fails in a multiple-cluster storage server, the cluster that remains in the configuration takes over the processes of that cluster.
controller image	A System/390® term for a logical subsystem that you access with an ESCON® I/O interface. One or more controller images exist in each controller. Each image appears to be an independent controller, but all images share a common set of hardware facilities. The ESS can emulate 3990-3, 3990-6, or 3990-3 TPF controller images.
count key data (CKD)	A System/390 term for a logical device that specifies the format of the logical data units on the device. The logical data unit is a track that contains one or more records, consisting of a count field, a key field (optional), and a data field (optional).
device adapter	A physical component of a storage controller that attaches to one or more interfaces. It enables communication between the interfaces and the associated storage devices.

destage	The process of writing modified storage from cache to the disk drive module (DDM).
disk drive module (DDM)	The primary, nonvolatile storage medium that you use for any host data that is stored within a storage server. The number and type of storage devices within a storage server may vary.

Enterprise Systems Connection architecture (ESCON)

1. An ESA/390 computer-peripheral interface. The I/O interface uses ESA/390 logical protocols over a serial interface.
2. A set of IBM products and services that provide a dynamically connected environment within an enterprise.

ESCON	See *Enterprise Systems Connection architecture*.
ESCON channel	A channel that has an ESCON channel-to-controller I/O interface that uses optical cables as a transmission medium.
ESCON host systems	System/390 hosts that you attach to the ESS with an ESCON adapter. Such host systems run on Multiple Virtual Storage (MVS), virtual machine (VM), VSE, or TPF operating systems.
fabric	In fibre-channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are *cascaded*.
fibre-channel	Fibre-channel is an architecture that supports full-duplex communication over a serial interface that configures attached units to a communication fabric.
	The ESS supports fibre-channel communications for open system hosts through its fibre-channel adapters.
fixed-block (FB) devices	An architecture for logical devices that specifies the format of the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size); the subsystem can access them independently. This is the required format of the logical data units for host systems that you attach with a small computer system interface (SCSI) or fibre-channel interface.
gigabyte (GB)	When referring to hard-disk-drive capacity, GB means 1 000 000 000 bytes; total user-accessible capacity may vary depending on operating environment.
host adapter	A physical component in a storage server that enables the server to attach to one or more host I/O interfaces.

IBM Enterprise Storage Server (ESS)
A member of the Seascape™ product family of storage servers and attached storage devices (disk drive modules). The ESS provides integrated caching and RAID support for the disk drive modules (DDMs). The DDMs are attached through a serial storage architecture (SSA) interface.

logical device
A pointer to a logical volume on a storage server. The pointer enables a host system to access the logical volume. For the ESS, the logical device represents a logical volume.

logical subsystem (LSS)
The LSS is a logical "container" for RAID-5 arrays, disk groups, and the volumes that are located on those arrays or disk groups. One SSA Adapter accesses an LSS primarily. One or more logical subsystems can exist on the ESS. In general, the ESS associates a given set of devices with only one logical subsystem.

For System/390 hosts, a logical subsystem represents a controller.

logical unit
The Small Computer System Interface (SCSI) term for a logical disk drive.

logical unit number (LUN)
LUN is a SCSI term for the field in an identifying message that is used to select a logical unit on a given target.

logical volume
The storage medium associated with a logical disk drive. A logical volume typically resides on one or more storage devices. For the ESS, you define this unit of storage; the logical volume resides on a RAID-5 array, and is spread over 6 + P or 7 + P drives, where P is parity. A logical volume can also reside on a non-RAID array on one storage device.

For CKD, you can define the logical volume size by the device emulation mode (3390 or 3380 track format). For UNIX®, Microsoft® Windows NT®, and Microsoft Windows 2000® operating systems in the fixed-block format, the size is 0.5 GB to 224 GB. For AS/400® operating systems in the fixed-block format, the size is 4.19, 8.59, 17.55, or 36 GB.

Note: The AIX® operating system views a logical volume as a logical disk or a hard disk (hdisk).

SCSI
See *small computer system interface*.

SCSI host systems
Identifies host systems that you attach to the ESS with a SCSI interface. Such host systems run on UNIX, OS/400, Windows NT, Windows 2000, or Novell NetWare operating systems.

SCSI ID
A unique identifier (ID) assigned to a SCSI device that is used in protocols on the SCSI interface to identify or select the device. The number of data

	bits on the SCSI bus determines the number of available SCSI IDs. A wide interface has 16 bits, with 16 possible IDs. A SCSI device is either an initiator or a target.
service personnel	Individuals or a company that you have authorized to service your ESS. This term also refers to a service provider, a service representative, or an IBM service support representative (SSR). An IBM SSR installs your ESS.
Small Computer System Interface	
	An American National Standards Institute (ANSI) standard for a logical interface to computer peripherals and for a computer-peripheral interface. The interface uses a SCSI logical protocol.
staging	To move data from an offline or low-priority device to an online or higher priority device is called staging.
storage server	A unit that manages attached storage devices and provides access to the storage or storage-related functions for one or more attached hosts.
terabyte (TB)	When referring to hard-disk-drive capacity, TB means 1 000 000 000 000 bytes; total user-accessible capacity may vary depending on operating environment.
volume	Refers to a *logical* volume.

Publications

This section describes the ESS library and publications for related products. It also gives ordering information for these publications.

The ESS product library

The ESS is an IBM Seascape architecture-based product. See the following publications for more information on the ESS:

*   *IBM Enterprise Storage Server Introduction and Planning Guide*, GC26-7294

    This guide introduces the product and lists the features you can order. It also provides guidelines on planning for the installation and configuration of the ESS.

*   *IBM Enterprise Storage Server User's Guide*, SC26-7295

    This guide provides instructions for setting up and operating the ESS and for analyzing problems.

*   *IBM Enterprise Storage Server Host Systems Attachment Guide*, SC26-7296

    This book provides guidelines for attaching the ESS to your host system and for migrating from SCSI to fibre-channel attachment.

*   *IBM Enterprise Storage Server SCSI Command Reference*, SC26-7297

    This book describes the functions of the ESS. It provides reference information for UNIX and Application System/400® (AS/400®) hosts, such as channel commands, sense bytes, and error recovery procedures.

*   *IBM Enterprise Storage Server System/390 Command Reference*, SC26-7298

This book describes the functions of the ESS and provides reference information for System/390 hosts, such as channel commands, sense bytes, and error recovery procedures.

- *IBM Storage Solutions Safety Notices*, GC26-7229

  This book provides translations of the danger notices and caution notices that IBM uses in ESS publications.

- *IBM Enterprise Storage Server Web Interface User's Guide*, SC26-7346

  This book provides instructions for using the IBM StorWatch™ Enterprise Storage Server Web interfaces, ESS Specialist and ESS Web Copy Services.

- *IBM Enterprise Storage Server Configuration Planner*, SC26-7353

  This book provides work sheets for planning the logical configuration of the ESS. This book is not available in hardcopy. This book is only available on the following Web site:

  www.storage.ibm.com/hardsoft/products/ess/refinfo.htm

- *IBM Enterprise Storage Server Quick Configuration Guide*, SC26-7354

  This booklet provides flow charts for using the StorWatch Enterprise Storage Server Specialist. The flow charts provide a high-level view of the tasks the IBM service support representative performs during initial logical configuration. You can also use the flow charts for tasks that you might perform during modification of the logical configuration.

  The hardcopy of this booklet is a 9-inch × 4-inch fanfold.

- *IBM Enterprise Storage Server Service Guide*, SY27–7605

  This service guide is for the service support representatives who are trained to install and repair the IBM 2105 Models E10/E20 and F10/F20. This service guide is broken into three volumes that contain the following chapters:

  – Volume 1: Information, Start, and Isolation
  – Volume 2: Repair, Install, and Configure
  – Volume 3: Locations, Service Terminal, Codes, Power

Ordering publications

All of the publications that are listed in "The ESS product library" on page xviii are available on a compact disc that comes with the ESS, unless otherwise noted. You can also order a hardcopy of each publication. For publications on compact disc, order *IBM Enterprise Storage Server Customer Documents*, SK2T-8770.

All the customer documents listed above are available on the following ESS Web site:

www.storage.ibm.com/hardsoft/products/ess/refinfo.htm

Related publications

The following related publications are also available:

- *DFSMS/MVS® Version 1 Release 5 Software Support for the IBM Enterprise Storage Server*, SC26-7318

  This book describes the changes you need to make to operating systems for System/390 hosts to support the ESS functions.

- *IBM Storage Area Network Data Gateway Installation and User's Guide, 2108 Model G07*, SC26-7304

  This book introduces the IBM Storage Area Network (SAN) Data Gateway and provides the procedures for installing and using it.

- *IBM Subsystem Device Driver*

This book describes how to use the IBM Subsystem Device Driver on open-systems hosts to enhance performance and availability on the ESS. The Subsystem Device Driver creates redundant paths for shared logical unit numbers. The Subsystem Device Driver permits applications to run without interruption when path errors occur. It balances the workload across paths, and it transparently integrates with applications.

This publication is not available in hardcopy. However, it is available on the compact disc that is delivered with your ESS. You can also view and copy this publication from the Web site:

www.ibm.com/storage/support/techsup/swtechsup.nsf/support/sddupdates/

- *DFSMS Advanced Copy Services*, SC35-0355

  This book provides detailed information about Copy Services functions such as Peer-to-Peer Remote Copy (PPRC), Extended Remote Copy (XRC), and FlashCopy.

- *OS/390 MVS System Messages Volume 1 (ABA - ASA)*, SG24-5465

  This publication helps you understand and use IBM Advanced Copy Services functions on an IBM System/390. It describes two dynamic-copy functions and several point-in-time copy functions. These functions provide backup and recovery of data should a disaster occur to your data center. The dynamic-copy functions are Peer-to-Peer Remote Copy and Extended Remote Copy, and are known collectively as remote copy. FlashCopy, SNAPSHOT®, and Concurrent Copy are the point-in-time copy functions.

- *IBM Enterprise Storage Server*, SG24-5465

  This book, from the IBM International Technical Support Organization, introduces the IBM Enterprise Storage Server (ESS) and provides an understanding of its benefits. It also describes in detail the architecture, hardware and functions of the ESS.

- *Implementing the IBM Enterprise Storage Server*, SG24-5420

  This book, from the IBM International Technical Support Organization, can help you install, tailor, and configure the IBM Enterprise Storage Server (ESS) in your environment.

- *IBM Enterprise Storage Server Performance Monitoring and Management*, SG24-5656.

  This book, from the IBM International Technical Support Organization, provides guidance on the best way to configure, monitor, and manage your Enterprise Storage Server (ESS) to ensure optimum performance.

- *IBM System/360™ and System/370™ I/O Interface Channel to Control Unit Original Equipment Manufactures' Information*, GA22-6974

  This publication provides a description of the interface between System/360, System/370, and System/390 channels and controllers that are designed to operate with this interface. This publication covers the parallel I/O interface. It does not cover the interface between the controller and the I/O device, nor does it cover the ESCON-I/O interface for the System/390.

  This publication is for designers of programs and equipment that are associated with parallel I/O interfaces and for service personnel that maintain the equipment. Anyone concerned with the functional details of this interface will also find it useful.

- *Fibre Transport Services (FTS) Direct Attach, Physical and Configuration Planning*, GA22-7234

  This publication provides information about fibre-optic and ESCON-trunking systems.

- *DFSMS/MVS Version 1 Remote Copy Guide and Reference*, SC35-0169

  This publication provides guidelines for using remote copy functions with System/390 hosts.
- *Implementing ESS Copy Services on S/390*, SG24-6480

  This publication tells you how to install, customize and configure Copy Services on IBM Enterprise Storage Server on a S/390 host system. Copy Services functions include, Peer-to-Peer Remote Copy, Extended Remote Copy, FlashCopy, and Concurrent Copy. This publication describes the functions, pre-requisites and co-requisites. The publication also describes how to implement each of the functions into your environment.
- *Implementing ESS Copy Services on UNIX and Windows NT*, SG24-5757

  This publications tells you how to install, customize, and configure Copy Services on an IBM Enterprise Storage Server on the UNIX and Windows NT host system. Copy Services functions include, Peer-to-Peer Remote Copy, FlashCopy, Extended Remote Copy, and Concurrent Copy. Extended Remote Copy and Concurrent Copy are not available for UNIX and Windows NT host systems. They are only available on System/390. This publication describes the functions, pre-requisites and co-requisites. The publications also shows you how to implement each of the functions into your environment. This publications also shows how to implement these solutions in an HACMP cluster.
- *NUMA-Q ESS Integration Release Notes*, Part Number 1003-80094-01

  This publication contains information about special procedures and limitations involved in running ESS with Copy Services on a NUMA-Q host system. It is not available through IBM ordering systems. Contact your IBM NUMA-Q sales representative to obtain this document

Web sites

For general information about IBM storage servers, see the following Web site:
- www.storage.ibm.com/hardsoft/products/ess/ess.htm

To view and print the IBM Enterprise Storage Server publications, see the following Web site:
- www.storage.ibm.com/hardsoft/products/ess/refinfo.htm

To get current information about the host system models, operating systems, and adapters that the ESS supports, see the following Web site:
- www.storage.ibm.com/hardsoft/products/ess/supserver.htm

For information about the IBM Subsystem Device Driver, see the following Web site:

  www.ibm.com/storage/support/techsup/swtechsup.nsf/support/sddupdates/

To attach a SAN or host system that uses an industry-standard, fibre-channel arbitrated loop (FC-AL) through the IBM 2108 SAN Data Gateway Model G07, see the following Web site:

  www.storage.ibm.com/hardsoft/products/sangateway/sangateway.htm

For information about the latest updates to Copy Services components XRC, PPRC, SnapShot, Concurrent Copy, and FlashCopy for S/390, see the following Web site:

  www.storage.ibm.com/software/sms/sdm/sdmtech.htm

Summary of Changes

Vertical revision bars (|) in the left margin indicate technical changes to this document. Minor editorial changes do not have vertical revision bars.

December 2000

This edition includes the following new information:
- Procedures on how to attach an ESS to a Hewlett Packard host system with fibre-channel adapters.
- Procedures on how to attach an ESS to a Sun host system with fibre-channel adapters.
- Procedures on how to attach an ESS to a Novell NetWare host system with fibre-channel adapters.
- Procedures on how to attach an ESS to a Windows 2000 host system with SCSI adapters.
- Procedures on how to attach an ESS to a Windows 2000 host system with fibre-channel adapters.
- Procedures on how to set the parameters for Sun host systems.
- Procedures on how to migrate from a 2108 SAN Data Gateway to fibre-channel.
- Procedures on how to migrate from SCSI to fibre-channel for the following host systems in a non-clustered environment:
  - AIX
  - HP-UX
  - Sun
- Procedures on how to migrate from SCSI to fibre-channel for a Windows NT host system in a clustered environment.
- New Copy Services commands, command parameters, exit statuses, and examples.
- Enhancements to the descriptions for the CLI for AIX, Windows NT, Windows 2000, Sun, and Hewlett Packard.

Chapter 1. Introduction

This guide provides an overview of the IBM Enterprise Storage Server (ESS) and guidelines for attaching the ESS to the following host systems:

- X/Open Company Group UNIX
- Microsoft Windows NT 4.0®
- Microsoft Windows 2000
- IBM Application System/400 (AS/400) with IBM Operating System/400® Version 3 or Version 4 (OS/400®)
- IBM S/390
- IBM ESA/390
- IBM RS/6000
- IBM RS/6000 SP
- Hewlett Packard
- Sun
- Compaq
- NUMA-Q
- Novell NetWare

IBM Enterprise Storage Server overview

This section provides an overview of the IBM Enterprise Storage Server (ESS) and describes its interfaces and components.

The ESS is a member of the Seascape family of storage servers. The ESS provides integrated caching and support for redundant arrays of independent disks (RAID) for the disk drive modules (DDMs). The DDMs are attached through a serial storage architecture (SSA) interface.

The ESS uses peripheral component interconnect (PCI) architecture that is designed to provide high availability and to avoid single points of failure.

The ESS Models E10 and E20 provide 6 GB of cache. The ESS Models F10 and F20 provide 8 GB of cache; an optional 16 GB of cache; and faster PCI architecture.

The ESS provides the following features:

- RAID 5 or non-RAID disk groups
- Fast SSA drives
- Fast reduced instruction-set computer (RISC) processors
- A fault-tolerant system
- Sharing of storage between open-systems hosts
- OS/390® parallel input/output (I/O) interface
- Instant copy solutions (with the FlashCopy option)
- Disaster recovery solutions

Models E20 and F20, with expansion enclosures, can provide up to 11 terabytes (TB) of storage capacity, with a choice of 9.1, 18.2, or 36.4 GB DDMs. When IBM refers to DDM capacity, TB means 1 000 000 000 000 bytes. For processor

storage, real and virtual, a TB equals 2^{40} or 1 099 511 627 766 bytes. Total user-accessible capacity may vary depending on the operating environment.

See Figure 1 and Figure 2 for illustrations of the ESS models and the expansion enclosure. ESS Models E10 and F10 do not support an expansion enclosure.

Front view   Rear view
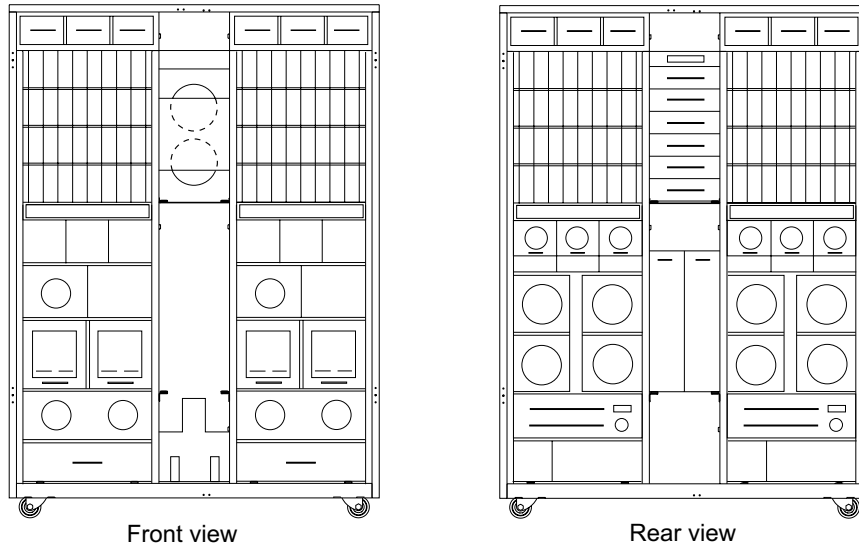
Figure 1. Models E10, E20, F10, and F20; front and rear views

Each ESS expansion enclosure has dual power cables and redundant power. The redundant power system allows both the storage controller and DDMs to continue normal operation when one of the power cables is inactive. Redundancy also ensures continuous data availability.

Front view   Rear view
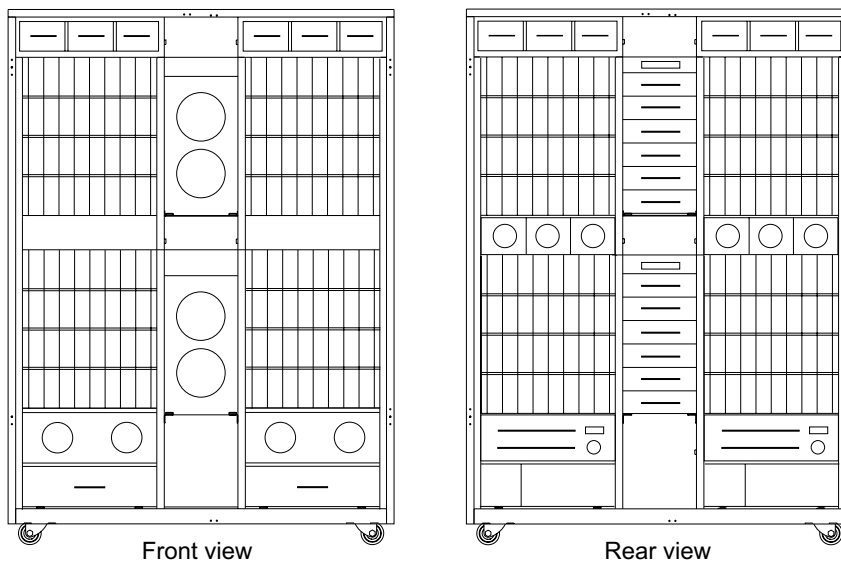
Figure 2. Expansion enclosure, front and rear views

ESS Models E10 and F10 support a maximum of 64 DDMs. The minimum configuration for a Model E10 or F10 base enclosure is 16 DDMs. ESS Models E20

and F20 support a maximum of 128 DDMs. With the expansion enclosure, Models E20 and F20 support a maximum of 384 DDMs.

Host systems supported by the ESS

The ESS provides heterogeneous data storage that you can share between workloads for open-systems hosts. The following sections contain information about:

- Open-systems hosts with small computer system interface (SCSI) adapters
- Open-systems hosts with fibre-channel adapters

Note: Because of possible interactions between host bus adapters in switched configurations, IBM recommends that you establish zones that contain a single port attached to a host bus adapter with the desired number of ports attached to ESS. You can establish the zones by using either the hard (by port) or soft (by WWPN) zoning method. You can configure ports that are attached to the ESS in more than one zone, which allows multiple host bus adapters to share access to the ESS fibre-channel ports. Shared access to an ESS fibre-channel port might be from host platforms that use a combination of supported host bus adapter types and operating systems.

SCSI host systems

Each SCSI adapter has two ports. With SCSI adapters you can connect up to 128 host systems when you serially interconnect them. The ESS supports the following host systems for SCSI attachment:

- Hewlett Packard with the HP-UX operating system
- IBM RISC System/6000® and RISC System/6000 SP with the IBM AIX operating system
- IBM AS/400 with the IBM Operating System/400 (OS/400) Version 3 or Version 4
- Intel-based servers with Microsoft Windows NT 4.0 operating systems
- Intel-based servers with Microsoft Windows 2000 operating systems
- Sun with the Solaris operating system
- Data General with the DG UX operating system
- Intel-based servers with Novell NetWare
- Compaq AlphaServers with Tru64 Unix and OpenVMS

See the following ESS Web site for details about types, models, adapters, and the operating systems that the ESS supports for SCSI-attached host systems:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Fibre-channel host systems

Each ESS fibre-channel adapter has one port. With fibre-channel adapters you can connect up to 127 host systems. See "Fibre-channel connection" on page 10 for information on the fibre-channel protocols that the ESS supports. The ESS supports the following host systems for fibre-channel attachment:

- IBM RISC System/6000 and RISC System/6000 SP with the IBM AIX operating system
- Intel-based servers with Microsoft Windows NT 4.0 operating systems
- Intel-based servers with Windows 2000 operating systems
- IBM NUMA-Q with DYNIX/ptx
- Hewlett Packard with the HP-UX operating system
- Intel-based servers with Novell NetWare
- Sun with the Solaris operating system

See the following ESS Web site for details about types, models, adapters, and the operating systems that the ESS supports for fibre-channel attached host systems:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

System/390 host systems

With ESCON adapters, the ESS supports up to 32 connections for System/390 host systems, each with up to 64 logical paths. IBM attaches an ESS to a System/390 server for fibre-channel connection (FICON™) through the bridge card on the IBM 9032 Model 005 ESCON Director.

The ESS supports the following operating systems:

- OS/390
- Multiple Virtual Storage/Enterprise Storage Architecture (MVS/ESA™)
- Virtual Machine/Enterprise Storage Architecture (VM/ESA®)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA™)
- Transaction Processing Facility (TPF)

The ESS also supports the following operating systems for the new IBM eserver zSeries 900 (z900 server):

- z/OS Version 1 Release 1
- OS/390 Version 2 Release 6 or higher
- VM
  - z/VM Version 3 Release 1
  - VM/ESA Version 2 Release 2
  - VM/ESA Version 2 Release 3
  - VM/ESA Version 2 Release 4
- VSE/ESA Version 2 Release 3 and higher
- Transaction Processing Facility (TPF) Version 4 Release 1

See the preventive service planning (PSP) bucket for operating system support and planning information that includes APARs and programming temporary fixes (PTFs).

For additional information about the changes you need to make to System/390 hosts to support ESS functions, see *DFSMS/MVS Version 1 Release 5 Software Support for the IBM Enterprise Storage Server*.

For information about the latest updates to Copy Services components XRC, PPRC, SnapShot, Concurrent Copy, and FlashCopy for S/390, see the following Web site:

www.storage.ibm.com/software/sms/sdm/sdmtech.htm

Web interfaces

This section describes the Web security, the ESSNet, and the Web interfaces for ESS. The Web interfaces include:

- StorWatch Enterprise Storage Server Specialist (ESS Specialist)
- StorWatch Enterprise Storage Server Web Copy Services (ESS Web Copy Services), a feature that is supplied when you purchase peer-to-peer remote copy or FlashCopy.
- StorWatch Expert, an optional software product

See your IBM field office for information about how to order the optional Web interfaces. See the *IBM Enterprise Storage Server Web Interface User's Guide*. This publication provides detailed descriptions of the ESS Specialist and the ESS Web Copy Services interfaces and instructions about how to use them.

Web connection security

You connect to the ESS through the ESSNet.

All data that is sent between the ESS and the Web browser through the ESSNet is encrypted to avoid unauthorized modification of configuration commands. Passwords and authorization levels protect access to the interface.

You control user access by assigning levels of access and passwords.

IBM Enterprise Storage Server Network

The IBM Enterprise Storage Server Network (ESSNet) is a private network resident on an IBM workstation. It is a required feature. IBM installs the ESSNet when they install your IBM Enterprise Storage Server. The ESSNet hardware includes:

- The IBM workstation (a PC) and monitor
- An external Ethernet hub that provides cable connections from the ESSNet to the IBM Enterprise Storage Server. The hub speed is 10 megabits per second (Mbps) or 10/100 megabits per second, depending on your system.

   Note: You can attach your Ethernet LAN to the external hub. You provide any hardware that is needed for this connection.

- A modem and a modem expander that allow your ESS to communicate between you and IBM

   Note: The feature code for Remote Service Support includes the modem and modem expander.

The ESSNet includes the following software on the workstation:

- Windows NT 4.0 operating system
- Browser software (Microsoft Internet Explorer and Netscape Navigator) that allows access to the ESS Specialist
- The ESSNet application for installation and configuration. The ESSNet workstation includes an application that provides links to the ESS. When you click on one of these links, it initiates the ESS Specialist.

The ESSNet provides the following features:

- Support for multiple ESSs. A hub with 16 ports will support 7 ESSs.
- Connectivity between your ESS and the ESS Specialist Web interface. The ESSNet provides browser software at the appropriate level for this connection.
- Improvements in Web performance compared to previous Web browser connections.
- Faster network connectivity and elimination of network setup problems when using previous Web connections.
- Ethernet connectivity through an Ethernet hub to the ESSNet.
- An independent platform that facilitates installation and configuration of the ESS.
- Software for maintenance and configuration.

IBM installs the ESSNet when they install your first IBM Enterprise Storage Server.

Accessing ESS Specialist and ESS Web Copy Services

You access the IBM StorWatch Enterprise Storage Server Specialist (ESS Specialist) from the ESSNet. The ESSNet includes browser software for this access. You access ESS Web Copy Services from the ESS Specialist Information Panel.

You can access ESS Specialist from your own workstation if you connect the ESSNet into your intranet by using one of the ports on the ESSNet hub. If you use your own workstation, IBM recommends at least 128 MB of memory in the workstation. You can access the ESS Specialist by using a browser that is enabled for Java(TM) 1.1.x. The ESS Specialist supports the following browsers:

- Netscape Navigator Version 4.04 or greater, which supports Windows NT and Windows 95.

    Note: Version 4.04 requires Java 1.1 fixpack; later versions such as 4.5 may not require this fixpack. For better performance on the web, IBM recommends you use Netscape Navigator Version 4.5.1 or greater.

- Microsoft Internet Explorer (MSIE) Version 4.0 or greater, which supports Windows NT and Windows 95.

    Note: Version 4.0 requires Service Pack 1.

The ESSNet PC is preloaded with Microsoft and Netscape.

If you do not choose to attach ESSNet into your intranet, you can only access ESS Specialist from a browser on the ESSNet workstation.

You must provide another network connection to the remote ESS through ESSNet hubs for Copy Services support.

IBM updates ESS Specialist and ESS Copy Services through engineering changes (ECs).

ESS Specialist

The ESS includes the ESS Specialist. The ESS Specialist is a Web-based interface that allows you to configure the ESS.

From the Web interface, you can perform the following tasks:

- Monitor error logs
- View and change the configuration:
    - Add or delete SCSI and fibre-channel host systems
    - Configure SCSI host ports and fibre-channel host ports on the ESS
    - Define controller images for System/390
    - Define fixed-block (FB) and count-key-data (CKD) disk groups
    - Add FB and CKD volumes
    - Assign volumes to be accessible to more than one host system
    - Change volume assignments
- Change and view communication resource settings, such as electronic mail (e-mail) addresses and telephone numbers
- Authorize user access

With the ESS Specialist, you can view the following information:

- The external connection between a host system and an ESS port

- The internal connection of SCSI ports and fibre-channel ports to cluster 1 or cluster 2
- The allocation of storage space to FB and CKD volumes

IBM updates the ESS Specialist through licensed internal code (LIC) updates. The command-line interface (CLI) is updated when a new LIC is provided.

ESS Copy Services

ESS Copy Services collects information from your IBM storage servers onto a single Copy Services server. The ESS supports Copy Services through a Web-based interface and a command-line interface.

This section describes the two interfaces for ESS Copy Services, shows an example of the connections between two Copy Services server groups, and gives you an overview of the functions you can perform using the ESS Copy Services panels.

Web-based interface: The ESS Web Copy Services interface initiates and manages Peer-to-Peer Remote Copy (PPRC) and FlashCopy functions for open systems and IBM System/390 hosts.

You access ESS Web Copy Services from the ESS Specialist interface main menu.

Command-line interface for S/390: The command line functions (TSO or API) on System/390 hosts initiate and manage Extended Remote Copy (XRC), Concurrent Copy, FlashCopy and Peer to Peer Remote Copy (PPRC). For more information, see *DFSMS Advanced Copy Services.*

Command-line interface for open systems: If you choose to install the command-line interface (CLI) on your open systems host, you can write customized scripts using CLI commands. After you create and save the scripts as tasks, you can execute the CLI commands from the host system. The CLI commands invoke Copy Services tasks in an ESS Copy Services server.

See "Appendix A. Using the ESS Copy Services commands" on page 107 for information about using the Copy Services command-line interface from your host systems to invoke Copy Services functions.

For more information about which open systems and host platforms are supported for CLI, see the following Web site:

www.ibm.com/storage/hardsoft/products/ess/refinfo.htm

Copy Services server groups: Figure 3 on page 8 shows the connections between two ESS Copy Services server groups. A Copy Services server group is a collection of ESS clusters that participate in Copy Services functions that include the volumes within the clusters.
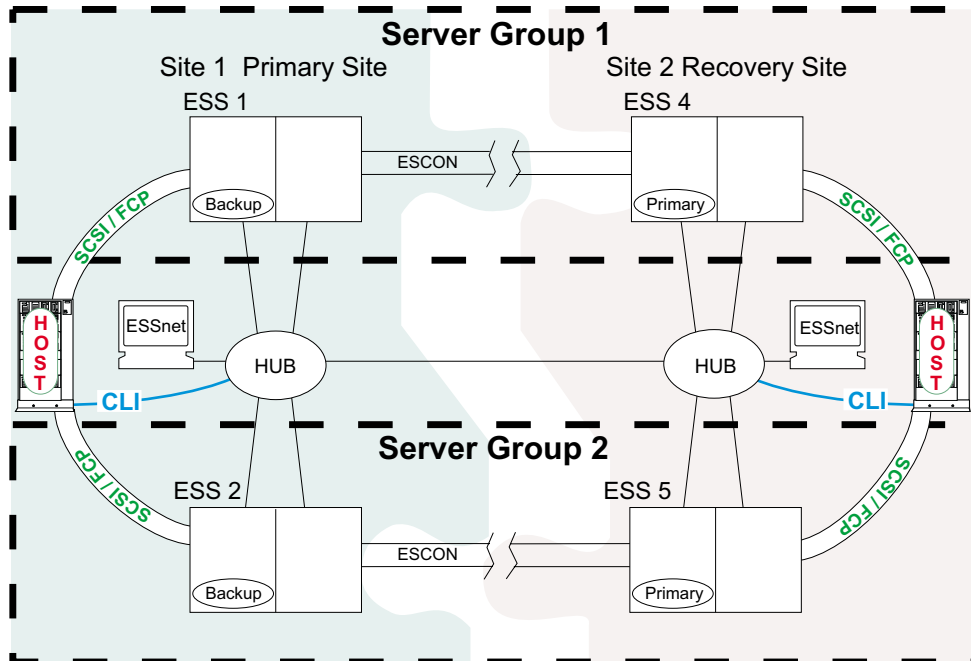
Figure 3. Connecting to ESS Copy Services server groups

Copy Services panels: Use the Copy Services panels to view and define:

- **Volumes**

  The Volumes panel allows you to view volumes and define them as source or target volumes for the PPRC process.

- **Server**

  The Storage Server panel allows you to work with logical servers as complete entities. You can build tasks to place the volumes of a logical server within a peer-to-peer relationship with the volumes of another logical server.

  You can also build a task to remove similar groups of volumes from an existing peer-to-peer relationship.

  You can determine the function of Consistency Groups and freeze and create commands.

- **Paths**

  The Paths panel displays the current status of paths between an ESS and the other ESSs or switches to which it is connected.

  You can also use this panel to add or remove copy service paths.

- **Tasks**

  The Tasks panel allows you to manage tasks you have defined. You can run, remove, save, group, or ungroup tasks. The host system command line interface function uses these pre-defined tasks.

- **Configuration**

  The Configuration panel allows you to add to or save the existing configuration. You can also use this panel to display the error log.

ESS Expert

The IBM StorWatch Enterprise Storage Server Expert (ESS Expert) is an optional software product that you can purchase to use with the ESS. The ESS Expert Web interface provides storage-resource management for the IBM storage servers.

- Asset management

  ESS Expert collects and displays asset management data.
- Capacity management

  ESS Expert collects and displays capacity management data.
- Performance management

  ESS Expert collects and displays performance management data. For example:
  – Number of I/O requests
  – Number of bytes transferred
  – Read and write response time
  – Cache usage statistics

ESS Expert allows you to schedule the information collection. With this information, you can make informed decisions about volume placement and capacity planning as well as isolate I/O performance bottlenecks.

Service interface

The ESS provides service interface ports for external connection of a service terminal.

IBM or your service provider can perform service on the ESS by using an IBM mobile service terminal (MoST) or equivalent.

Remote services support
The ESS service interface also provides remote service support with call-home capability for directed maintenance for service personnel.

You provide an analog telephone line to enable this support. The service interface provides an RS232 connection through a modem switch and modem to the analog telephone line.

You need to order a modem and modem switch. The first ESS you order requires this equipment. The modem and modem switch support up to seven ESSs. The cable length from the ESS to the modem switch should be a maximum of 15 m (50 ft.).

The ESS provides the following service functions:
- Continuous self-monitoring initiates a call (call home) to service personnel if a failure has occurred. Because service personnel who respond to the call know about the failing component, the service personnel can reduce the repair time.
- Error and problem logs are available that service personnel can access remotely to analyze potential failures.
- Remote support allows the ESS to correct many types of problems. When the ESS reports a problem, service personnel can often correct the problem from a remote location.

Configuration
IBM logically configures your ESS during installation using the work sheets that you completed from the *IBM Enterprise Storage Server Configuration Planner*. After IBM installs the ESS, you can perform additional configuration by using the ESS Web interfaces. You can also change the remote service functions.

Fibre-channel connection

The ESS provides fibre-channel connection to open-systems hosts that it supports. Fibre-channel interconnection architecture provides a variety of communication protocols on the ESS. The units that are interconnected are referred to as *nodes.* Each node has one or more ports.

An ESS is a node in a fibre-channel network. Each port on an ESS fibre-channel host adapter is a fibre-channel port. A host is also a node in a fibre-channel network. Each port attaches to a serial-transmission medium that provides duplex communication with the node at the other end of the medium.

With fibre-channel technology, the distance between an ESS and attached host systems increases from the 25 m (75 ft) maximum imposed by SCSI connections up to 500 m (1500 ft). The ESS can be up to 11 km (6.8 mi) from your host when you connect to it with an IBM SAN fibre-channel switch. The ESS can also be the same distance from your host when you connect to it with an IBM fibre-channel storage hub.

ESS architecture supports three basic interconnection topologies:
- Point-to-point
- Switched fabric
- Arbitrated loop

Point-to-point topology
The point-to-point topology, also known as direct connect, allows you to interconnect ports directly. Figure 4 shows an illustration of a point-to-point topology.
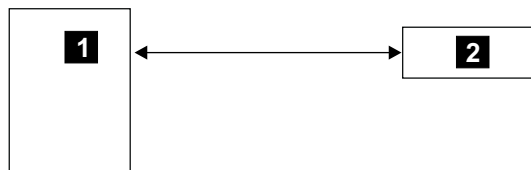
S008944L

Legend

1 is the host system.

2 is the ESS.

Figure 4. Point-to-point topology

Switched fabric topology
The switched fabric topology provides the underlying structure that allows you to interconnect multiple nodes. You can use a fabric that provides the necessary switching functions to support communication between multiple nodes. You can implement a fabric by using available vendor products that the ESS supports. For a list of these vendor products, see the ESS Web site at:
- www.storage.ibm.com/hardsoft/products/ess/supserver.htm

The ESS supports the switched-fabric topology with point-to-point protocol. The ESS fibre-channel adapter should be configured to operate in point-to-point mode when you connect it to point-to-point topologies or fabric topologies. See Figure 5 on page 11.
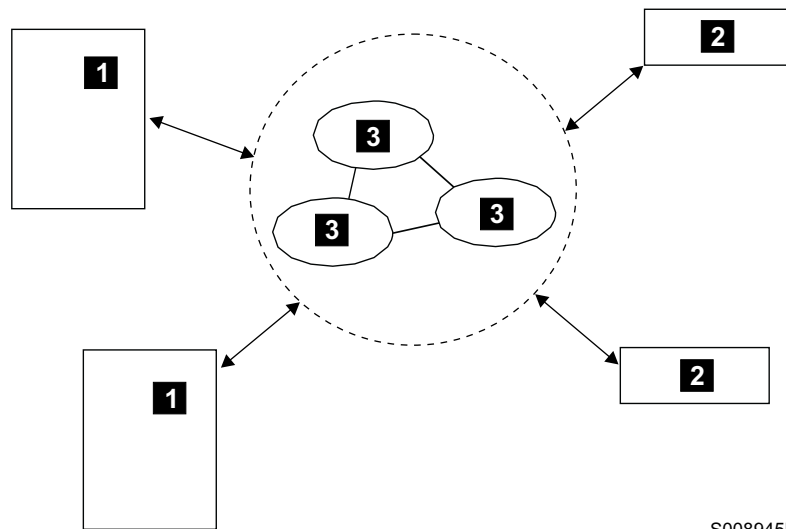
S008945N

Legend

■1■ is the host system.

■2■ is the ESS.

■3■ is a switch.

Figure 5. Switched fabric topology

Arbitrated loop

Fibre-channel arbitrated loop (FC-AL) is a ring topology that allows you to interconnect a set of nodes. The maximum number of ports you can have for a fibre-channel arbitrated loop is 127. See Figure 6 on page 12.

The ESS supports FC-AL as a private loop. It does not support the fabric-switching functions in FC-AL.
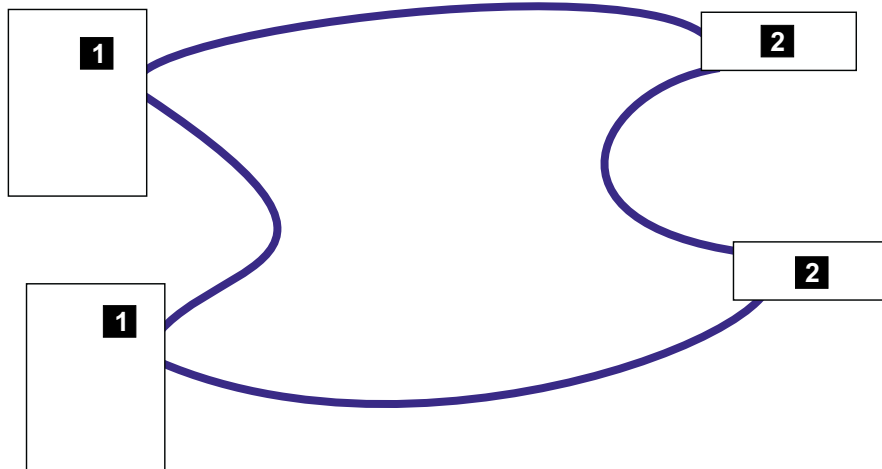
S008943N

Legend

1 is the host system.

2 is the ESS.

Figure 6. Arbitrated loop topology

Introducing the IBM Subsystem Device Driver

The IBM Subsystem Device Driver resides in the host server with the native disk device driver for the ESS. It uses redundant connections between the host server and disk storage in an ESS to provide enhanced performance and data availability. Figure 7 on page 13 is an example of the type of configuration that IBM Subsystem Device Driver supports. These connections comprise many different components through which data flows during input and output processes. Redundancy and the ability to switch between these components provides many different paths for the data to travel. In the event of failure in one input-output path, it automatically switches to another input-output path. This automatic switching in the event of failure is called *failover*.

```
                  Host Server

            SCSI / FCP    SCSI / FCP
            adapter 0     adapter 1
```
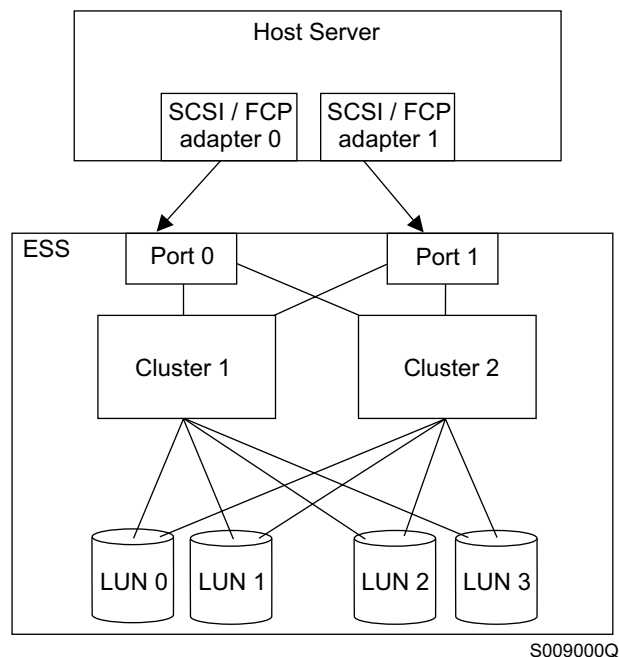
Figure 7. Multipath connections between a host server and ESS LUNs

The IBM Subsystem Device Driver provides the following functions:

• Enhanced data availability

• Automatic path failover and recovery to an alternate path

• Dynamic load balancing of multiple paths

• Path selection policies for the AIX operating system

• Concurrent download of licensed internal code

In most cases, host servers are configured with multiple host adapters with SCSI or fibre-channel connections to an ESS that, in turn, provides internal component redundancy. With dual clusters and multiple host interface adapters, the ESS provides more flexibility in the number of input-output (I/O) paths that are available.

When there is a failure, the IBM Subsystem Device Driver reroutes I/O operations from the failed path to the remaining paths. This function eliminates the following connections as single points of failure: a bus adapter on the host server, an external SCSI cable, a fiber-connection cable, or a host interface adapter on the ESS.

In addition, multipath load balancing of data flow prevents a single path from becoming overloaded with I/O operations.

The IBM Subsystem Device Driver path recovery algorithms now test *Dead* paths that are not manually offline every 30 minutes.

Concurrent download of licensed internal code is the capability to download and install licensed internal code on an ESS while applications continue to run. During the time when new licensed internal code is being installed in an ESS, the upper interface adapters inside the ESS may not respond to host I/O requests for approximately 30 seconds. The IBM Subsystem Device Drivers makes this transparent to the host through its path selection and retry algorithms.

> **Note:** For updated and additional information not included in this publication, see the README file on the IBM Subsystem Device Driver compact disk recordable (CDR) or visit the Subsystem Device Driver Web site at:
>
> www.ibm.com/storage/support/techsup/swtechsup.nsf/support/sddupdates/

Equipment requirements

Your shipment of the IBM Enterprise Storage Server includes:

- A compact disc that includes:
  - Install scripts for the 2105 host attachment for AIX and HP-UX
  - Installation instructions for the IBM Subsystem Device Driver for the following platforms:
    - Windows NT
    - Windows 2000
    - HP-UX
    - Sun Solaris 2.6
    - Sun Solaris 7
    - Sun Solaris 8
    - AIX
    - Compaq
- Licensed internal code (LIC) compact disc.

  Note: IBM service enables or disables any LIC features on your ESS.
- Host interface cards for the ESS, and host cables for attaching the ESS to your host system.
- ESS SCSI adapters, fibre-channel adapters and cables (optional). For details about the types, models, adapters, and operating systems supported for SCSI and fibre-channel open systems hosts, see the following Web site:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm
- A compact disc for host adapters.
- A 31-m (100 ft) (50 μ) cable for fibre-channel attachment.
- Modems, modem switches, cables, and power cords for remote support. See the *IBM Enterprise Storage Server Introduction and Planning Guide* for details.
- The IBM workstation, cables, and power cords for ESSNet.
- The extension cord that the service provider uses to connect the service terminal to a power outlet. See the *IBM Enterprise Storage Server Introduction and Planning Guide* for details.
- Operating system compact disc-1.
- Operating system compact disc-2.
- Operating system compact disc for program temporary fixes (PTFs).
- Compact disc for service diagnostics.
- Supporting software for host systems to which you are attaching the ESS.
- IBM Enterprise Storage Server Customer Documents compact disc, SK2T-8770

  This compact disc includes a softcopy of the ESS customer publications. See "The ESS product library" on page xviii for a list of the books.
- Additional items that are used by authorized service personnel:
  - One set of blank diskettes to extract state-save information during service.

> **Note:** The ESS diskette drive only reads diskettes with 1.44 MB format that a 1.44 MB drive has formatted.

– IBM Enterprise Storage Server Service Documents compact disc, SK2T-8771

  A compact disc and hard copies of the service documentation, which includes the service guide and the parts catalog.

You also will need the following equipment for installing and operating the ESS:

- An analog telephone line near the ESS to enable remote support. The service interface provides an RS232 connection, through a modem switch, to the analog telephone line.
- Power cord connectors. The ESS requires two power cords that are 60 A (country and location dependent).
- Power outlets must be compatible with the extension cords and power cords for the Remote Service feature. Outlets must be within 3 m (6 ft) of the ESS.
- Two ESS cover keys. If you open the ESS, be aware of IBM safety concerns. The tag to the keys has the following caution notice:

  CAUTION:
  This machine is certified to be serviced by trained personnel only.

  1062

Engineering changes

IBM might release engineering changes to the materials in the ship group periodically to correct problems or provide additional support. You might receive engineering changes that are mandatory or optional field bills. Install the mandatory field bills as directed by IBM.

Notes:

1. Information about the level of the engineering change is on the label of the compact disc.
2. The ESS stores up to three engineering change levels of LIC code. The ESS stores a new EC level prior to activating it as the current level.

Chapter 2. Attaching an ESS to an open system host with SCSI adapters

This chapter provides general information about attaching an ESS to the following open system hosts with SCSI adapters:

- Microsoft Windows NT host system. See "Chapter 3. Attaching an ESS to a Windows NT 4.0 host system with SCSI adapters" on page 23.
- Microsoft Windows 2000 host system. See "Chapter 4. Attaching an ESS to a Windows 2000 host system with SCSI adapters" on page 29.
- Novell NetWare host system. See "Chapter 5. Attaching an ESS to a Novell NetWare host system with SCSI adapters" on page 35.
- Hewlett Packard host system. See "Chapter 6. Attaching an ESS to a Hewlett Packard 9000 host system with SCSI adapters" on page 39.
- Sun host system. See "Chapter 7. Attaching an ESS to a Sun host system with SCSI adapters" on page 41.
- Compaq host system. See "Chapter 8. Attaching an ESS to a Compaq host system with SCSI adapters" on page 47.
- RS/6000 host system. See "Chapter 9. Attaching an ESS to an IBM RS/6000 host system with SCSI adapters" on page 53.
- RS/6000 host system without HACMP/6000. See "Chapter 10. Attaching the IBM ESS to multiple RISC System/6000 hosts without HACMP/6000™" on page 57.
- Configuring for High-availability (HACMP/6000). See "Chapter 11. Configuring for HACMP/6000" on page 61.
- AS/400 host system. See "Chapter 12. Attaching an ESS to an IBM AS/400 host system" on page 63.

For configuration limitations for the host systems, see the *IBM Enterprise Storage Server Introduction and Planning Guide*. Also see "SCSI host system limitations" on page 21.

SCSI host system attachment overview

The following sections contain information about attaching your SCSI open system host.

Cabling interconnection

Figure 8 on page 18 shows the cabling interconnection for a single SCSI bus between an ESS and a set of SCSI devices. Each SCSI adapter card in an ESS has a built-in terminator. You can configure each SCSI bus that is attached to the ESS independently.

The attached SCSI devices might be initiators (hosts) or target devices. The ESS supports a maximum of four SCSI target devices on any wide SCSI bus. IBM recommends that you use one SCSI initiator per SCSI bus on an ESS. The number of SCSI devices that the ESS controller uses on the bus is determined by the number of targets specified in the logical configuration for that bus. The SCSI adapter card in the ESS operates in target-only mode.

Note: If you have multiple hosts attached to the same SCSI bus, IBM strongly recommends that you use the same type of host. If you have different hosts

on the same SCSI bus, you must use the same type of host adapter. For a list of adapters see the following Web site:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm
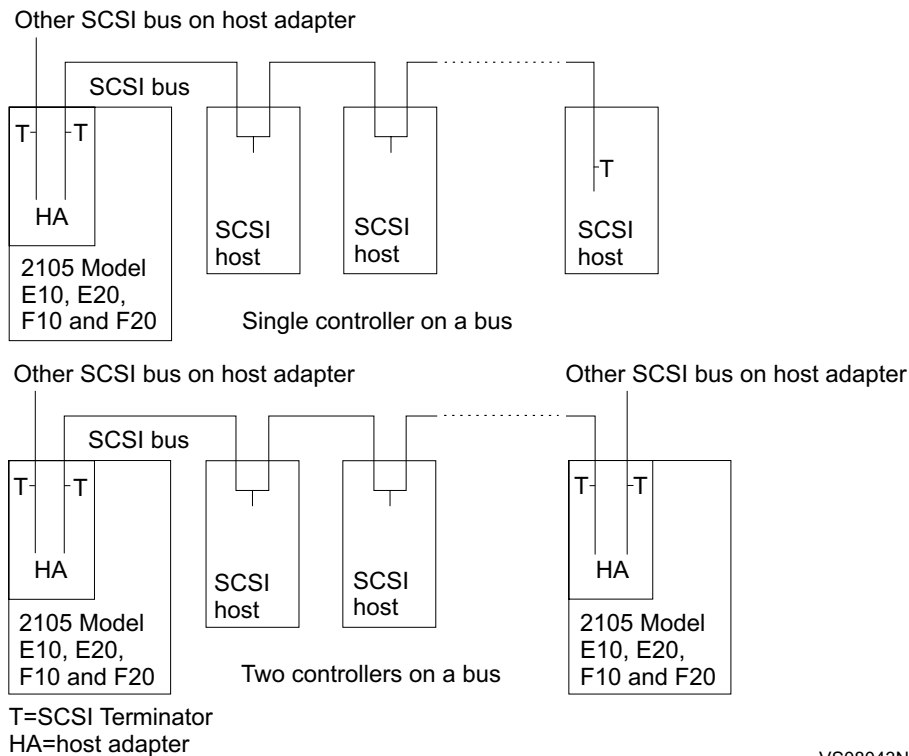
Figure 8. ESS host interconnections

Notes:

1. Host time-outs might occur due to bus contention when there are too many initiators that try to drive excessive loads over a single bus. The four-initiator limit allows each host to run a significant amount of work without incurring time-outs on I/O operations.

2. Your host system might have configuration requirements on the number and type of SCSI devices on the SCSI bus other than what you can do on the ESS.

3. You can attach a host system to multiple ports through a separate SCSI bus cable and a separate SCSI adapter for each port.

4. You cannot use the configuration in Figure 8 for the AS/400. See "Recommended configurations for the AS/400" on page 63 for information about how to configure an AS/400.

5. The SCSI adapter card in an ESS does not provide terminator power (TERMPWR) for the SCSI bus to which it is connected.

6. Each host system you attach to a single SCSI bus must be a compatible host system.

7. The SCSI adapter card in an ESS provides its own power for termination.

8. The host adapter in the ESS has a built-in terminator. Therefore, you do not require external terminators.

9. The SCSI adapter card in an ESS must always be at one end of the SCSI bus to which it is connected.

10. Each device on a SCSI bus must have a unique ID. Before you attach any device to a SCSI bus, ensure that it has a unique ID for the bus to which you want to connect.

11. When you attach a device to the end of your SCSI bus, you must terminate it. If you attach a device in the middle of a SCSI bus, you must not terminate it.

12. Each SCSI bus requires at least one initiator. The SCSI specification requires initiators to provide TERMPWR to the SCSI bus.

Cable lengths

The ESS requires a total SCSI bus length that is no greater than 25 m (75 ft). The resulting configuration must meet any cable length limitations that are required by any attached SCSI device. Use only ESS supported cables that are 10 m (30 ft) and 20 m (60 ft) in length.

SCSI initiators and I/O queuing

SCSI host adapters support from 1 to 15 initiators on a SCSI bus. The number of initiators and the number of targets you define on the bus will be less than or equal to 16. The limit for the number of initiators that perform persistent reservations is 512 node ports.

Connecting the SCSI cables

Perform the following steps to connect the IBM Enterprise Storage Server (ESS) to your host system.

Attention: To avoid static discharge damage when you handle disk drive modules and other parts, observe the precautions in "Handling electrostatic discharge-sensitive components" on page 20.

1. Complete the installation and configuration procedures for the ESS identified in the *IBM Enterprise Storage Sever Introduction and Planning Guide*.

2. Install a SCSI adapter (interface card) in your host system by using the instructions in your host system documents.

   Note: Contact your IBM service support representative to install the 6501 adapter on the IBM AS/400. The 6501 adapter is a feature code.

3. Connect the SCSI cables to your host system.

   Note: Use caution when handling the SCSI cables, especially when aligning the connectors for plugging. You can damage the cables or plugs easily.

4. You or an IBM service support representative can attach the SCSI cables to the ESS.

5. If you are attaching a second host to the same SCSI interface card, ensure that each host adapter has a unique SCSI ID (address).

   Figure 9 on page 20 represents an ESS that is connected to two hosts.

```
┌─────────────┐                          ┌──────────┐
│ ESS         │                          │  First   │
│             │        SCSI cable        │          │
│             ├──────────────────────────┤  host    │
│             │                          └──────────┘
│             │
│             │
│             │                          ┌──────────┐
│             │                          │  Second  │
│             │        SCSI cable        │          │
│             ├──────────────────────────┤  host    │
│             │                          └──────────┘
└─────────────┘
```
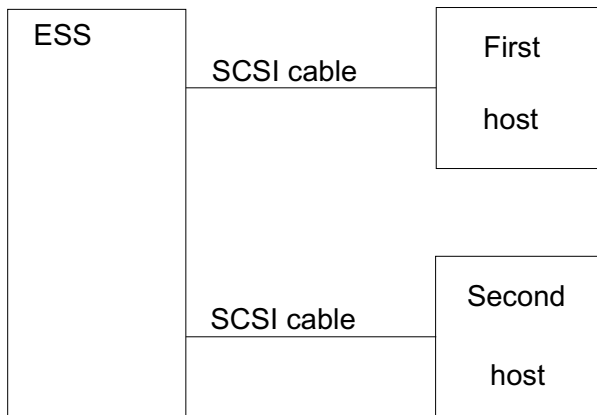
Figure 9. Connecting the ESS to two host systems

Handling electrostatic discharge-sensitive components

Observe the following precautions when handling disk drive modules and other parts to avoid causing damage from electrostatic discharge (ESD):

1. Keep the ESD-sensitive part in its original shipping container until you install the part in the machine.
2. Before you touch the ESD-sensitive part, discharge any static electricity in your body by touching the metal frame of the machine. Keep one hand on the frame when you install or exchange an ESD-sensitive part.
3. Hold the ESD-sensitive part by the plastic enclosure or the locking handles. Do not touch any connectors or electronic components.
4. When you hold the ESD-sensitive part, move as little as possible to prevent an increase of static electricity from clothing fibers, carpet fibers, and furniture.

Checking the attachment

Ensure that your installation meets the following requirements:

1. One or two ESSs and no other I/O devices are attached to each SCSI interface card.
2. Cables are connected correctly and are seated properly.

Solving attachment problems

If errors occur during the attachment procedure, the conditions listed below might be what is causing the problem:

1. Your host system has an incorrect SCSI ID.

   You or the service support representative can check the SCSI ID by using the service interface terminal.
2. The root file system is not large enough to add another device.

   You or the service support representative can increase the size of the root file system.

If a problem persists, contact your service provider.

LUN affinity

For SCSI attachment, logical unit numbers (LUNs) have an affinity to SCSI ports, independent of which hosts might be attached to the ports. If you attach multiple hosts to a single SCSI port, each host has the exact same access to all the LUNs available on that port.

Targets and LUNs

For SCSI attachment, each SCSI bus can attach a combined total of 16 initiators and targets. Because at least one of these attachments must be a host initiator, that leaves a maximum of 15 that can be targets. The ESS is capable of defining all 15 targets on each of its SCSI ports. Each can support up to 64 LUNs. The software in many hosts is only capable of supporting 8 or 32 LUNs per target, but the architecture allows for 64. Therefore, the ESS can support 960 LUNs per SCSI port (15 targets x 64 LUNs = 960).

FlashCopy and PPRC restrictions for open system hosts

When you copy a source volume to a target volume with FlashCopy or PPRC, and you require concurrent read/write access of both volumes, the source and target volumes should be on different host systems. A copy operation with the source and target volume on the same host system creates a target volume with the same identification as the source volume. The host system sees two identical volumes.

When the copy operation creates the same identification for the target volume as for the source volume you are not able to distinguish one from the other, so you might not be able to access the original data.

Note: You cannot create a host target on a single Novell NetWare host system. For Novell NetWare, the target volume must be attached to a second Novell NetWare host system.

The target volume and the source volume can be on the same host system for a PPRC or FlashCopy operation only under the following conditions:

- For AIX, when the host system is using a Logical Volume Manager (LVM) with **recreatevg** command support.
- For AIX, Sun, and HP, when the host system is **not** using an LVM.
- For any host system, when the host system can distinguish between a source and a target volume that have the same identification.

SCSI host system limitations

Table 1 shows the configuration limitations for the host systems. Device drivers, hardware, or different adapters that the host systems support cause limitations.

Table 1. Host system limitations

Host System	LUN Assignments per Target	Configuration Notes
Data General	0 - 7	None
HP 9000	0 - 7	None

Table 1. Host system limitations (continued)

Host System	LUN Assignments per Target	Configuration Notes
IBM AS/400	0 - 7	The target SCSI ID is always 6. Sixteen LUNs are supported for each feature code 6501. For ESS, the two ports on the feature code 6501 each support 8 drives at full capacity for RAID. Real 9337s running RAID-5 must account for parity. Therefore, the 8 drives provide the equivalent of a 7-drive capacity.
IBM Personal Computer Server	0 - 7	None
IBM RS/6000	0 - 31	AIX 4.3.3 supports 64 LUNs per target.
Sun Ultra A	0 - 7	None
Sun Ultra B	0 - 31	Use Solaris 2.6, 7 or 8. (Solaris 2.6 and 7 require a Solaris patch to enable 32 LUNs per target).
Windows NT	0 - 7	None
Windows 2000	0 - 7	None
Novell NetWare	0 - 31	None
Compaq	0 - 7	None
NUMA-Q (UNIX)	0 - 7	Use a minimum operating system level of DYNIX/ptx V4.4.7

Chapter 3. Attaching an ESS to a Windows NT 4.0 host system with SCSI adapters

This chapter tells you how to attach the IBM ESS to a Windows NT host system with SCSI adapters.

For procedures about how to attach an ESS to a Windows NT host system with fibre-channel adapters, see "Chapter 15. Attaching an ESS to a Windows NT 4.0 host system with fibre-channel adapters" on page 77.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:
- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  For details about the release level for your operating system, see the following Web site:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server.
1. The IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.
3. Either you or an IBM SSR configures the host system for the IBM Enterprise Storage Server by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.2.1 supports the Windows NT 4.0 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters supported is 16 for a total of 32 SCSI ports.

Note: To improve performance, IBM recommends that you map to the LUNs for the target volumes of the Windows NT or Windows 2000 host until you need access to the data on the target volume. Perform the LUN mapping after the PPRC operation and immediately before you need access to the data. You must restart the host system before you can access the data on the target volume. You greatly reduce the time it takes the host system to reboot by performing the LUN mapping. Otherwise, the time to reboot could take 10 minutes per PPRC target volume.

Attaching an ESS to a Windows NT host system

This section describes how to attach a Windows NT host system to an IBM ESS with the following adapter cards:

- Adaptec AHA-2944UW
- Symbios 8751D
- QLogic QLA1041

Installing and configuring the Adaptec AHA-2944UW adapter card

Note: The steps to install and configure adapter cards are examples. Your configuration might be different.

Perform the following steps to install and configure the Adaptec AHA-2944UW adapter card:

1. Install the Adaptec AHA-2944UW in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Ctrl+A to get to the **SCSISelect** menu.
5. From the **SCSISelect** menu, select **Advanced Configuration Options**.
   a. Set the parameters on the Advanced Configuration Options panel as follows:
      - Host Adapter SCSI ID: **7**
      - SCSI Parity Checking: **Enabled**
      - Host Adapter SCSI Termination: **Automatic**
      - Sync Transfer Rate (megabytes per second): **40.0**
      - Initiate Wide Negotiation: **Yes**
      - Enable Disconnection: **Yes**
      - Send Start Unit Command: **No**
      - Enable Write Back Cache: **No**
      - BIOs Multiple LUN Support: **Yes**
      - Include in BIOS Scan: **Yes**
   b. Set the parameters on the SCSI Device Configuration panel as follows:
      - Reset SCSI BIOS at IC Int: **Enabled**
      - Display Ctrl+A Message During BIOS: **Enabled**
      - Extend BIOS translation for DOS drives > 1 GB: **Enabled**
      - Verbose or Silent Mode: **Verbose**
      - Host Adapter BIOS: **Disabled:scan bus**
      - Support Removable Disks under Basic Input/Output System (BIOS) as fixed disks: **Disabled**
      - BIOS support for bootable CD-ROM: **Disabled**
      - BIOS support for INT 13 extensions: **Enabled**
   c. Save the changes and select **SCSISelect** again to verify that you saved the changes.
6. Restart the server.
7. Load the Adaptec drive, and restart the system if instructed to do so.

Installing and configuring the Symbios 8751D adapter card

Perform the following steps to install and configure the Symbios 8751D adapter card.

Note: The parameter settings shown are an example. The settings for your environment might be different.

1. Install the Symbios 8751D in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Ctrl+C to get to the **Symbios Configuration Utility** menu.
5. From the Symbios Configuration Utility menu, select **LSI Logic Host Bus Adapters**.

    a. Set the parameters on the LSI Logic Host Bus Adapters panel as follows:

       1) Press F2 at the opening panel.
       2) Select the Boot Adapter list option to display the boot adapter list. See Figure 10 for an example of the boot adapter list.

          Note: The boot adapter list shows only user-definable parameters.

```
Boot Order [0]
Next Boot [Off]
```

Figure 10. Example of boot adapter list for the Symbios 8751D adapter card for Windows NT

       3) Perform the following steps to change the BIOS settings:
          a) Change the setting to ON.
          b) Restart the host.
          c) Select the **Symbios Configuration Utility** again and make the changes.
          d) After you make the changes, change the setting back to OFF.
          e) Restart the host.
       1) Set the parameters on the Global Properties panel as follows:
          • Pause When Boot Alert Displayed: **[No]**
          • Boot Information Display Mode: **[Verbose]**
          • Negotiate With Devices: **[Supported]**
          • Video Mode: **[Color]**
          • Restore Defaults (restores defaults)
       2) Set the parameters on the Adapters Properties panel as follows:
          • SCSI Parity: **[Yes]**
          • Host SCSI ID: **[7]**
          • SCSI Bus Scan Order: **[Low to High (0..Max)]**
          • Removable Media Support: **[None]**
          • CHS Mapping: **[SCSI Plug and Play Mapping]**
          • Spinup Delay (Secs): **[2]**
          • Secondary Cluster Server: **[No]**
          • Termination Control: **[Auto]**
          • Restore Defaults: (restores defaults)

3) Set the parameters on the Device Properties panel as follows:
   - MT or Sec: **[20]**
   - Data Width: **[16]**
   - Scan ID: **[Yes]**
   - Scan LUNs >0: **[Yes]**
   - Disconnect: **[On]**
   - SCSI Timeout: **<240>**
   - Queue Tags: **[On]**
   - Boot Choice: **[No]**
   - Format: **[Format]**
   - Verify: **[Verify]**
   - Restore defaults: (restores defaults)

4) Save the changes and select **Symbios Configuration Utility** again to verify that you saved the changes.

6. Restart the server.
7. Load the Symbios driver, and restart the system if instructed to do so.

Installing and configuring the QLogic adapter card

Perform the following steps to install and configure the QLogic QLA1041 adapter card.

Note: The parameter settings shown are an example. The settings for your environment might be different.

1. Install the QLogic QLA1041 adapter card in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Alt+Q to get to the **FAST!Util** menu.

   a. From the **Configuration Settings** menu, select **Host Adapter Settings**. Set the following parameters:
      - Host Adapter: **Enabled**
      - Host Adapter BIOS: **Disabled**
      - Host Adapter SCSI ID: **7**
      - PCI Bus direct memory access (DMA) Burst: **Enabled**
      - Compact disc Boot: **Disabled**
      - SCSI Bus Reset: **Enabled**
      - SCSI Bus Reset Delay: **5**
      - Concurrent Command or Data: **Enabled**
      - Drivers Load RISC Code: **Enabled**
      - Adapter Configuration: **Auto**

   b. Set the parameters in the **SCSI Device Settings** menu as follows:
      - Disconnects OK: **Yes**
      - Check Parity: **Yes**
      - Enable LUNS: **Yes**
      - Enable Devices: **Yes**
      - Negotiate Wide: **Yes**
      - Negotiate Sync: **Yes**

- Tagged Queueing: **Yes**
- Sync Offset: **8**
- Sync Period: **12**
- Exec Throttle: **16**

    c. Save the changes and select **FAST!Util** again to verify that you saved the changes.

5. Restart the server.
6. Load the Qlogic driver, and restart the system if instructed to do so.

Configuring for availability and recoverability for a Windows NT host system

This section describes how to ensure optimum availability and recoverability when you attach an IBM ESS to a Windows NT host system. You must set the timeout value associated with the supported host bus adapters to 240 seconds. The setting is consistent with the configuration for IBM SSA adapters and disk subsystems when attached to Windows NT host system.

The host bus adapter uses the timeout parameter to bound its recovery actions and responses to the disk subsystem. The value exists in different places in the system configuration. You can retrieve and use it in different ways depending on the type of host bus adapter. The following instructions tell you how to modify the value safely in either the Windows NT registry or in the device adapter parameters.

Setting the TimeOutValue registry
The following instructions tell you how to set the timeout value registry:

1. From the **Run** menu or command prompt, type:

   `Regedt32.exe`

2. Navigate to the following registry key:

   `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Disk`

3. Look for the value called `TimeOutValue`. If the value called `TimeOutValue` does not exist, go to step 3a. If the `TimeOutValue` exists, go to step 4.

   a. Click **Edit -> Add Value...**
   b. For ValueName, click: **TimeOutValue**
   c. For data type, click: **REG_DWORD**
   d. Click **OK**
   e. For data, click: **f0**
   f. For radix, click: **Hex**
   g. Click **OK**

4. If the value exists and is less than 0x000000f0 (240 decimal), perform the following steps to increase it to 0xf0.

   a. Click **TimeOutValue**
   b. Click **Edit -> DWORD...**
   c. For data, click : **f0**
   d. For radix, click : **hex**
   e. Click **OK**

5. Exit the Regedt32 program.
6. Restart your Windows NT server for the changes to take effect.

Performing a FlashCopy from one volume to another volume

Perform the following steps to perform a FlashCopy from one Windows NT 4.0 volume to another volume. Before you perform the steps, you must log on with administrator authority. The following steps assume you perform the steps from the host where the FlashCopy target is.

1. From the taskbar, click **Start**.
2. From the Start menu, click **Programs**.
3. From the Programs menu, click **Administrative Tools**.
4. From the Administrative Tools menu, click **Disk Administrator**.

   This action displays the Disk Administrator error message window. Click **OK**.
5. From the Disk Administrator dialogue box, select the disk drive letter that is your target.
6. From the menu bar, click **Tools**.
7. From the Tools pull down menu, click **Assign Drive letter**.
8. From the Assign Driver letter window, click the radio button for **Do Not Assign a Drive Letter**. Click **OK**.
9. Perform the FlashCopy operation.

   Note: If the ESS uses the volume serial numbers to do a FlashCopy on a Windows NT host system, use the IBM Subsystem Device Driver to obtain the volume serial numbers.
10. Go back to the Disk Administrator and select the FlashCopy target.
11. From the menu bar, click **Tools**.
12. Click **Assign the drive letter**.
13. From the Assign Driver letter window, click the radio button for **Select the Assigned Drive letter**. Click **OK**.

Chapter 4. Attaching an ESS to a Windows 2000 host system with SCSI adapters

This chapter tells you how to attach the IBM ESS to a Windows 2000 host system with SCSI adapters.

For procedures about how to attach an ESS to a Windows 2000 host system with fibre-channel adapters, see "Chapter 16. Attaching an ESS to a Windows 2000 host system with fibre-channel adapters" on page 83.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:
- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  For details about the release level for your operating system, see the following Web site:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server.
1. The IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.
3. Either you or an IBM SSR configures the host system for the IBM Enterprise Storage Server by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.2.1 supports the Windows NT 4.0 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters supported is 16 for a total of 32 SCSI ports.

Note: To improve performance, IBM recommends that you map to the LUNs for the target volumes of the Windows NT or Windows 2000 host until you need access to the data on the target volume. Perform the LUN mapping after the PPRC operation and immediately before you need access to the data. You must restart the host system before you can access the data on the target volume. You greatly reduce the time it takes the host system to reboot by performing the LUN mapping. Otherwise, the time to reboot could take 10 minutes per PPRC target volume.

Attaching an ESS to a Windows 2000 host system

This section describes how to attach a Windows 2000 host system to an IBM ESS with the following adapter cards:

- Adaptec AHA-2944UW
- Symbios 8751D
- QLogic QLA1041

Installing and configuring the Adaptec AHA-2944UW adapter card

Note: The steps to install and configure adapter cards are examples. Your configuration might be different.

Perform the following steps to install and configure the Adaptec AHA-2944UW adapter card:

1. Install the Adaptec AHA-2944UW in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Ctrl+A to get to the **SCSISelect** menu.
5. From the **SCSISelect** menu, select **Advanced Configuration Options**.
   a. Set the parameters on the Advanced Configuration Options panel as follows:
      - Host Adapter SCSI ID: **7**
      - SCSI Parity Checking: **Enabled**
      - Host Adapter SCSI Termination: **Automatic**
      - Sync Transfer Rate (megabytes per second): **40.0**
      - Initiate Wide Negotiation: **Yes**
      - Enable Disconnection: **Yes**
      - Send Start Unit Command: **No**
      - Enable Write Back Cache: **No**
      - BIOS Multiple LUN Support: **Yes**
      - Include in BIOS Scan: **Yes**
   b. Set the parameters on the SCSI Device Configuration panel as follows:
      - Reset SCSI BIOS at IC Int: **Enabled**
      - Display Ctrl+A Message During BIOS: **Enabled**
      - Extend BIOS translation for DOS drives > 1 GB: **Enabled**
      - Verbose or Silent Mode: **Verbose**
      - Host Adapter BIOS: **Disabled:scan bus**
      - Support Removable Disks under Basic Input/Output System (BIOS) as fixed disks: **Disabled**
      - BIOS support for bootable CD-ROM: **Disabled**
      - BIOS support for INT 13 extensions: **Enabled**
   c. Save the changes and select **SCSISelect** again to verify that you saved the changes.
6. Restart the server.
7. Load the Adaptec drive, and restart the system if instructed to do so.

Installing and configuring the Symbios 8751D adapter card

Perform the following steps to install and configure the Symbios 8751D adapter card.

Note: The parameter settings shown are an example. The settings for your environment might be different.

1. Install the Symbios 8751D in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Ctrl+C to get to the **Symbios Configuration Utility** menu.
5. From the Symbios Configuration Utility menu, select **LSI Logic Host Bus Adapters**.

   a. Set the parameters on the LSI Logic Host Bus Adapters panel as follows:

      1) Press F2 at the opening panel.
      2) Select the Boot Adapter list option to display the boot adapter list. See Figure 11 for an example of the boot adapter list.

         Note: The boot adapter list shows only user-definable parameters.

```
Boot Order [0]
Next Boot [Off]
```

Figure 11. Example of boot adapter list for the Symbios 8751D adapter card for Windows 2000

      3) Perform the following steps to change the BIOS settings:
         a) Change the setting to ON.
         b) Restart the host.
         c) Select the **Symbios Configuration Utility** again and make the changes.
         d) After you make the changes, change the setting back to OFF.
         e) Restart the host.
      1) Set the parameters on the Global Properties panel as follows:
         * Pause When Boot Alert Displayed: **[No]**
         * Boot Information Display Mode: **[Verbose]**
         * Negotiate With Devices: **[Supported]**
         * Video Mode: **[Color]**
         * Restore Defaults (restores defaults)
      2) Set the parameters on the Adapters Properties panel as follows:
         * SCSI Parity: **[Yes]**
         * Host SCSI ID: **[7]**
         * SCSI Bus Scan Order: **[Low to High (0..Max)]**
         * Removable Media Support: **[None]**
         * CHS Mapping: **[SCSI Plug and Play Mapping]**
         * Spinup Delay (Secs): **[2]**
         * Secondary Cluster Server: **[No]**
         * Termination Control: **[Auto]**

- Restore Defaults: (restores defaults)
  3) Set the parameters on the Device Properties panel as follows:
     - MT or Sec: **[20]**
     - Data Width: **[16]**
     - Scan ID: **[Yes]**
     - Scan LUNs >0: **[Yes]**
     - Disconnect: **[On]**
     - SCSI Timeout: **<240>**
     - Queue Tags: **[On]**
     - Boot Choice: **[No]**
     - Format: **[Format]**
     - Verify: **[Verify]**
     - Restore defaults: (restores defaults)
  4) Save the changes and select**Symbios Configuration Utility** again to verify that you saved the changes.
6. Restart the server.
7. Load the Symbios driver, and restart the system if instructed to do so.

Installing and configuring the QLogic adapter card

Perform the following steps to install and configure the QLogic QLA1041 adapter card.

Note: The parameter settings shown are an example. The settings for your environment might be different.

1. Install the QLogic QLA1041 adapter card in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Alt+Q to get to the **FAST!Util** menu.
   a. From the **Configuration Settings** menu, select **Host Adapter Settings**. Set the following parameters:
      - Host Adapter: **Enabled**
      - Host Adapter BIOS: **Disabled**
      - Host Adapter SCSI ID: **7**
      - PCI Bus direct memory access (DMA) Burst: **Enabled**
      - Compact disc Boot: **Disabled**
      - SCSI Bus Reset: **Enabled**
      - SCSI Bus Reset Delay: **5**
      - Concurrent Command or Data: **Enabled**
      - Drivers Load RISC Code: **Enabled**
      - Adapter Configuration: **Auto**
   b. Set the parameters in the **SCSI Device Settings** menu as follows:
      - Disconnects OK: **Yes**
      - Check Parity: **Yes**
      - Enable LUNS: **Yes**
      - Enable Devices: **Yes**
      - Negotiate Wide: **Yes**

- Negotiate Sync: **Yes**
- Tagged Queueing: **Yes**
- Sync Offset: **8**
- Sync Period: **12**
- Exec Throttle: **16**

   c. Save the changes and select **FAST!Util** again to verify that you saved the changes.

5. Restart the server.
6. Load the Qlogic driver, and restart the system if instructed to do so.

Configuring for availability and recoverability for a Windows 2000 host system

This section describes how to ensure optimum availability and recoverability when you attach an IBM ESS to a Windows 2000 host system. You must set the timeout value associated with the supported host bus adapters to 240 seconds. The setting is consistent with the configuration for IBM SSA adapters and disk subsystems when attached to Windows 2000 host system.

The host bus adapter uses the timeout parameter to bound its recovery actions and responses to the disk subsystem. The value exists in different places in the system configuration. You can retrieve and use it in different ways depending on the type of host bus adapter. The following instructions tell you how to modify the value safely in either the Windows 2000 registry or in the device adapter parameters.

Setting the TimeOutValue registry

The following instructions tell you how to set the timeout value registry:

1. From the **Run** menu or command prompt, type:

   `Regedt32.exe`

2. Navigate to the following registry key:

   `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Disk`

3. Look for the value called `TimeOutValue`. If the value called `TimeOutValue` does not exist, go to step 3a. If the value called `TimeOutValue` exists, go to step 4.

   a. Click **Edit -> Add Value...**
   b. For ValueName, click: **TimeOutValue**
   c. For data type, click: **REG_DWORD**
   d. Click **OK**
   e. For data, click: **f0**
   f. For radix, click: **Hex**
   g. Click **OK**

4. If the value exists and is less than 0x000000f0 (240 decimal), perform the following steps to increase it to 0xf0.

   a. Click **TimeOutValue**
   b. Click **Edit -> DWORD...**
   c. For data, click : **f0**
   d. For radix, click : **hex**
   e. Click **OK**

5. Exit the Regedt32 program.
6. Restart your Windows 2000 server for the changes to take effect.

Performing a FlashCopy from one volume to another volume

Perform the following steps to perform a basic FlashCopy from one Windows 2000 volume to another volume. Before you perform the steps, you must log on with administrator authority. The following steps assume you perform the steps from the host where the FlashCopy target is.

1. Perform the FlashCopy operation.
2. Restart the server that has the target volume.
3. From the taskbar, click **Start**.
4. From the Start menu, click **Programs**.
5. From the Programs menu, click **Administrator**.
6. From the Administrator menu, click **Computer Management**.
7. From the Computer Management menu, click **Disk Management** to launch Disk Management.

   This assigns the drive letter to the target if needed.

If the volume is in the basic mode, you are finished.

If the volume is in dynamic mode, perform the following steps:

1. Perform the FlashCopy operation.

   Note: If the ESS uses the volume serial numbers to do a FlashCopy on a Windows 2000 host system, use the IBM Subsystem Device Driver to obtain the volume serial numbers.

2. Restart the host machine (target).
3. From the taskbar, click **Start**.
4. From the Start menu, click **Programs**.
5. From the Programs menu, click **Administrator**.
6. From the Administrator menu, click **Computer Management**.
7. From the Computer Management menu, click **Disk Management** to launch Disk Management.
8. Find the disk that is associated with your volume.

   There are two panels for each disk. The panel on the left should read Dynamic and Foreign. It is probable that no drive letter will be associated with that volume.

9. Right click on that panel and select **Import Foreign Disks**. Select OK, then OK again.

   The volume now as a drive letter assigned to it. It is defined as Simple Layout and Dynamic Type. You can read and write to that volume.

10. Run CHKDSK if requested by Windows 2000.

Chapter 5. Attaching an ESS to a Novell NetWare host system with SCSI adapters

This section describes how to attach a Novell NetWare host system to an IBM ESS with the following adapter cards:

- Adaptec AHA-2944UW
- QLogic QLA1041

Note: The steps to install and configure adapter cards are examples. Your configuration might be different.

Installing and configuring the Adaptec adapter card

Perform the following steps to install and configure the Adaptec AHA-2944UW adapter card.

Note: The parameter settings shown are examples. The settings for your environment might be different.

1. Install the Adaptec AHA-2944UW on the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Ctrl+A to get to the **SCSISelect** menu.
   a. Set the parameters on the Advanced Configuration Options panel as follows:
      - Host Adapter SCSI ID: **7**
      - SCSI Parity Checking: **Enabled**
      - Host Adapter SCSI Termination: **Automatic**
      - Sync Transfer Rate (megabytes per second): **40.0**
      - Initiate Wide Negotiation: **Yes**
      - Enable Disconnection: **Yes**
      - Send Start Unit Command: **No**
      - Enable Write Back Cache: **No**
      - BIOS Multiple LUN Support: **Yes**
      - Include in BIOS Scan: **Yes**
   b. Set the parameters on the SCSI Device Configuration panel as follows:
      - Reset SCSI BIOS at IC Int: **Enabled**
      - Display Ctrl+A Message During BIOS: **Enabled**
      - Extend BIOS translation for DOS drives > 1 GB: **Enabled**
      - Verbose or Silent Mode: **Verbose**
      - Host Adapter BIOS: **Disabled:scan bus**
      - Support Removable Disks under BIOS as fixed disks: **Disabled**
      - BIOS support for bootable CD-ROM: **Disabled**
      - BIOS support for INT 13 extensions: **Enabled**
   c. Save the changes and select **SCSISelect** again to verify that you saved the changes.
5. Restart the server.

6. With NetWare 5, use the **nwconfig** command; with NetWare 4.2, use the **load install** command. Type the command on the command line.
7. Load the AHA2940.ham file (version 7.0) by using the disk driver option.
8. Edit the startup.ncf file and make sure that the load statement looks like the following example:

```
LOAD AHA2940.ham  SLOT=x lun_enable=ff
```

where *x* is the slot number of the adapter.
9. Save the startup.ncf file.
10. Edit the autoexec.ncf file and add the following text to the end of the file:

```
SCAN ALL LUNS
```

11. Save the file.
12. Restart the server.
13. At the system console, type the following commands:

```
SCAN FOR NEW DEVICES
LIST DEVICES
```

A list of devices is displayed.
14. Partition the devices and make volume groups.

Installing and configuring the QLogic QLA1041 adapter card

Perform the following steps to install and configure the QLogic QLA1041 adapter card.

Note: The parameter settings shown are an example. The settings for your environment might be different.

1. Install the QLogic QLA1041 adapter card in the server.
2. Connect the cable to the ESS port.
3. Start the server.
4. Press Alt+Q key to get to the **FAST!Util** menu.
   a. From the **Configuration Settings menu**, select **Host Adapter Settings**. Set the following parameters:
      - Host Adapter: **Enabled**
      - Host Adapter BIOS: **Disabled**
      - Host Adapter SCSI ID: **7**
      - PCI Bus DMA Burst: **Enabled**
      - CD ROM Boot: **Disabled**
      - SCSI Bus Reset: **Enabled**
      - SCSI Bus Reset Delay: **5**
      - Concurrent Command or Data: **Enabled**
      - Drivers Load RISC Code: **Enabled**
      - Adapter Configuration: **Auto**
   b. Set the parameters in the **SCSI Device Settings** menu as follows:
      - Disconnects OK: **Yes**
      - Check Parity: **Yes**
      - Enable LUNS: **Yes**
      - Enable Devices: **Yes**

- Negotiate Wide: **Yes**
- Negotiate Sync: **Yes**
- Tagged Queueing: **Yes**
- Sync Offset: **8**
- Sync Period: **12**
- Exec Throttle: **16**

   c. Save the changes and select **FAST!Util** again to verify that you saved the changes.

5. Restart the server.
6. With NetWare 5, use the **nwconfig** command; with NetWare 4.2, use the **load install** command. Type the command on the command line.
7. Load the QL1000.ham file (version 1.27) by using the disk driver option.
8. Edit the startup.ncf file, and make sure that the load statement looks like the following example:

   ```
   LOAD QL1000.HAM SLOT=x
   ```

   where *x* is the slot number of the adapter.
9. Save the file.
10. Edit the autoexec.ncf file, and add the following text to the end of the file:

    ```
    SCAN ALL LUNS
    ```
11. Save the file.
12. Restart the server.
13. At the system console, type the following commands:

    ```
    SCAN FOR NEW DEVICES
    LIST DEVICES
    ```

    A list of all the devices is displayed.
14. Partition the devices and make volume groups.

Chapter 6. Attaching an ESS to a Hewlett Packard 9000 host system with SCSI adapters

This chapter describes the host system requirements and provides procedures to attach an ESS to a Hewlett Packard 9000 host system with SCSI adapters. For procedures about how to attach an ESS to Hewlett Packard 9000 host system with fibre-channel adapters, see "Chapter 18. Attaching an ESS to a Hewlett Packard 9000 host system with fibre-channel adapters" on page 93.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Ensure that you have the installation script files. The script file is on the compact disc that you receive with the ESS.
- Ensure that you have 1 MB minimum of hard disk space available to install the 2105inst script file.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details about the release level for your operating system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

- Check the logical unit number limitations for your host system. See Table 1 on page 21.

Note: You must have special SCSI cables to attach the ESS to a Hewlett Packard host that has program-controlled interruption (PCI) adapters installed. The SCSI cables have built-in terminators on the host end. See the following Web site for information about the special SCSI cable to attach the ESS to a Hewlett Packard host that has PCI adapters installed:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server.

1. The IBM SSR installs the IBM ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either your or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

3. Either you or an IBM SSR configures the host system for the IBM ESS by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver does not support the Hewlett Packard hosts in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters

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supported is 16 for a total of 32 SCSI ports. For the HP-UX operating system
11.0, the IBM Subsystem Device Driver supports 64-bit mode.

Instructions for installing the 2105inst script

This section provides the instructions to install the 2105inst script file from a
compact discs for the ESS on your host system. You must have superuser authority
to complete the instructions.

Before installing the 2105inst script, connect the host system to the ESS. See
"Chapter 2. Attaching an ESS to an open system host with SCSI adapters" on
page 17.

Install the 2105inst script from a compact disc. You must have superuser authority
to complete these instructions.

Notes:
1. You can only install and run the IBM 2105 set queue depth program (version
   2.7.1.00) on the HP-UX operating system 10.01 or later.
2. You can change the queue depth for an HP-UX N class from 8 to 21.
3. You cannot change the queue depth for an HP-UX L class from 8 to 21.

Perform the following steps to install the 2105inst script from a compact disc.
1. If you do not already have a directory called /SD_CDROM, type `mkdir /SD_CDROM`
   to create a new directory.
2. Insert the compact disc into the CD-ROM drive.
3. Mount the drive as a file system.
4. Type: `ioscan -fnkC disk`

   After you type `ioscan -fnkC disk`, look for the device name on the list with a
   name of either compact disc or DVD.
5. Type: `mount -o cdcase /dev/dsk/c_t_d_ /SD_CDROM`

   Replace /dev/dsk/c_t_d_ with the device special file found in step 4.
6. Type: `swinstall -s /SD-CDROM/hp-ux/ibmis.depot`
7. Type `swinstall -s /var/spool/sw/ibm2105`
8. From the Software Selection window, click **IBM2105 product.**
9. From the **Action** menu click **Mark for Install**.
10. When you see the word Yes next to the IBM2105 product, go to the **Action**
    menu and click **Install**.
11. When the analysis completes with no errors (Status- Ready), click **OK**.
12. Click **Yes** in the Confirmation window to begin the installation.

    A dialogue box is displayed, notifying you that installation is complete and that
    the system needs to be restarted.
13. Click **OK** to continue

Chapter 7. Attaching an ESS to a Sun host system with SCSI adapters

This chapter tells you how to attach an IBM Enterprise Storage Server to a Sun Microsystem host system with SCSI adapters. You must install the SCSI adapters in the Sun host system before you start. For procedures on how to attach an ESS to a Sun Microsystems host with fibre-channel adapters, see "Chapter 19. Attaching an ESS to a Sun host system with fibre-channel adapters" on page 95.

Attachment requirements

This section lists the requirements to attach the ESS to your host system.

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the logical unit number limitations for your host system. See Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

Solaris 2.6, Solaris 2.7 and Solaris 8 require patches to ensure the host and Enterprise Storage Server function correctly. See table Table 2 for the minimum revision level required for each Solaris patch ID.

Table 2. Solaris 2.6, 2.7 and 8 minimum revision level patches for SCSI

Solaris 2.6	Solaris 7	Solaris 8
105181-23 kernel update	106541-12 kernel update	108528-03 kernel update
105356-16 sd, ssd drivers	106924-06 isp driver	109524-02 ssd driver
105580-16 glm driver	106925-04 glm driver	109657-01 isp driver
105600-19 isp driver	107147-08 pci driver	108974-03 sd, uata drivers
-	107458–10 dad, sd, ssd, uata drivers	-

Review the Sun host SCSI adapter device driver installation and configuration utility documents for additional Solaris patches that you might need.

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server. The tasks are shown in the recommended sequence.

See the following Web site for details about the release level for your operating system:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

1. The IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

3. Either you or an IBM SSR configures the host system for the ESS. Use the instructions in your host system publications.

For a list of supported servers, host adapters, operating systems, application software, APARs, and firmware, see the following Web site:

http://www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Note: The IBM Subsystem Device Driver does not support the Sun host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters supported is 16 for a total of 32 SCSI ports. The two IBM Subsystem Device Drivers for Sun host systems support:

- Sun host hardware platforms limited to 32-bit mode and all Sun host systems running Solaris 2.6.
- Sun host hardware platforms with 64-bit mode capabilities running Solaris 7 or Solaris 8.

Mapping hardware

Perform the following steps to map the hardware if your host is not turned on:

1. Turn on the Sun host system and wait for the host to perform the self-tests.
2. Press Stop+A.
3. Type `printenv` at the console prompt.
4. Review the list that displays to determine the value of the scsi_initiator_id.

   The target ID is reserved for the system and must not be used by another device.

Perform the following steps to map the hardware if your host is turned on:

1. Type `eeprom` at the console prompt.
2. Review the list that displays to determine the value of the scsi_initiator_id.

   The target ID is reserved for the system and must not be used by another device.

Configuring host device drivers

The following instructions explain how to update device driver configuration files on the Sun host to enable access to target and LUN pairs configured on the ESS.

1. Change to the device driver configuration subdirectory by typing:

   `cd /kernel/drv`
2. Backup the sd.conf file in the subdirectory.
3. Edit the sd.conf file to add support for the target and LUN pairs configured on the ESS. Figure 12 on page 43 shows the lines requires to access LUNs 0 - 7 on target 8.

   Note: Do not add duplicate target and LUN pairs.

```
name="sd" class="scsi"
target=8 lun=0;
name="sd" class="scsi"
target=8 lun=1;
name="sd" class="scsi"
target=8 lun=2;
name="sd" class="scsi"
target=8 lun=3;
name="sd" class="scsi"
target=8 lun=4;
name="sd" class="scsi"
target=8 lun=5;
name="sd" class="scsi"
target=8 lun=6;
name="sd" class="scsi"
target=8 lun=7;
```

Figure 12. Example of sd.conf file entries

4. If you attach the ESS to a Sun host through a PCI SCSI adapter, continue to step 5. If not, skip to step 7.

5. If the glm.conf file exists, back it up to the /kernel/drv subdirectory.

6. If you are running Solaris 2.6, edit the glm.conf file and add the following lines to enable support for LUNs 8-32:

```
device-type-scsi-options-list=
"IBM     2105F20          ", "ibm-scsi-options";
ibm-scsi-options = 0x107f8;
```

If you are running Solaris 7 or Solaris 8, edit the glm.conf file and add the following lines to enable support for LUNs 8 - 32:

```
device-type-scsi-options-list=
"IBM     2105F20          ", "ibm-scsi-options";
ibm-scsi-options = 0x407f8;
```

Note: The ESS inquiry information in these examples (IBM 2105F20), must include eight characters of vendor information (IBM and five spaces), followed by 16 characters of product information (2105F20 and nine spaces). The examples show the inquiry data for the IBM 2105 Model F20. The actual product information must match the model being attached.

7. Type either `reboot -- -r` from the Open Windows panel to shut down and restart the Sun host system with the kernel reconfiguration option or type `boot -r` from the `ok` prompt after you shut down.

Descriptions for setting scsi_options in /etc/system

You can configure the scsi_options variable in the Solaris 2.x kernel to enable or disable particular capabilities. For example, you can set the scsi_options in the /etc/system file. The default scsi_options variable allows the widest range of capabilities that the SCSI host adapter provides.

The default scsi_options value on Solaris 2.x works for 5 MB and 10 MB devices. The driver negotiates with each device to determine if it is 10 MB transfer capable or not. If they are 10 MB devices, 10 MB transfer will be used. If not, 5 MB transfer will be used.

If a particular capability is needed to be enabled or disabled the following definitions can be used.

The following is a list of SCSI subsystem options:

- Bits 0 to 2 are reserved for debugging or informational level.
- Bit 3 is reserved for a global disconnect/reconnect switch.
- Bit 4 is reserved for a global linked command capability switch.
- Bit 5 is reserved for a global synchronous SCSI capability switch.

All other bits are reserved for future use.

For example, a line in the /etc/system that reads:

```
set scsi_options=0x3f8
```

This example allows you to specify default options that allow wide SCSI, fast SCSI, tagged commands, global parity, and synchronous transfer linked commands, and global disconnect or reconnect.

In the /etc/system file, ensure the mark scsi_options has the following values. For Solaris 2.4, 2.5 or higher, include the following entry in the /etc/system file:

```
set scsi_options = 0x3F8
```

See Table 3 for an example of the SCSI options.

Table 3. Example of SCSI options

Bit	Mask	Meaning
3	0x08	Disconnect enable
4	0x10	Linked commands enable
5	0x20	Synchronous transfer enable
6	0x40	Parity support enable
7	0x80	Command tagged queuing
8	0x100	Fast SCSI enable
9	0x200	Wide SCSI enable

Installing the IBM Subsystem Device Driver

The following instructions explain how to install the IBM Subsystem Device Driver from a CD-R. You can use the IBM Subsystem Device Driver in conjunction with the IBM command-line interface program.

1. To ensure that volume manager is running, type `ps -ef | grep vold`

   This command shows the /usr/sbin/vold output. If it does not display, type: `/etc/init.d/volmgt start`

2. Insert the IBM Subsystem Device Driver CD-R into the CD-ROM drive.

   A File Manager window is displayed showing the paths for the Subsystem Device Driver package subdirectories. Figure 13 on page 45 shows an example of the path.

```
/cdrom/unnamed_cdrom
```

Figure 13. Example of the path you see when you insert the IBM Subsystem Device Driver CD-R

3. Change to the subdirectory that contains the Subsystem Device Driver package.

   a. For Sun host hardware platforms limited to 32-bit mode, and for all Sun host systems running Solaris 2.6, type:

      ```
      cd /cdrom/unnamed_cdrom/Sun32bit
      ```

   b. For Sun host hardware platforms with 64-bit capabilities running Solaris 7 or Solaris 8 type:

      ```
      cd /cdrom/unnamed_cdrom/Sun64bit
      ```

4. To initiate the package add menu, type `pkgadd -d`.

5. Select the option number for the IBM DPO driver (IBMdpo) and press Enter.

6. Select **y** to continue the installation for all prompts until the package installation is complete

7. Select **q** and press Enter to exit the package options menu.

8. Type `cd` to change back to the root directory.

9. To remove the Subsystem Device Driver CD-R, type `eject cdrom`. Press Enter.

10. Edit the .profile file in the root directory and add the following lines shown in the following example to include the IBM DPO subdirectory in the system path.

    ```
    PATH=$PATH:/opt/IBMdpo/bin
    export PATH
    ```

The IBM DPO driver subdirectory will automatically be added to the path where the system is started.

Setting Sun host system parameters

The following procedures explain how to set the Sun host system parameters for optimum performance on the ESS.

* Type `cd /etc` to change to the /etc subdirectory.
* Backup the system file in the /etc subdirectory.
* Edit the system file to set the following parameters:
  – sd_max_throttle

    This parameter specifies the maximum number of commands that the sd driver will queue to the host bus adapter driver. The default value is 256, but you must set the parameter to a value less or equal to a maximum queue depth for each LUN connected. Determine the value with the following formula: 256/(LUNs per adapter)

    The format shows thirty two 2105 LUNs attached to controller 1, (c1t#d#), and forty eight 2105 LUNs attached to controller 2, (c2t#d#). The value for sd_max_throttle is calculated using the controller with the highest number of LUNs attached. The sd_max_throttle parameter for the ESS LUNs in this example would be set by adding the following line to the /etc/system file:

    ```
    set sd:sd_max_throttle=5
    ```

  – sd_io_time

    This parameter specifies the timeout value for disk operations. Add the following lines to the /etc/system file to set the sd_io_time parameter for the ESS LUNs:

```
set sd:sd:_io_time=0xf0
```
– sd_retry_count

This parameter specifies the retry count for disk operations. Add the following lines to the /etc/system file to set the sd_retry_count parameter for the ESS LUNs

```
set sd:sd_retry_count=10
```
– maxphys

This parameter specifies the maximum number of bytes you can be transfer for each SCSI transaction. The default value is 126976 (124KB). If the I/O block size requested exceeds the default value, the request is broken into more then one request. The value should be tuned to the intended use and application requirements. For maximum bandwidth set the maxphys parameter by adding the following line to the /etc/system file:

```
set maxphys=8388608
```

If you are using Veritas volume manager on the ESS LUNs, you must set the VxVM max I/O size parameter, (vol_maxio), to match the maxphys parameter. If you set the maxphys parameter to 8388608 you will need to add the following line to the /etc/system file to set the VxVM I/O size also to 8 MB:

```
set vxio:vol_maxio=16384
```

Chapter 8. Attaching an ESS to a Compaq host system with SCSI adapters

This chapter describes the host system requirements and provides the procedure to attach a Compaq AlphaServer to an ESS.

For information about the Compaq AlphaServers models that you can attach to the ESS, see the following Web site:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Attachment requirements

This section lists the requirements to attach the ESS to your host system.

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the logical unit number limitations for your host system. See Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details about the release level for your operating system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server. The tasks are shown in the recommended sequence.

1. An IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

3. Either you or an IBM SSR configures the host system for the ESS. Use the instructions in your host system publications.

Note: The IBM Subsystem Device Driver does not support the Compaq open system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters supported is 16 for a total of 32 SCSI ports.

Installing and configuring the Compaq Tru64 UNIX Version 4.0x

Use the following procedures to install and configure the IBM ESS disk drives on a Compaq Tru64 UNIX Version 4.0x.

Console device check

The following procedures tell you how to perform a console device check.

1. Push the halt button to turn on the AlphaServer.

   The system performs self-test diagnostics and responds with the console prompt >>>.

2. Type `show device` at the >>> prompt to list the devices available to the AlphaServer.

   The system responds with a list of controllers and disks that are connected to the system. In the description field on the right of the screen, you should see a list of all devices assigned by the ESS. Disk devices begin with the letters dk.

   If you do not see a list of devices, verify the SCSI connections, connectors, and terminators on the bus. If you still do not see a list of devices, check the ESS to ensure that the ESS is operating correctly.

3. When the list of the devices is displayed on your screen, type `Boot` to restart the system.

Operating system device recognition

After the system has restarted, perform the following steps to verify that UNIX recognizes the disks:

1. Open two new terminal windows.

2. Type `uerf -R 300|more` on the command line in each of the windows.

   A list of device names that begin with the letters rz displays in each window. For example, device names should look like the following:

   `rz28, rz29, rzb28, and rzb29`

3. Compare the lists to determine which ESS devices you want to add to the system.

Device special files

If you install a serial storage architecture (SSA) device after the initial operating system installation, you must make the device special files that create the character devices needed for file systems. Perform the following steps:

1. Type: `# cd /dev`

2. Type: `# ./MAKEDEV rzxx`, where *xx* is the device name number.

   Type `# ./MAKEDEV rzxx`, where *xx* is the device name number for each new drive you installed in the SSA device.

Initializing disk drives

After the list of devices have been determined, you must label the disk volume sizes. Perform the following steps to label the disks:

1. Write the new label by typing: `#disklabel —rw rz28 ESS`

2. Verify the label by typing: `#disklabel rz28`

The `#disklabel rz28` command shows the new partition layouts on the disk Compaq Tru64 and automatically detects the units provided by the serial storage architecture (SSA).

Configuring AdvFS

Before you create an AdvFS file system, you must design a structure by assigning a file domain and the file sets. Perform the following steps to create an AdvFS file system with file sets:

1. Type: # cd /
2. Type: # mkfdmn –rw /dev/rzXc vol1_dom
3. Type: # mkfset vol1_dom vol1
4. Type: # mkdir /vol1 # mount vol1_dom#vol1 /vol1

To display all mounted devices, type: df -k

Configuring devices to mount automatically

To enable an AdvFS file system to start automatically, the /etc/fstab file must have an entry made for the mount command to issue while starting. Figure 14 shows an example of a modified /etc/fstab file.

In Figure 14, the lines that are shown in bold type are the lines that you entered since the initial operating system installation.

```
# root_domain#root / advfs rw,userquota,groupquota 0 0
/proc /proc procfs rw 0 0
usr_domain#usr /usr advfs rw,userquota,groupquota 0 0
/dev/rz8b swap1 ufs sw 0 2
vol1_dom#vol1  /vol1 advfs rw,userquota,groupquota 0 2
vol2_dom#vol1  /vol2 advfs rw,userquota,groupquota 0 2
vol3_dom#vol1  /vol3 advfs rw,userquota,groupquota 0 2
vol4_dom#vol1  /vol4 advfs rw,userquota,groupquota 0 2
vol5_dom#vol1  /vol5 advfs rw,userquota,groupquota 0 2
vol6_dom#vol1  /vol6 advfs rw,userquota,groupquota 0 2
vol7_dom#vol1  /vol7 advfs rw,userquota,groupquota 0 2
vol8_dom#vol1  /vol8 advfs rw,userquota,groupquota 0 2
vol9_dom#vol1  /vol9 advfs rw,userquota,groupquota 0 2
vol10_dom#vol1 /vol10 advfs rw,userquota,groupquota 0 2
```

Figure 14. Example of a modified /etc/fstab file

When the system starts, it should mount all volumes created in "Configuring AdvFS".

Installing and configuring the Compaq Tru64 UNIX Version 5.0x

Use the following procedures to install and configure the ESS disk drives on a Compaq Tru64 UNIX Version 5.0x.

Console device check

1. Push the halt button to turn on the AlphaServer.

   The system performs self-test diagnostics and responds with the console prompt >>>.
2. Type show device at the >>> prompt to list the devices available to the AlphaServer.

   The system responds with a list of controllers and disks that are connected to the system. In the description field on the right of the screen, you should see a list of all devices assigned by the ESS. Disk devices begin with the letters dk.

If you do not see a list of devices, verify the SCSI connections, connectors, and terminators on the bus. If you still do not see a list of devices, check the ESS to ensure that the ESS is operating correctly.

3. When the list of devices is displayed, type `Boot` to restart the system.

Operating system device recognition

To view the disk information for installed devices on the Compaq AlphaServer, type:

```
# /sbin/hwmgr -view devices
```

Table 4 shows an example of what you see when you type the `# /sbin/hwmgr -view devices` command. The */dev/disk/dsk** are the actual devices connected to the Compaq AlphaServer. The default internal disk, */dev/disk/dsk0a*, is the disk the Compaq AlphaServer uses for starting the operating systems.

Table 4. Example of disk information for installed devices for a Compaq AlphaServer

Hardware ID	Device Special File	Manufacturing	Model	Location
3:	/dev/kevm	N/A	N/A	N/A
28:	/dev/disk/floppy0c	N/A	3.5 in floppy	fdi0-unit-0
30:	/dev/disk/dsk0c	DEC	RZ1DF-CB DEC	bus-0-targ-0-lun-0
31:	/dev/disk/cdrom0c	DEC	RRD47 DEC	bus-0-targ-4-lun-0

Device special files

If you install an SSA device after the initial operating system installation, you must make the device special files that create the character devices needed for file systems. Perform the following steps:

1. Type: `# cd /dev`
2. Type: `# ./MAKEDEV /dev/rdisk/dsk1a`

   Type `# ./MAKEDEV /dev/rdisk/dsk1a` for each new drive that you installed in the SSA device.

Initializing disk devices

After the list of devices have been determined, you must label the disk volume sizes. Perform the following steps to label the disk volume sizes:

1. Write the new label by typing: `#disklabel –rw dsk1a ess`
2. Verify label by typing: `#disklabel dsk1a`

The `#disklabel dsk1a` command shows the new partition layouts on the disk Compaq Tru64 and automatically detects the units provided by the SSA device.

Configuring AdvFS

Before you create an AdvFS file system you must design a structure by assigning the file sets. Perform the following steps to create an AdvFS file system with file sets:

1. Type: `# cd /`
2. Type: `# mkfdmn –rw /dev/disk/dsk1a vol1_dom`
3. Type: `# mkfset vol1_dom vol1`

4. Type: # mkdir /vol1

5. Type: # mount vol1_dom#vol1 /vol1

To display all mounted devices, type: df -k

Configuring devices to mount automatically

To enable an AdvFS file system to start automatically, the /etc/fstab file must have an entry made for the mount command to issue while starting. See Figure 15 for an example of a modified /etc/fstab file.

In Figure 15, the lines that are shown in bold type are the lines that you entered since the initial operating system installation.

```
# root_domain#root / advfs rw,userquota,groupquota 0 0
/proc /proc procfs rw 0 0
usr_domain#usr /usr advfs rw,userquota,groupquota 0 0
/dev/rz8b swap1 ufs sw 0 2
vol1_dom#vol1 /vol1 advfs rw,userquota,groupquota 0 2
vol2_dom#vol1 /vol2 advfs rw,userquota,groupquota 0 2
vol3_dom#vol1 /vol3 advfs rw,userquota,groupquota 0 2
vol4_dom#vol1 /vol4 advfs rw,userquota,groupquota 0 2
vol5_dom#vol1 /vol5 advfs rw,userquota,groupquota 0 2
vol6_dom#vol1 /vol6 advfs rw,userquota,groupquota 0 2
vol7_dom#vol1 /vol7 advfs rw,userquota,groupquota 0 2
vol8_dom#vol1 /vol8 advfs rw,userquota,groupquota 0 2
vol9_dom#vol1 /vol9 advfs rw,userquota,groupquota 0 2
vol10_dom#vol1 /vol10 advfs rw,userquota,groupquota 0 2
```

Figure 15. Example of how to label disks with volume sizes

When the system starts, it should mount all volumes created in "Configuring AdvFS" on page 50.

Chapter 9. Attaching an ESS to an IBM RS/6000 host system with SCSI adapters

This chapter describes the host system requirements and provides procedures to attach an ESS to an IBM RISC System/6000 (RS/6000) with SCSI adapters or an IBM RISC System/6000 Series Parallel (SP) Complex host system with SCSI adapters.

For procedures on how to attach an ESS to an RS/6000 host system with fibre-channel adapters, see "Chapter 20. Attaching an ESS to an IBM RS/6000 host system with fibre-channel adapters" on page 101.

For procedures on how to migrate from SCSI to fibre-channel for an RS/6000 host system, see "Appendix C. Migrating from SCSI to fibre-channel" on page 139.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system.

- Ensure that you have all of the items listed in the "Equipment requirements" on page 14.
- Ensure that you have 1 MB minimum of hard disk space available to install the AIX host attachment package.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details for information about the release level for your operating system:

  http://www.storage.ibm.com/hardsoft/products/ess/supserver.htm
- Ensure that you have the installation script files. These files are on the compact disc you receive with the ESS.
- Check the LUN limitations for the RS/6000. See Table 1 on page 21

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server.

1. The IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR assigns the SCSI hosts to the SCSI ports on the ESS.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.
3. Either you or an IBM SSR configures the host system for the IBM Enterprise Storage Server. Use the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.1.4 supports the RS/6000 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two adapters. You can run the Subsystem Device Driver with one SCSI adapter, but you have no failover protection. The maximum number of adapters supported is 16 for a total of 32 SCSI ports.

Installing the 2105 host attachment package

This section provides the instructions to install the host attachment package for the ESS on your host system. IBM recommends that you run the host attachment package on each host system attached to the ESS for which an installation script is provided.

Before you install the 2105 host attachment package

Before you install the host attachment package:

1. Attach the ESS to your host system. See "Chapter 2. Attaching an ESS to an open system host with SCSI adapters" on page 17.
2. Turn on the host system and all attachments.

Note: Before you install the host attachment package, you must have:
- Root access
- AIX system administrator knowledge
- Knowledge of the System Management Interface Tool (SMIT) to install the ESS host attachment package.

Replacing an older version of the 2105 host attachment package

If you want to replace an older version of the host attachment package and have data that exists on all configured 2105 disks, the code prompts you to remove all ESS product-related hdisk devices. Perform the following steps to remove the devices:

1. Run umount on the file system.
2. Run varyoffvg 2105 volume group.
3. Type `rmdev -dl` on the command line to unconfigure the 2105 devices.

After you install the ibm2105.rte file and reconfigure the devices, vary on the volume groups and remount the file systems. The data on the file systems should now be available again.

Step-by-step procedure to install the 2105 host attachment package

Perform the following steps by using SMIT to install the IBM 2105 host attachment on your system.

Note: The following procedure is an example. The example uses /dev/cd0 for the address of the compact disc. Your address might vary.

Install the host attachment package from a compact disc. You must have superuser authority to complete the instructions.

1. From your desktop window, type `smit install_update` to go directly to the installation panel.
2. Click **Install and Update from the Latest Available Software** and press Enter.
3. Press F4 to display the Input Device/Directory for Software window.
4. Select the compact disc drive that you are using for the installation, for example, /dev/cd0.
5. Press Enter. The Install and Update from the Latest Available Software window is displayed.
6. Click **Software to Install** and press F4.

7. Select **Software Packages**. Press Enter.

The Install and Update from the Latest Available Software panel is displayed
with the name of the software you selected to install.

  8. Check the default option settings to ensure that they are what you need.

  9. Press Enter to install the software. SMIT responds with the following question:
     ```
     Are you sure?
     ```

 10. Press Enter to continue. The installation process may take several minutes. A
     message is displayed on your screen when the installation process is
     complete.

 11. Press F10 when the installation process is complete.

 12. Exit from SMIT.

 13. Remove the compact disc.

 14. Shut down the host system.

 15. Turn on the host system.

Verifying the IBM ESS configuration

To verify the configuration of the ESS on the AIX host system, type the following
command:

```
lsdev -Cc disk | grep 2105
```

A list of all ESS devices is displayed. See the example in Figure 16.

```
hdisk3 Available 30-68-00-0-,1 IBM 2105E20
hdisk4 Available 30-68-00-0-,2 IBM 2105E20
hdisk5 Available 30-68-00-0-,3 IBM 2105E20
...
...
```

*Figure 16. Example of a list of devices displayed when you use the lsdev -Cc disk | grep
2105 command, SCSI*

If a device is listed as another type of device, the message shown in Figure 17 is
displayed. This message indicates that the configuration was not successful.

```
hdisk3 Available 30-68-00-0-, Other SCSI disk device
hdisk4 Available 30-68-00-0-, Other SCSI disk device
hdisk5 Available 30-68-00-0-, Other SCSI disk device
...
...
```

*Figure 17. Example of list of other devices displayed when you use the lsdev -Cc disk | grep
2105 command, SCSI*

When you use the **lsdev -Cc disk | grep 2105** command, you know the installation
is successful if you see the information listed in Figure 16.

When you use the **lsdev -Cc disk | grep 2105** command you see only display lines
that contain the value immediately after it. If you have not defined any 2105
devices, a message of none is displayed.

Configuring VSS devices and ESS devices with multiple paths per LUN

The Versatile Storage Server™ (VSS) and Enterprise Storage Server support multiple path configurations for a LUN. This means that you can have multiple hdisks available on the AIX server for each physical LUN. If you create a PVID sector 0 of a LUN and you delete all hdisks from the system with the **rmdev** command, you must restart the system. If you want to restore all multiple paths for all LUNS, use the **cfgmgr** command for each SCSI adapter.

Emulating UNIX-based host systems

For UNIX-based host systems, the ESS emulates multiple SCSI DDMs. The host system accesses the virtual drives of the ESS as if they were generic SCSI DDMs. The AIX operating system contains entries in its object distribution manager database to identify the ESS. However, the AIX operating system accesses the ESS through its generic SCSI DDMs.

The ESS appears as a standard physical volume or *hdisk* to AIX, Solaris, and HP-UX systems.

When you use ultra- or wide-SCSI adapters in your host systems, a total of 16 SCSI IDs per interface is available on the ESS. The host system SCSI IDs are known as initiators; the ESS SCSI IDs are the targets.

If only one host system connects to an ESS SCSI port, the ESS can assign up to 15 unique target IDs. If the maximum of four host systems are connected to an ESS SCSI port, the ESS assigns up to 12 unique SCSI target IDs because each host uses one SCSI ID.

You can configure an ESS to appear as 64 logical unit numbers (LUNs) per SCSI target. Each LUN has a capacity of 0.5 GB to 112 GB. Valid LUN sizes for the ESS are 0.1, 0.5, 1, 2, 4, 8, 12, 16, 20, 24, 28, 32, 40, 48, 56, 64, 80, 96 and 112. If the ESS has 36 GB DDM, then LUN sizes 112, 128, 160, 192, 224 and 245.5 GB are also available. If you do not specify a value, an 8-GB LUN is the default.

Note: LUN usage is limited for some host systems. See Table 1 on page 21.

Table 5. Size of drives, configurations, and maximum size of LUNs

Size of Drives	Configuration	Maximum Size of LUNs
9 GB	6 + P array Model E10, E20, F10 or F20	52.5
9 GB	7 + P array Expansion enclosure for Model E20	61.3
18 GB	6 + P array Model E10, E20, F10 or F20	105.2
18 GB	7 + P array Expansion enclosure for Model E20	122.7
36 GB	6 + P array Model E10, E20, F10 or F20	210.4
36 GB	7 + P array Expansion enclosure for Model E20	245.5

Chapter 10. Attaching the IBM ESS to multiple RISC System/6000 hosts without HACMP/6000™

This chapter describes the requirements and provides the instructions to attach one or two ESSs to multiple host systems without HACMP/6000.

Install HACMP/6000 to define and access a unique journaled file system (JFS) file stored on a single ESS from any attached host system unit.

When attaching multiple host systems to an ESS, consider the following:
- Multiple host systems cannot access the same volume group or the same journaled file system simultaneously.
- Without HACMP/6000, some system failure management features such as failover are not available. Therefore, a failure on the IBM ESS or any one of the connected host systems will most likely affect the availability of the other connected devices.
- You must vary and mount the volume groups and journaled file systems every time you start the system.
- The IBM Enterprise Storage Server does not allow ownership of volume groups to move from one system to another.
- When you use this procedure, you can define between two to four multiple host systems.

Software requirements for attaching multiple host systems

This section lists the software requirements for attaching multiple RS/6000 host systems to the ESS.
- For details about the RS/6000 operating system requirements, see the following Web site

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm
- All host systems must have the devices.SCSI.TM (target mode) package installed.
- All host systems connected to the same IBM ESS must have either the same or compatible SCSI interface cards installed.
- You must set unique IDs for the SCSI interface cards on the ESS.

  You or the IBM service support representative uses the service terminal to assign the SCSI addresses.

  Note: You previously completed the information on the logical configuration work sheets. See the *IBM Enterprise Storage Server Configuration Planner*.
- All host systems must have the external SCSI ID of each adapter (interface card that is set to a unique ID). Follow the instructions in your RS/6000 documents for setting the IDs.
- Restart the systems to make the changes effective.

Hardware requirements for attaching multiple host systems

The hardware requirements for connecting an IBM ESS to multiple host systems are:
- A cable to connect the IBM Enterprise Storage Server to each host system SCSI adapter card.

- This configuration allows up to 32 host SCSI attachments. Refer to your host system documents for instructions on connecting additional SCSI interface cards with a Y-cable.
- All host systems connected to the same IBM Enterprise Storage Server must have the same type of SCSI adapter or a compatible SCSI adapter. See the following Web site:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm for details on adapters.

Attachment procedures

Perform the following steps to attach multiple host systems to the IBM Enterprise Storage Server:

1. Is the IBM Enterprise Storage Server currently installed on a host system?

   Yes   No

   ↓   Go to step 3.

2. Is any data stored on the IBM Enterprise Storage Server that you want to preserve?

   No   Yes

   ↓   Go to "Saving data on the IBM Enterprise Storage Server" on page 59.

3. If you have not previously installed SCSI interface cards in the associated host systems, do so now by using the instructions in your host system manuals.

4. Assign a unique SCSI ID to each of the SCSI interface cards that you install in your host system.

5. Turn off the host systems that you are connecting. This allows the SCSI ID to take effect when you turn on the host.

   Note: Do *not* connect the host systems to the IBM Enterprise Storage Server at this time.

6. Install the SCSI signal cables.

7. Turn on one host system at a time. Allow each system unit to complete its start up procedure before you turn on the next host system connected to the ESS.

8. After all the host systems have completely started up, if the power to the IBM Enterprise Storage Server is off, turn it on.

9. On each of the host systems, use the **mkdir /usr/opt/your_files** command to create a new directory. This step is unnecessary if the directory already exists.

10. On each of the host systems, use the **cd /usr/opt/your_files** command to change the active directory.

11. On each of the host systems, use the **tar** command to read the compact disc files into the /usr/lpp/2105 directory. This step is unnecessary if the directory and files already exist. Use the tar **xvf** flags for proper extraction. For example, to read the files from the fd0 directory, type: `tar -xvf /dev/fd0`.

12. On each of the host systems, use the **/usr/opt/your_files** command to run the ESS install program on each host system that is connected to the ESS. Wait for the program to complete on one system before running it on the next.

13. On each host system, use the **lsdev -Cc disk** command to verify that each associated system unit has the hdisk descriptions defined for all initialized LUNs.

14. Determine which hdisks are accessed.

15. Do you have any data currently on the IBM Enterprise Storage Server that you want preserved from a previous installation on the host system?

    No   **Yes**

    ↓   Go to "Restoring data on the IBM Enterprise Storage Server" on page 60.

16. Type `smit mkvg` to create a volume group on the selected hdisk.
17. Click **No** for the ACTIVATE volume group AUTOMATICALLY at system restart option.
18. Select an appropriate physical partition size for the volume group, using the Physical partition SIZE in megabytes option.

    Note: AIX limits the number of physical partitions to 1016 per logical volume. This limitation does not apply to AIX 4.3.1.

    The default physical partition size is 4 megabytes. Choose this value to make the most efficient use of the physical hard disk size. See your host system documentation for more information.

19. Type `smit chvg` to change the volume group on the selected hdisk.
20. Click **No** for the ACTIVATE volume group AUTOMATICALLY at system start option.
21. Click **No** for the A QUORUM of disk required to keep the volume group on line option.
22. Type `varyonvg <volumegroup_name>` to vary the volume group online.
23. If you are using the journaled file system (JFS), type `smit crjfs` to create the JFS for the selected hdisk.

    Note: Click **No** for the Mount AUTOMATICALLY at system restart option.
24. Type `mount <mount_point>` to mount the file system and verify access from the selected host system.

Saving data on the IBM Enterprise Storage Server

Perform the following steps to preserve the data that is stored on an IBM Enterprise Storage Server that was previously installed and connected to a host system. This procedure does not erase the data on the ESS, but it removes the volume groups from the host system.

1. Type `umount` to unmount all file systems from all host systems connected to the ESS.
2. Type `fsck` on each of the file systems on the ESS to verify the file system integrity.
3. Type `varyoffvg` to vary off all the ESS volume groups from all of the host systems connected to the ESS.
4. Type `exportvg` to remove all of the ESS volume groups from all the host systems connected to the ESS.
5. Type `rmdev -ld hdiskx` to delete all physical volumes (hdisks) on each host system that is associated with the ESS.
6. Be sure you have completed step 3 on page 58 of the attachment procedures.

Restoring data on the IBM Enterprise Storage Server

Perform the steps in this section to restore access to the data that is originally installed on a host system. This procedure assumes that you have preserved the data by following the instructions in "Saving data on the IBM Enterprise Storage Server" on page 59.

1. Check to be sure that the ESS physical volumes (hdisks) are available.

   Type `lsdev -Cc disk` to display the hdisks on the host system.

2. Type `importvg` to restore the ESS volume groups to the applicable host systems that are connected to the ESS, one system at a time.

3. Type `smit chvg` to verify that **No** is selected for `ACTIVATE volume group AUTOMATICALLY and A QUORUM of disks required to keep the volume group online?`

4. Type `varyonvg` to vary-on the ESS volume groups to the applicable host systems connected to the ESS. Perform the steps one system at a time.

5. Type `mount` to mount the ESS volume groups to the applicable host systems that are connected to the ESS. Perform the steps one system at a time.

6. Do you want to create new volume groups? If yes, go to step 16 on page 59 in "Restoring data on the IBM Enterprise Storage Server".

Chapter 11. Configuring for HACMP/6000

This chapter provides guidelines for planning and installing the software for the High Availability Cluster Multi Processing/6000 (HACMP/6000).

The HACMP provides an availability solution for the commercial UNIX environment. The HACMP/6000 software supports shared external disk configurations, such as the ESS.

You can use the ESS in non-concurrent access clusters and also in concurrent clusters if the clusters are not mirrored.

High Availability Cluster Multiprocessing (HACMP/6000)

For information about the latest releases of HACMP/6000 that are available to attach the ESS to the RS/6000 and RS/6000 SP servers with SCSI adapters, see the following web site:

www.storage.ibm.com/hardsoft/products/ess/supserver

Use the HACMP/6000 documentation for your software version to plan and set up a cluster. Because the ESS appears to the host as a pure SCSI device, you do not need specific device type considerations.

For information about the latest releases of HACMP/6000 that are available to attach the ESS to the RS/6000 and the RS/6000 SP servers with a fibre-channel adapter through the IBM SAN Data Gateway, see the following web site:

www.storage.ibm.com/hardsoft/products/ess/supserver

HACMP for AIX Version 4 Release 3 Modification level 1 now supports the following hardware for the IBM SAN Data Gateway 2108 Model G07:

- Feature code 2214
- Feature code 2213
- Feature code 2319

Note: When you use two fibre-channel adapters to a single SAN Data Gateway in an HACMP environment, the SAN Data Gateway must be run in split mode. Each fibre-channel adapter must be connected to a separate port on the SAN Data Gateway and two separate ports on the SAN Data Gateway must be used to attach to two separate SCSI ports on the ESS.

The feature codes add 4-initiator fibre-channel support. Support includes a matrix for HACMP and the Enterprise Storage Server Models E10 and E20. The Models F10 and F20 are not supported by HACMP.

For additional information about supported host systems, operating systems, and adapters, see the following Web site:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

The IBM Subsystem Device Driver is only supported in concurrent mode available in the CRM and ESCRM features of HACMP. For ESS installations, use IBM Subsystem Device Driver Version 1 Release 1 Modification level 4. Prior versions

do not support the SAN Data Gateway. See Table 6 for information about hardware and software levels supported for HACMP Version 4 Release 2 Modification level 2 and HACMP Version 4 Release 3 Modification level 1.

Table 6. Hardware and software levels supported for HACMP version 4.2.1, 4.2.2, 4.3.1, and 4.3.3

Hardware/Software	HACMP 4.2.2 AIX 4.2.1	HACMP 4.2.2 AIX 4.3.3	HACMP 4.3.1 AIX 4.3.3
IBM SAN Data Gateway Model 2108 Model G07	Not supported	Not supported	HACMP APAR IY07313 and APAR IY09595
IBM Enterprise Storage Server 2105 Model E20	APAR IY04403	APAR IY04403	APAR IY03438
IBM Subsystem Device Driver for UNIX Version 1.4			HACMP APAR IY07392

The host systems and attached ESS should use the SCSI ID assignments recommended in Table 7.

Table 7. Recommended SCSI ID assignments in a multihost environment

SCSI ID	Recommended SCSI device	Should not be used for:
07	Not applicable	Not applicable
06	Host system number 1 (primary)	IBM Enterprise Storage Server
05	IBM Enterprise Storage Server number 1	Host system
04	Host system number 2	IBM Enterprise Storage Server
03	Host system number 3 (if applicable)	IBM Enterprise Storage Server
02	Host system number 4 (if applicable)	IBM Enterprise Storage Server
01	IBM Enterprise Storage Server number 2 (if applicable)	Host system
00	Not applicable	Not applicable

Notes:

1. The ESS supports SCSI IDs 00 through 15.

2. If you do not use a Y-cable, you do not need to assign special SCSI IDs.

Chapter 12. Attaching an ESS to an IBM AS/400 host system

This chapter describes the host system requirements and provides the procedure for attaching your IBM AS/400 host system to the IBM Enterprise Storage Server (ESS) SCSI bus.

Note: The IBM AS/400 host system does not support serially interconnecting multiple host systems for attachment to the ESS. It also does not support interconnecting multiple ESS attachments to a single port on the host adapter.

Your IBM AS/400 host system supports the ESS as a peripheral device.

The ESS emulates an IBM 9337 subsystem when you attach it to an IBM AS/400 host system. You must configure the ESS so that it appears to be four to eight logical units (LUNs). Because the IBM AS/400 host system requires a separate address for each LUN, configure the ESS to report a unique address for each virtual drive defined to the IBM AS/400 host system. See "9337 subsystem emulation" in this chapter for more details about emulating the 9337 subsystem.

Note: You cannot use the IBM Subsystem Device Driver on the AS/400 host system.

Attachment requirements for the AS/400

This section lists the requirements for attaching the ESS to your host system:
- Ensure that you have all of the items in the equipment list shown in the *IBM Enterprise Storage Server Introduction and Planning Guide.*
- Obtain the documents for the IBM AS/400 host system.
- See the following Web site for details about program temporary fixes (PTFs) that you need to install on your AS/400 host system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm
- Check the LUN limitations for your host system. See Table 1 on page 21.

Contact your IBM service support representative to install and configure the IBM Enterprise Storage Server.

Recommended configurations for the AS/400

IBM recommends the following configurations:
- Install the 6501 adapter card in the AS/400 system unit or the I/O towers. Feature code 6501 is an adapter.
- Do not use more than two 6501 adapter cards for each AS/400 tower.

9337 subsystem emulation

When attached to an IBM AS/400 host system, the ESS emulates a 9337 subsystem. The ESS, emulating a 9337, shows one unique controller that has as many as eight disk units (LUNs) attached.

A single feature code 6501, which contains two ports and is attached to an ESS, supports 2 emulated 9337s. It requires 16 LUNs, 8 per port, and requires 2 ports with at least 1 adapter on the ESS. IBM recommends that you spread the ESS ports across clusters and adapters.

For a 9337, parity data occupies one-fourth the capacity of each odd numbered physical drive installed. The total capacity for the parity data is equivalent to one full physical drive. Four out of eight physical drives show less available capacity to the AS/400. On the ESS, you can perform the parity function so that all eight LUNs show a total available capacity for the AS/400.

A real 9337 reports each LUN serial number to the AS/400 host system as a two-digit physical slot number. It also reports the last five digits of the 9337 physical subsystem's serial number. It shows on the AS/400 as one controller with as many as eight LUNs.

The ESS reports each LUN to the AS/400 host system in the following sequence: a zero (not shown on the AS/400 display), the LUN number, a zero, a two-digit port number, followed by a 3-digit storage facility identification number. The ESS sets the storage facility identification number equal to the last 3 characters of the rack serial number. If an enterprise has installed multiple ESS racks where the last 3 characters of the rack serial number are equal, the SSR can modify the value using the service login..

An example of a storage facility number is: 01003789 for LUN 1 on port 3 in storage facility 789. The AS/400 host system uses the last five digits as the controller serial number. The ESS appears to be the same as a real 9337 to the AS/400. They both appear as one controller with up to eight LUNs attached.

Table 8 shows an example of the display from hierarchical storage management (HSM) logical resources.

Table 8. Example of the display from hierarchical storage management (HSM) logical resources for AS/400

Opt Description	Type-Model	Status	Name
Storage OIP	6501-001	Operational	SI03
Disk controller	9337-5A2	Operational	DC07
Disk unit	9337-5AC	Operational	DD033
Disk unit	9337-5AC	Operational	DD034
Disk unit	9337-5AC	Operational	DD036
Disk unit	9337-5AC	Operational	DD038
Disk unit	9337-5AC	Operational	DD040

Table 9 shows an example of the display capacity and status of the disk units.

Table 9. Example of the display capacity and status of disk units for AS/400

Serial number	Type-Model	Resource name	Capacity status
00-1003789	9337-5AC	DD032	17548 DPY/Active
00-2003789	9337-5AC	DD035	17548 DPY/Active
00-3003789	9337-5AC	DD037	17548 DPY/Active
00-4003789	9337-5AC	DD039	17548 DPY/Active

Table 9. Example of the display capacity and status of disk units for AS/400 (continued)

Serial number	Type-Model	Resource name	Capacity status
00-5003789	9337-5AC	DD041	17548 DPY/Active

The 2105 disk units that emulate the 9337 models on an AS/400 show full-capacity drives (all *xx*C models). They always have a status column of the display (DPY). The disk units do not show as unprotected to the AS/400 and are not mirrored at the AS/400 system level.

Non-RAID configurations are not supported for AS/400. There is a customer requirement to allow software mirroring of the ESS volumes. The ESS supports this requirement by defining protected and unprotected 9337 models. The AS/400 allows software mirroring on a unprotected 9337 model and prevents software mirroring on a protected 9337 model. From a ESS logical configuration view point all AS/400 volumes are RAID-5 and are protected. When you create the AS/400 volume from Web Copy Services Specialist you can create it as a protected or unprotected volume. This allows you to see the protected and unprotected models. Unprotected models can be software mirrored. See Table 10.

Note: AS/400 model designations that end in C are protected models and those that end in A are unprotected models to the AS/400. Software mirroring is supported on the AS/400 for unprotected models only.

Table 10. Example of the display capacity and status of disk units for AS/400

Size	Type	Protected	Unprotected	Release support
4.190 GB	9337	48C	48A	V3R1.0 and up
8.589 GB	9337	59C	59A	V3R2.0 V3R7.0 and up
17.548 GB	9337	5AC	5AA	V4R2.0 only 5AC with PTF (not 5AA). V4R3.0, V4R4.0 both models with PTF V4R5.0 base for 5AC. 5AA with PTF.
35.165 GB	9337	5CC	5CA	V4R2.0 only 5AC with PTF (not 5AA). V4R3.0, V4R4.0 both models with PTF V4R5.0 base for 5AC. 5AA with PTF.
36.003 GB	9337	5BC	5BA	V4R2.0 only 5AC with PTF (not 5AA). V4R3.0, V4R4.0 both models with PTF V4R5.0 base for 5AC. 5AA with PTF.

For AS/400 hosts, an additional distinction is made based on the operating system that is installed:

- AS/400 hosts that are running the OS/400 operating system Version 3 Release 1, or Version 3 Release 6, only support one volume size, the emulated 9337-580 (4.19 GB).
- AS/400 hosts that are running the OS/400 operating system Version 3 Release 2, Version 3 Release 7, or a higher level, support all AS/400 volume sizes, including the 9337-580 (4.19 GB), the 9337-590 (8.59 GB), the 9337-5AC (16 GB), and the 9337-5BC (32 GB).

Software requirements for the IBM OS/400 operating system

Release V3R1.0 and later releases of the OS/400 operating system support 4-GB and 8-GB capacity disk drives. Table 11 lists the required program temporary fixes (PTFs) for OS/400 versions that do not include the PTFs in the base code.

Table 11. OS/400 program temporary fixes for V3R1.0 through V4R1.4

Operating System Version Level	PTF
V3R1.0	SF44131
V3R2.0	SF44132
V3R6.0	SF44126
V3R7.0	SF44127
V4R1.0	SF44113
V4R1.4	SF44745

Releases V4R2.0, V4R3.0, and V4R4.0 also support 18-GB and 36-GB capacity logical unit numbers with the PTFs shown in Table 12.

*Table 12. OS/400 program temporary fixes for V4R2.0 and higher*

Operating System Version Level	PTF
V4R2.0	SF44114, MF21961, MF21975
V4R3.0	MF21962, MF21979
V4R4.0	MF21963, MF21978

Chapter 13. Attaching the ESS ESCON adapter to a System/390 host system

This chapter describes the host system requirements to attach the IBM System/390 host system to the IBM Enterprise Storage Server ESCON adapter.

For information on how to use parallel access volumes (PAVs) for S/390 hosts, see the *IBM Enterprise Storage Server User's Guide*. The information includes an overview of PAV, PAV requirements, and an example of the input/output configuration program (IOCP).

Figure 18 shows how an ESS is attached through ESCON links to different computer-electronic complexes and logical partitions (LPARs). It also shows a configuration of the availability. For optimum availability, make the ESCON host adapters available through all bays. For optimum performance, have at least eight host adapter ports installed on four ESCON host adapter cards in the Enterprise Storage Server. This setup ensures the best performance from the attached systems.
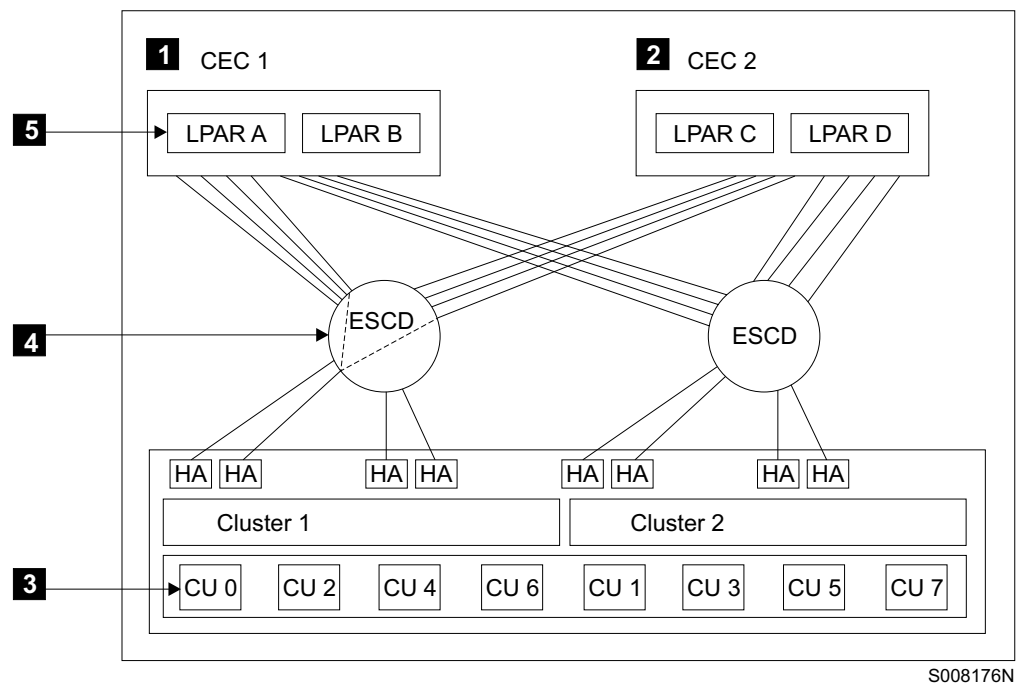

Legend

1 – computer-electronic complex 1

2 – computer-electronic complex 2

3 – controller

4 – ESCON director

5 – logically partitioned mode

Figure 18. ESCON connectivity

Controller images and controls

An ESS supports up to 16 controller images.

All controller images are accessible over any installed ESCON physical path. Each controller image can have from 1 -256 devices. The ranges of supported device addresses may be non-contiguous. Devices that are not mapped to a logical device respond and show address exceptions.

Note: When a primary controller connects to a secondary controller, the primary connection converts to a channel. You cannot use it for host connectivity. You can convert all 32 host attachments to channels. You should not use more than 31 channels.

The controller images can handle the ESCON interconnections that are listed below.
- 1 to 256 devices (bases and aliases) per controller images
- 1 to 4096 devices (bases and aliases) with 16 controller images
- 1 to 128 logical paths per controller images
- 1 to 64 paths per ESCON Port (shared by all controller images)
- 2048 logical paths in the ESS

Support for 9032 Model 5 ESCON director's FICON bridge feature

The ESS provides fibre-channel connectivity to System/390 host systems with the IBM 9032 Model 5 ESCON director. The 9032 FICON bridge provides connection and switching among FICON channels and ESCON controllers.

Host adapters for ESCON

Each ESCON host adapter connects to both clusters. An ESS emulates 0, 8, or 16 of the 3990 logical controllers. Half the logical controllers are in cluster 1 and half in cluster 2. Because the ESCON adapter connects to both clusters, each adapter can address 16 logical controllers.

ESCON host cables

Each ESCON host adapter provides two host connections. Order two ESCON cables for each adapter for S/390 hosts.

Note: When you order an ESCON adapter card, feature code 3011, in Europe, the Middle East and Asia, you receive two 31-m ESCON cables, P/N 34L7544.

ESCON distances

The standard distances for ESCON cables are 2 km (1.2 mi) with a 50-µm multimode fibre and 3 km (1.9 mi) with 62.5-µm multimode fibre. You can extend the distance of the cable to 103 km (64 mi) for peer-to-peer remote copy. You can also extend the distance of the cable to 103 km (64 mi) from controller-to-controller.

Note: For optimum performance use a cable shorter than 103 km (64 mi).

ESCON cabling specifications

There is an ESCON channel on the S/390 host system. The S/390 host system attaches to one port of an ESCON host adapter in the ESS. Each ESS adapter card has two ports.

See the *IBM Enterprise Storage Server Introduction and Planning Guide* for a list of the ESCON host adapter features codes. The publication also contains the number of ESCON host adapters, cable group number, number of cables, and connector IDs to order for the cables.

Note: When you order an ESCON adapter card, feature code 3011, in Europe, the Middle East and Asia, you receive two 31-m ESCON cables, P/N 34L7544.

Logical paths

A logical path is a connection between a controller image and a host image. An ESCON link consists of two fibre-channels. There is a fibre-channel for each direction. An ESCON connector connects the fibre-channel port to an ESCON.

Each ESCON adapter card supports two ESCON ports or links. Each port supports 64 logical paths. With a maximum of 32 ESCON ports, the maximum number of logical paths is 2048.

Path groups

Each controller image supports up to 64 path groups. Each path group may have up to eight logical paths. Each controller image supports a maximum of 128 logical paths.

Cable lengths and path types

All ESCON attachments have a light-emitting diode (LED) interface. The link attached to the host adapter can be up to 2 km (1.2 mi) in length using 50- μm fibre or 3 km (1.9 mi) in length for 62.5 μm fibre. There are no cable splices internal to the storage facility. Laser links or LEDs can exist between the unit attached to the:

• Storage server and host channel controller
• Peer controller host channel
• Peer controller with appropriate equipment

An example is the ESCON directors and channel extenders.

Note: Appropriate retention hardware to support cable attachments and to control bend-radius limits come with each ESCON host attachment.

Data transfer

The ESCON host adapter supports all data input buffer sizes up to 256 bytes. During write operations, the host adapter requests the minimum pacing count of hex XX'02X'. For commands whose parameter data length is not determined by the parameter data itself, the full transfer count in the command frame is requested in the first data request. The adapter supports an NDF-R count of 7 (that is, a maximum of eight data requests).

Directors and channel extenders

The storage facility supports IBM ESCON directors 9032 Models 1, 2, 3, and 5. The storage facility supports IBM 9036 channel extenders to the distances that are allowed by the 9036 as described in "Cable lengths and path types" on page 69. The storage facility supports the 9729 Wavelength Division Multiplexer channel extender up to 50 km (31 mi).

Port identification for System/390 TSO commands

Figure 19 helps you identify the port ID for the MVS TSO commands for System/390 hosts. The numbers like 806, 804, 802, and 800 are internal microcode numbers. The numbers like 00, 04, 08, and 0C are tag numbers. You need tag numbers for the path setup. To determine the tag number, use the **read configuration data (rcd)** command.

For information about TSO commands, see the publications for the TSO operating system.

```
                    Cluster 1                                  Cluster 2

          Board 0 (CPI4)       Board 1 (CPI6)        Board 0 (CPI5)       Board 1 (CPI7)

         ┌─┬─┬─┬─┐            ┌─┬─┬─┬─┐             ┌─┬─┬─┬─┐            ┌─┬─┬─┬─┐
Slot#     0   1   2   3        0   1   2   3         0   1   2   3        0   1   2   3
ID
Port 0   806 804 802 800      816 814 812 810       80E 80C 80A 80C      81E 81C 81A 818
Port 1   807 805 803 801      817 815 813 811       80F 80D 80B 809      81F 81D 81B 819
Tag
Port 0    00  04  08  0C       20  24  28  2C        80  84  88  8C       A0  A4  A8  AC
Port 1    01  05  09  0D       21  25  29  2D        81  85  89  8D       A1  A5  A9  AD
```

Figure 19. Port identification for S/390 TSO commands

Checking the attachment

Ensure that your installation meets the following requirements:

1. One or two ESSs and no other I/O devices attach to each ESCON host adapter card.

   Attention: To avoid causing static discharge damage when handling disk drive modules and other parts, observe the precautions in "Handling electrostatic discharge-sensitive components" on page 20.

2. The cables connect correctly and seat properly.

Chapter 14. Attaching an ESS to host systems with fibre-channel adapters

This chapter provides an overview of how to attach an ESS to various host systems with fibre-channel adapter.

For details on how to attach an IBM ESS to a Windows NT host system with fibre-channel adapters, see "Chapter 15. Attaching an ESS to a Windows NT 4.0 host system with fibre-channel adapters" on page 77.

For details on how to attach an IBM ESS to a Windows 2000 host system with fibre-channel adapters, see "Chapter 16. Attaching an ESS to a Windows 2000 host system with fibre-channel adapters" on page 83.

For details on how to attach an IBM ESS to a Novell NetWare host system with fibre-channel adapters, see "Chapter 17. Attaching an ESS to a Novell NetWare host system with fibre-channel adapters" on page 89.

For details on how to attach an IBM ESS to a Hewlett Packard host system with fibre-channel adapters, see "Chapter 18. Attaching an ESS to a Hewlett Packard 9000 host system with fibre-channel adapters" on page 93.

For details on how to attach an IBM ESS to a Sun host system with fibre-channel adapters, see "Chapter 19. Attaching an ESS to a Sun host system with fibre-channel adapters" on page 95.

For details on how to attach an IBM ESS to a RS/6000 host system with fibre-channel adapters, see "Chapter 20. Attaching an ESS to an IBM RS/6000 host system with fibre-channel adapters" on page 101.

For details on how to attach an IBM ESS to a NUMA-Q host system with fibre-channel adapters, see "Chapter 21. Attaching an ESS to a NUMA-Q host system with fibre-channel adapters" on page 105.

ESS to host system fibre-channel attachment overview

Fibre-channel is a 100 megabytes per second, full-duplex, serial communications technology to interconnect I/O devices and host systems that are separated by tens of kilometers.

Fibre-channel transfers information between the sources and the users of the information. This information can include commands, controls, files, graphics, video, and sound. Fibre-channel connections are established between fibre-channel ports that reside in I/O devices, host systems, and the network that interconnect them. The network consists of elements like switches, hubs, bridges, and repeaters that are used to interconnect the fibre-channel ports. The ESS architecture supports three basic topologies:
- Point-to-point
- Switched fabric
- Arbitrated loop

Before you start

Before you start, check that the fibre-channel host has the correct fibre-channel host bus adapters installed or at least has slots available for them. For a list of operating systems and the host bus adapters for fibre-channel attachment, see following the Web site:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Fibre-channel cables and adapter types

Use feature code 3022 for the short-wave, fibre-channel host adapter card. Feature code 3022 comes with a complimentary 31 m 50-micron multimode fibre cable. You can also use a 62.5-micron fibre cable with the short-wave fibre-channel card. For a 50-micron multimode fiber cable, use a cable length of 2 - 500 m (6.5 ft - 1,640 ft).

For a 62.5-micron multimode fiber cable, use a cable length of 2 - 175 m (6.5 ft - 575 ft).

If you use fibre-channel-to-ESCON cable converters at both ends of the link to allow connection through an ESCON cable, the ESCON cable must be a 62.5-micron fiber cable. The maximum length for the 62.5-micron fiber cable is 175 m (575 feet).

Limitations on distances between nodes on a fibre-channel network might exist depending on the upper-layer protocol (ULP).

Fibre-channel node-to-node distances

For fibre-channel, the maximum distance between fabric switches, fabric hubs, and link extenders and a host fibre-channel port or an ESS fibre-channel port is limited to 11 km (6 mi).

The maximum distance might be greater than 11 km (6 mi) when a link extender provides appropriate target initiator or controller emulation functions such that the length of the connection perceived by the ESS does not exceed 11 km (6 mi).

Link extenders with emulation functions should not be used on links over which synchronous PPRC operations are performed because of the additional path delay introduced by these units.

LUN affinity

For fibre-channel attachment, LUNs have an affinity to the host's fibre-channel adapter through the world-wide port name (WWPN) for the host adapter. In a switched fabric configuration, a single fibre-channel host could have physical access to multiple fibre-channel ports on the ESS. In this case, you can configure the ESS either to allow the host to use

- All physically accessible fibre-channel ports on the ESS
- Only a subset of the physically accessible fibre-channel ports on the ESS.

In either case, the set of LUNs that are accessed by the fibre-channel host are the same on each of the ESS ports that can be used by that host.

Targets and LUNs

For fibre-channel attachment, each fibre-channel host adapter can architecturally attach up to 2^{64} LUNs. The ESS supports only a maximum of 4096 LUNs divided into a maximum of 16 logical subsystems each with up to 256 LUNs. If the software

in the fibre-channel host supports the SCSI command **Report LUNs**, then you can configure all 4096 LUNs on the ESS to be accessible by that host. Otherwise, you can configure no more than 256 of the LUNs in the ESS to be accessible by that host.

FlashCopy and PPRC restrictions for open system hosts

When you copy a source volume to a target volume with FlashCopy or PPRC, and you require concurrent read/write access of both volumes, the source and target volumes should be on different host systems. A copy operation with the source and target volume on the same host system creates a target volume with the same identification as the source volume. The host system sees two identical volumes.

When the copy operation creates the same identification for the target volume as for the source volume you cannot distinguish one from the other, so you might not be able to access the original data.

Note: You cannot create a host target on a single Novell NetWare host system. For Novell NetWare, the target volume must be attached to a second Novell NetWare host system.

The target volume and the source volume can be on the same host system for a PPRC or FlashCopy operation only under the following conditions:

- For AIX, when the host system is using a Logical Volume Manager (LVM) with **recreatevg** command support.
- For AIX, Sun, and HP, when the host system is **not** using an LVM.
- For any host system, when the host system can distinguish between a source and a target volume that have the same identification.

LUN access modes

The following sections describe the LUN access modes for fibre-channel.

Fibre-channel access modes

The fibre-channel architecture allows any fibre-channel initiator to access any fibre-channel device, without access restrictions. However, in some environments this kind of flexibility can represent a security exposure. Therefore, the Enterprise Storage Server allows you to restrict this type of access when IBM sets the access mode for your ESS during initial configuration. There are two types of LUN access modes:

1. Access-any mode

   The access-any mode allows all fibre-channel attached host systems that do not have an access profile to access all non-AS/400 open system logical volumes that you have defined in the ESS.

   Note: If you connect the ESS to host systems multiple platforms and use the access-any without setting up an access profile for the hosts, the data in the LUN used by one open system host might be inadvertently corrupted by a second open system host. Certain host operating systems insist on overwriting specific LUN tracks during the LUN discovery phase of the operating system boot process.

2. Access-restricted mode

   The access-restricted mode prevents all fibre-channel-attached host systems that do not have an access profile from accessing any volumes that you have defined in the ESS. This is the default mode.

Your IBM service support representative (SSR) can change the logical unit number (LUN) access mode. However, changing the access mode is a disruptive process, and requires that you shut down and restart both clusters of the ESS.

Access profiles

Whichever access mode you choose, any fibre-channel-attached host system that has an access profile can access only those volumes that are defined in the profile. Depending on the capability of the particular host system, an access profile can contain up to 256 or up to 4096 volumes.

The setup of an access profile is transparent to you when you use the ESS Specialist Web interface to configure the hosts and volumes in the ESS. Configuration actions that affect the access profile are as follows:

*   When you define a new fibre-channel-attached host system in the ESS Specialist by specifying its world-wide port name (WWPN) using the Modify Host Systems screen, the access profile for that host system is automatically created. Initially the profile is empty. That is, it contains no volumes. In this state, the host cannot access any logical volumes that are already defined in the ESS.
*   When you add new logical volumes to the ESS using the Add Fixed Block Volumes screen, the new volumes are assigned to the host that you select. The new volumes are created and automatically added to the access profile of the selected host.
*   When you assign volumes to fibre-channel-attached hosts using the Modify Volume Assignments panel, the selected volumes are automatically added to the access profile of the selected host.
*   When you remove a fibre-channel-attached host system from the ESS Specialist using the Modify Host Systems panel, you delete the host and its access profile.

The anonymous host

When you run the ESS in access-any mode, the ESS Specialist Web interface displays a dynamically created pseudo-host called anonymous. This is not a real host system connected to the storage server, but is intended to represent all fibre-channel-attached host systems (if any) that are connected to the ESS that do not have an access profile defined. This is a visual reminder to the user that certain logical volumes defined in the ESS can be accessed by hosts which have not been specifically identified to the ESS

Fibre-channel storage area networks (SANs)

A SAN is a specialized, high-speed network that attaches servers and storage devices. A SAN is also called the network behind the servers. With a SAN, you can perform an any-to-any connection across the network using interconnect elements such as routers, gateways, hubs, and switches. With a SAN, you can eliminate the dedicated connection between a server and storage and the concept that the server effectively owns and manages the storage devices.

The SAN also eliminates any restriction to the amount of data that a server can access, currently limited by the number of storage devices, which can be attached to the individual server. Instead, a SAN introduces the flexibility of networking to enable one server or many heterogeneous servers to share a common storage utility, which might comprise many storage devices, including disk, tape, and optical storage. You can locate the storage utility far from the servers that use it.

Think of ESCON as the first real SAN. It provides connectivity that is commonly found in SANs. However, it was restricted to ESCON hosts and devices. Fibre-channel SANs, though, have the potential to allow the interconnection of open

systems and storage in the same network as S/390 systems and storage. This is possible because you can map the protocols for attaching open systems and S/390 systems to the FC-4 layer of the fibre-channel architecture.

Chapter 15. Attaching an ESS to a Windows NT 4.0 host system with fibre-channel adapters

This chapter tells you how to attach an ESS to a Windows NT host system with fibre-channel adapters.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details about the release level for your operating system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an ESS.

1. The IBM SSR installs the ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. You or an IBM SSR defines the fibre-channel host system with the world-wide port name identifiers. For the list of world-wide port names see "Appendix B. Locating the world-wide port name (WWPN)" on page 135.
3. You or an IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

4. You or an IBM SSR configures the host system for the ESS by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.2.1 supports the Windows NT 4.0 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel adapters supported is 16 for a total of 16 fibre-channel ports.

Note: To improve performance, IBM recommends that you map to the LUNs for the target volumes of the Windows NT or Windows 2000 host until you need access to the data on the target volume. Perform the LUN mapping after the PPRC operation and immediately before you need access to the data. You must restart the host system before you can access the data on the target volume. You greatly reduce the time it takes the host system to reboot by performing the LUN mapping. Otherwise, the time to reboot could take 10 minutes per PPRC target volume.

Installing the QLogic QLA2100F adapter card

This section tells you how to attach an ESS to a Windows NT host system with the QLogic QLA2100F adapter card.

Single port fibre-channel interfaces with the QLogic QLA2100F adapter card supports the following loop modes:

- Target
- Initiator
- Target and initiator

Notes:

1. The arbitrated loop topology is the only topology available for the QLogic QLA2100F adapter card.
2. When you install the QLA2100F adapter card on your server, IBM recommends you install the card on a server with four processors. This ensures you do not have a problem when you start the server.

Perform the following steps to install the QLogic QLA2100F adapter card:

1. Install the QLogic QLA2100F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the Configuration Settings menu, select **Host Adapter Settings**.
6. From the Advanced Adapter Settings menu, press the Down Arrow to highlight **LUNs per target**; then press Enter.
7. Use the Down Arrow to find and highlight **256**. Press Enter.
8. Press Escape.
9. To save the changes, click **Yes**. Press Enter.
10. Restart the server.

Installing the QLogic QLA2200F adapter card

This section tells you how to attach an ESS to a Windows NT host system with the QLogic QLA2200F adapter card. Single- and dual-port fibre-channel interfaces with the QLogic QLA2200F adapter card support the following public and private loop modes:

- Target
- Public initiator
- Private initiator
- Target and public initiator
- Target and private initiator

Perform the following steps to install the QLogic QLA2200F adapter card:

1. Install the QLogic QLA2200F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the **Configuration Settings**, menu select **Host Adapter Settings**.

To set the parameters and values from the Host Adapter settings menu, use the following:

a. Host adapter BIOS: **Disabled**

b. Frame size: **2,048**

c. Loop reset delay: **5 (minimum)**

d. Adapter hard loop ID: **Disabled**

Some configurations might require hard IDs. Consult the separate application note that addresses fibre-channel address for more information.

6. From the **Advanced Adapter Settings menu**, press the Down Arrow to highlight **LUNs per target**. Press Enter. Set the parameters and values from the **Advanced Adapter Settings** menu as follows:

a. Execution throttle: **240**

b. Fast command posting: **Enabled**

c. >4 GB addressing: **Disabled for 32 bit systems**

d. LUNs per target: **0**

e. Enable LIP reset: **No**

f. Enable LIP full login: **No**

g. Enable target reset: **Yes**

h. Login retry count: **20 (minimum)**

i. Port down retry count: **20 (minimum)**

j. Driver load RISC code: **Enabled**

k. Enable database updates: **No**

l. Disable database load: **No**

m. IOCB allocation: **256**

n. Extended error logging: **Disabled (might be enabled for debugging)**

> **Note:** The Enable LIP reset, Enable LIP full logon, and Enable target reset parameters control the behavior of the adapter when Windows NT tries to do a SCSI bus reset. You must perform a target reset to make cluster failovers work. Use SCSI bus device reset to clear SCSI reservations. The SAN Data Gateway does not support LIP reset and full login is not necessary after the target reset.

7. Press Escape to return to the **Configuraton Settings** menu.

8. From the **Configuration Settings** menu, scroll down to the **Extended Firmware Settings** menu. Press Enter.

9. From the **Extended Firmware Settings** menu, scroll down to **Connection Options** to open a window for Option and Type of Connection.

10. Select the option:

- 0: Loop only
- 1: Point-to-point
- 2: Loop preferred (If you cannot use arbitrated loop, then default to point-to-point)
- 3: Point-to point, otherwise loop (If you cannot use point-to-point, default to arbitrated loop).

> **Note:** If you do a direct connect between the ESS and the host system, the option you select must match the port connections on the ESS. This statement is not true if you connect through a switch because the ESS is point-to-point.

11. Press Escape.
12. Save the changes. Highlight **Yes**.
13. Restart the server.

Loading the current fibre-channel adapter driver

Perform the following steps to load the current driver onto the QLogic adapter card.

1. Go to the following Web site: www.qlogic.com
2. From the home page, click **Driver Download**.
3. Click **Drivers**.
4. Click **Fibre-Channel Adapter Drivers**.
5. Click **QLA2*xxx* drivers**.
6. Click **Windows NT 4.0**.
7. Click **Driver**.
8. In the Save As pop-up window, scroll to find the current driver file, 2*xxxxxxx*.exe

   Note: Save the file to an existing file folder or create a temporary directory where you can save the current driver file.

9. Click **Save**.
10. Close the Web site.
11. From your Windows NT Start menu, click **Run**.
12. In the Run pop-up window, ensure the drive letter in the field is the same as the drive letter where you saved the 2*xxxxxxx*.exe file in step 8. If no drive letter appears, type the letter of the drive where you saved the driver file.
13. Type the driver file name after *x:* where *x* is the drive letter you specified to save the file.
14. Type the directory name where you want to put the file. Click **Zip**.
15. Click **OK** to unzip the current driver file.

Installing the fibre-channel adapter drivers

Perform the following steps to install the fibre-channel adapter drivers.

1. From your Windows NT desktop, double click the icon for **My Computer**.
2. Double click the icon for **Control Panel**.
3. Double click the icon for **SCSI Adapters**.
4. In the SCSI Adapters window, click the tab for **Drivers**.
5. Click **Add**.
6. In the Install Drivers window, click **Have Disk**.
7. In the Install from Disk window, ensure the drive letter in the field for **Copy Manufacturer's Files From** is the drive letter you specified to save the 2*xxxxxxx*.exe file in step 8 in "Loading the current fibre-channel adapter driver".
8. Type the name of the current driver file in the field for **Copy Manufacturer's Files From** after the drive letter prompt.
9. Click **OK**.
10. Click **OK** to exit.
11. Restart your host system.

Configuring the ESS with the QLogic QLA2100F or QLogic QLA2200F host adapter card

To configure the host adapter card, use the IBM Enterprise Storage Server StorWatch Specialist.

Performing a FlashCopy from one volume to another volume

Perform the following steps to perform a FlashCopy from one Windows NT 4.0 volume to another volume. Before you perform the steps, you must log on with administrator authority. The following steps assume you perform the steps from the host where the FlashCopy target is.

1. From the taskbar, click **Start**.
2. From the Start menu, click **Programs**.
3. From the Programs menu, click **Administrative Tools**.
4. From the Administrative Tools menu, click **Disk Administrator**.

   This action displays the Disk Administrator error message window. Click **OK**.
5. From the Disk Administrator dialogue box, select the disk drive letter that is your target.
6. From the menu bar, click **Tools**.
7. From the Tools pull down menu, click **Assign Drive letter**.
8. From the Assign Driver letter window, click the radio button for **Do Not Assign a Drive Letter**. Click **OK**.
9. Perform the FlashCopy operation.

   Note: If the ESS uses the volume serial numbers to do a FlashCopy on a Windows NT host system, use the IBM Subsystem Device Driver to obtain the volume serial numbers.
10. Go back to the Disk Administrator and select the FlashCopy target.
11. From the menu bar, click **Tools**.
12. Click **Assign the drive letter**.
13. From the Assign Driver letter window, click the radio button for **Select the Assigned Drive letter**. Click **OK**.

Chapter 16. Attaching an ESS to a Windows 2000 host system with fibre-channel adapters

This chapter tells you how to attach an ESS to a Windows 2000 host system with fibre-channel adapters.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details about the release level for your operating system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an ESS.

1. The IBM SSR installs the ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. You or an IBM SSR defines the fibre-channel host system with the world-wide port name identifiers. For the list of world-wide port names see "Appendix B. Locating the world-wide port name (WWPN)" on page 135.
3. You or an IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

4. You or an IBM SSR configures the host system for the ESS by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.2.1 does not support the Windows 2000 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel adapters supported is 16 for a total of 16 fibre-channel ports.

Note: To improve performance, IBM recommends that you map to the LUNs for the target volumes of the Windows NT or Windows 2000 host until you need access to the data on the target volume. Perform the LUN mapping after the PPRC operation and immediately before you need access to the data. You must restart the host system before you can access the data on the target volume. You greatly reduce the time it takes the host system to reboot by performing the LUN mapping. Otherwise, the time to reboot could take 10 minutes per PPRC target volume.

Installing the QLogic QLA2100F adapter card

This section tells you how to attach an ESS to a Windows 2000 host system with the QLogic QLA2100F adapter card.

Single port fibre-channel interfaces with the QLogic QLA2100F adapter card supports the following loop modes:

- Target
- Initiator
- Target and initiator

Notes:

1. The arbitrated loop topology is the only topology available for the QLogic QLA2100F adapter card.
2. When you install the QLA2100F adapter card on your server, IBM recommends you install the card on a server with four processors. This ensures you do not have a problem when you start the server.

Perform the following steps to install the QLogic QLA2100F adapter card:

1. Install the QLogic QLA2100F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the Configuration Settings menu, select **Host Adapter Settings**.
6. From the Advanced Adapter Settings menu, press the Down Arrow to highlight **LUNs per target**. Press Enter.
7. Use the Down Arrow find and highlight **256**. Press Enter.
8. Press Escape.
9. To save the changes, highlight **Yes**. Press Enter.
10. Restart the server.

Installing the QLogic QLA2200F adapter card

This section tells you how to attach an ESS to a Windows 2000 host system with the QLogic QLA2200F adapter card. Single- and dual-port fibre-channel interfaces with the QLogic QLA2200F adapter card support the following public and private loop modes:

- Target
- Public initiator
- Private initiator
- Target and public initiator
- Target and private initiator

Perform the following steps to install the QLogic QLA2200F adapter card:

1. Install the QLogic QLA2200F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the **Configuration Settings** menu, select **Host Adapter Settings**.

To set the parameters and values from the Host Adapter settings menu, use the following:

a. Host adapter BIOS: **Disabled**

b. Frame size: **2,048**

c. Loop reset delay: **5 (minimum)**

d. Adapter hard loop ID: **Disabled**

   Some configurations might require hard IDs. Consult the separate application note that addresses fibre-channel addres for more information.

6. From the **Advanced Adapter Settings** menu, press the Down Arrow to highlight **LUNs per target**; then press Enter. Set the parameters and values from the **Advanced Adapter Settings** menu as follows:

   a. Execution throttle: **240**

   b. Fast command posting: **Enabled**

   c. >4 GB addressing: **Disabled for 32 bit systems**

   d. LUNs per target: **0**

   e. Enable LIP reset: **No**

   f. Enable LIP full login: **No**

   g. Enable target reset: **Yes**

   h. Login retry count: **20 (minimum)**

   i. Port down retry count: **20 (minimum)**

   j. Driver load RISC code: **Enabled**

   k. Enable database updates: **No**

   l. Disable database load: **No**

   m. IOCB allocation: **256**

   n. Extended error logging: **Disabled (might be enabled for debugging)**

   > **Note:** The Enable LIP reset, Enable LIP full logon, and Enable target reset parameters control the behavior of the adapter when Windows 2000 tries to do a SCSI bus reset. You must perform a target reset to make cluster failovers work. Use SCSI bus device reset to clear SCSI reservations. The SAN Data Gateway does not support LIP reset and full login is not necessary after the target reset.

7. Press Esc to return to the **Configuraton Settings** menu.

8. From the **Configuration Settings** menu, scroll down to the **Extended Firmware Settings** menu. Press Enter.

9. From the **Extended Firmware Settings** menu, scroll down to **Connection Options** to open a window for Option and Type of Connection.

10. Select the option:

    - 0: Loop only
    - 1: Point-to-point
    - 2: Loop preferred (If you cannot use arbitrated loop, then default to point-to-point)
    - 3: Point-to point, otherwise loop (If you cannot use point-to-point, default to arbitrated loop).

    > **Note:** If you do a direct connect between the ESS and the host system, the option you select must match the port connections on the ESS. This statement is not true if you connect through a switch because the ESS is point-to-point.

11. Press Esc.
12. Save the changes. Highlight **Yes**.
13. Restart the server.

Loading the current fibre-channel adapter driver

Perform the following steps to load the current driver onto the QLogic adapter card.

1. Go to the following Web site: http://www.qlogic.com
2. From the home page, click **Driver Download**.
3. Click **Drivers**.
4. Click **Fibre-Channel Adapter Drivers**.
5. Click **QLA2*xxx* drivers**.
6. Click **Windows 2000**.
7. Click **Driver**.
8. In the Save As pop-up window, scroll to find the current driver file, 2*xxxxxxx*.exe

   Note: Save the file to an existing file folder or create a temporary directory where you can save the current driver file.

9. Click **Save**.
10. Close the Web site.
11. From your Windows 2000 Start menu, click **Run**.
12. In the Run pop-up window, ensure the drive letter in the field is the same as the drive letter where you saved the 2*xxxxxxx*.exe file in step 8. If no drive letter appears, type the letter of the drive where you saved the driver file.
13. Type the driver file name after *x:*, where *x* is the drive letter you specified to save the file.
14. Type the directory name where you want to put the file. Click **Zip**.
15. Click **OK** to unzip the current driver file.

Installing the fibre-channel adapter drivers

Perform the following steps to install the fibre-channel adapter drivers.

1. From your Windows 2000 desktop, double click the icon for **My Computer**.
2. Double click the icon for **Control Panel**.
3. Double click the icon for **SCSI Adapters**.
4. In the SCSI Adapters window, click the tab for **Drivers**.
5. Click **Add**.
6. In the Install Drivers window, click **Have Disk**.
7. In the Install from Disk window, ensure the drive letter in the field for **Copy Manufacturer's Files From** is the drive letter you specified to save the 2*xxxxxxx*.exe file in step 8 on page 80 in "Loading the current fibre-channel adapter driver" on page 80.
8. Type the name of the current driver file in the field for **Copy Manufacturer's Files From** after the drive letter prompt.
9. Click **OK**.
10. Click **OK** to exit.
11. Restart your host system.

Configuring the ESS with the QLogic QLA2100F or QLogic QLA2200F host adapter card

To configure the host adapter card, use the IBM Enterprise Storage Server StorWatch Specialist.

Performing a FlashCopy from one volume to another volume

Perform the following steps to perform a basic FlashCopy from one Windows 2000 volume to another volume. Before you perform the steps, you must log on with administrator authority. The following steps assume you perform the steps from the host where the FlashCopy target is.

1. Perform the FlashCopy operation.

   Note: If the ESS uses the volume serial numbers to do a FlashCopy on a Windows 2000 host system, use the IBM Subsystem Device Driver to obtain the volume serial numbers.

2. Restart the server that has the target volume.
3. From the taskbar, click **Start**.
4. From the Start menu, click **Programs**.
5. From the Programs menu, click **Administrator**.
6. From the Administrator menu, click **Computer Management**.
7. From the Computer Management menu, click **Disk Management** to launch Disk Management..

   This assigns the drive letter to the target if needed.

If the volume is in the basic mode, you are finished.

If the volume is in dynamic mode, perform the following steps:

1. Perform the FlashCopy operation.
2. Restart the host machine (target).
3. From the taskbar, click **Start**.
4. From the Start menu, click **Programs**.
5. From the Programs menu, click **Administrator**.
6. From the Administrator menu, click **Computer Management**.
7. From the Computer Management menu, click **Disk Management** to launch Disk Management.
8. Find the disk that is associated with your volume.

   There are two panels for each disk. The panel on the left should read Dynamic and Foreign. It is probable that no drive letter will be associated with that volume.

9. Right click on that panel and select **Import Foreign Disks**. Select OK, then OK again.

   The volume now as a drive letter assigned to it. It is defined as Simple Layout and Dynamic Type. You can read and write to that volume.

10. Run CHKDSK if requested by Windows 2000.

Chapter 17. Attaching an ESS to a Novell NetWare host system with fibre-channel adapters

This chapter describes how to attach a Novell NetWare host system to an IBM ESS with the following adapter cards:

- QLogic QLA2100F
- QLogic QLA2200F

Note: The IBM SAN Fibre Channel switch 2109 S08 and IBM SAN Fibre Channel switch 2109 S16 are supported for Novell NetWare. The IBM SAN Data Gateway 2108 Model G07 is not supported for Novell NetWare.

Installing the QLogic QLA2100F adapter card

This section tells you how to attach an ESS to a Novell NetWare host system with the QLogic QLA2100F adapter card.

Single-port fibre-channel interfaces with the QLogic QLA2100F adapter card supports the following loop modes:

- Target
- Initiator
- Target and initiator

Note: The arbitrated loop topology is the only topology available for the QLogic QLA2100F adapter card.

Perform the following steps to install the QLogic QLA2100F adapter card:

Note: The following steps are an example of a configuration. The configuration for your adapter might differ.

1. Install the QLogic QLA2100F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.
6. From the **Advanced Adapter Settings** menu, press the Down Arrow to highlight **LUNs per target**. Press Enter.
7. Press the Down Arrow to find and highlight **256**. Press Enter.
8. Press Escape.
9. To save the changes, click **Yes**. Press Enter.
10. Restart the server.

Installing the QLogic QLA2200F adapter card

This section tells you how to attach an ESS to a Novell NetWare host system with the QLogic QLA2200F adapter card. Single and dual port fibre-channel interfaces with the QLogic QLA2200F adapter card support the following public and private loop modes:

- Target
- Public initiator

- Private initiator
- Target and public initiator
- Target and private initiator

Perform the following steps to install the QLogic QLA2200F adapter card:

Note: The following steps are an example of a configuration. The configuration for your adapter might differ.

1. Install the QLogic QLA2200F adapter card in the host system.
2. Connect the cable to the ESS port.
3. Restart the server.
4. Press Alt+Q to get to the **FAST!Util** command panel.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.

   Set the parameters and values from the **Host Adapter Settings** menu as follows:

   a. Host adapter BIOS: **Disabled**
   b. Frame size: **2,048**
   c. Loop reset delay: **5 (minimum)**
   d. Adapter hard loop ID: **Disabled**

      Some configurations might require hard IDs. Consult the separate application note that addresses fibre-channel addresses for more information.

6. From the **Advanced Adapter Settings** menu, press the Down Arrow key to highlight **LUNs per target**; then press Enter. Set the parameters and values from the **Advanced Adapter Settings** menu as follows:

   a. Execution throttle: **240**
   b. Fast command posting: **Enabled**
   c. >4 GB addressing: **Disabled for 32 bit systems**
   d. LUNs per target: **0**
   e. Enable LIP reset: **No**
   f. Enable LIP full login: **No**
   g. Enable target reset: **Yes**
   h. Login retry count: **20 (minimum)**
   i. Port down retry count: **20 (minimum)**
   j. Driver load RISC code: **Enabled**
   k. Enable database updates: **No**
   l. Disable database load: **No**
   m. IOCB allocation: **256**
   n. Extended error logging: **Disabled (might be enabled for debugging)**

7. Press Esc to return to the Configuraton Settings menu.
8. From the **Configurations Settings** menu, scroll down to the **Extended Firmware Settings**. Press Enter.
9. From the **Extended Firmware Settings** menu, scroll down to **Connection Options** to open the Option and Type of Connection window.
10. Press Enter.
11. Select the option:

    - 0: Loop only

- 1: Point-to-point
- 2: Loop preferred (If you cannot use arbitrated loop, then default to point-to-point.)
- 3: Point-to point, otherwise loop (If you cannot use point-to-point, default to arbitrated loop.)

Note: If you connect the ESS directly to the host system, the option you select must match the port connections on the ESS. This statement is not true if you connect through a switch because the ESS is point-to-point.

12. Press Esc.
13. To save the changes, click **Yes**. Press Enter.
14. Restart the server.

Loading the current fibre-channel adapter driver

Perform the following steps to load the current driver onto the QLogic adapter card.

1. Go to the following Web site: www.qlc.com
2. From the home page, click **Driver Download**.
3. Click **Drivers**.
4. Click **Fibre-Channel Adapter Drivers**.
5. Click **QLA2*xxx* drivers**.
6. Click **Novell NetWare**.
7. Click **Driver**.
8. In the Save As pop-up window, find the current driver file, 2*xxxxxxx*.exe

   Note: Save the file to an existing file folder or create a temporary directory where you can save the current driver file.

9. Click **Save**.
10. Close the Web site.
11. From your Novell NetWare Start menu, click **Run**.
12. In the Run pop-up window, ensure the drive letter in the field is the same as the drive letter where you saved the 2*xxxxxxx*.exe file in step 8. If no drive letter appears, type the letter of the drive where you saved the driver file.
13. Type the driver file name after *x:*, where *x* is the drive letter you specified to save the file.
14. Type the directory name where you want to put the file. Click **Zip**.
15. Click **OK** to unzip the current driver file.

Installing the fibre-channel adapter drivers

Perform the following steps to install the fibre-channel adapter drivers.

1. From your Novell NetWare desktop, double click the **My Computer** icon.
2. Double click the **Control Panel** icon.
3. Double click the **SCSI Adapters** icon.
4. In the SCSI Adapters window, click the **Drivers** tab.
5. Click **Add**.
6. In the Install Drivers window, click **Have Disk**.

7. In the Install from Disk window, ensure the drive letter in the field for **Copy Manufacturer's Files From** is the drive letter you specified to save the 2*xxxxxxx*.exe file in step 8 on page 91.

8. Type the name of the current driver file in the field for **Copy Manufacturer's Files From** after the drive letter prompt.

9. Click **OK**.

10. Click **OK** to exit.

11. Restart your host system.

Configuring the ESS with the QLogic QLA2100F or QLogic QLA2200F host adapter card

To configure the host adapter card, use the IBM Enterprise Storage Server StorWatch Specialist.

Chapter 18. Attaching an ESS to a Hewlett Packard 9000 host system with fibre-channel adapters

This chapter describes the host system requirements and provides procedures to attach an ESS to a Hewlett Packard 9000 host system with fibre-channel adapters.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Ensure that you have the installation script files. The script file is on the compact disc that you receive with the ESS.
- Ensure that you have 1 MB minimum of hard disk space available to install the 2105inst script file.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

  See the following Web site for details about the release level for your operating system:

  www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an ESS.

1. The IBM SSR installs the ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR defines the fibre-channel host system with the world-wide port name identifiers. For the list of world-wide port names, see "Appendix B. Locating the world-wide port name (WWPN)" on page 135.
3. Either you or an IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

4. Either you or an IBM SSR configures the host system for the ESS by using the instructions in your host system publications.

Note: The IBM Subsystem Device Driver 1.1.3 supports the Hewlett Packard host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel adapters supported is 16 for a total of 16 fibre-channel ports.

Instructions for installing the 2105inst script

This section provides the instructions to install the 2105inst script file for the ESS on your host system.

Before installing the 2105inst script, connect the host system to the ESS. See "Chapter 2. Attaching an ESS to an open system host with SCSI adapters" on page 17.

Install the 2105inst script from a compact disc. You must have superuser authority to complete these instructions.

Notes:

1. You can only install and run the IBM 2105 set queue depth program (version 2.7.1.00) on HP-UX operating system 10.01or later.

2. If an ESS was used with the SAN Data Gateway on a Hewlett Packard host system and the LUNs were created as fibre-channel devices by spoofing HP-UX and describing the ESS device types as Sun or other non-Hewlett Packard fibre-channel device types, the LUNs created under this false ID must be deleted and recreated as Hewlett Packard device types

Perform the following steps to install the 2105inst script from a compact disc.

1. If you do not already have a directory called /SD_CDROM, type `mkdir /SD_CDROM` to create a new directory.

2. Insert the compact disc into the CD-ROM drive.

3. Mount the drive as a file system.

4. Type: `ioscan -fnkC disk`

   After you type `ioscan -fnkC disk`, look for the device name on the list with a name of either compact disc or DVD.

5. Type: `mount -o cdcase /dev/dsk/c_t_d_ /SD_CDROM`

   Replace /dev/dsk/c_t_d_ with the device special file found in 4.

6. Type: `swinstall -s /SD-CDROM/hp-ux/ibmis.depot`

7. Type `swinstall -s /var/spool/sw/ibm2105`

8. From the Software Selection window, click **IBM2105 product.**

9. From the **Action** menu click **Mark for Install**.

10. When you see the word Yes next to the IBM2105 product, go to the **Action** menu and click **Install**.

11. When the analysis completes with no errors (Status- Ready), click **OK**.

12. Click **Yes** in the Confirmation window to begin the installation.

    A dialogue box is displayed, notifying you that installation is complete and that the system needs to be restarted.

13. Click **OK** to continue

Chapter 19. Attaching an ESS to a Sun host system with fibre-channel adapters

This chapter tells you how to change the Sun system kernel. Before you start, you must meet several attachment requirements.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system:

- Ensure that you have all of the items listed in "Equipment requirements" on page 14.
- Check the LUN limitations for your host system; see Table 1 on page 21.
- Ensure there are enough fibre-channel adapters installed in the server to handle the total LUNS you want to attach. The maximum LUNs per adapter in an fibre-channel arbitrated loop topolgy is 50.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.
- Solaris 2.6, Solaris 2.7 and Solaris 8 require patches to ensure the host and Enterprise Storage Server function correctly. See table Table 13 for the minimum revision level required for each Solaris patch ID.
-

Table 13. Solaris 2.6, 2.7 and 8 minimum revision level patches for fibre-channel

Solaris 2.6	Solaris 2.7	Solaris 8
105181-23 kernel update	106541-12 kernel update	108528-03 kernel update
105356-16 sd, ssd drivers	106924-06 isp driver	109524-02 ssd driver
105580-16 glm driver	106925-04 glm driver	109657-01 isp driver
105600-19 isp driver	107147-08 pci driver	108974-03 sd, uata drivers
-	107458–10 dad, sd, ssd, uata drivers	-

Review the Sun host SCSI adapter device driver installation and configuration utility documents for additional Solaris patches that you might need.

-

See the following Web site for details about the release level for your operating system:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an ESS.

1. The IBM SSR installs the ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR defines the fibre-channel host system with the world-wide port name identifiers. For the list of world-wide port names, see "Appendix B. Locating the world-wide port name (WWPN)" on page 135.
3. Either you or an IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

Note: You previously filled out the information on the logical configuration work
sheet in the *IBM Enterprise Storage Server Configuration Planner*.

4. Either your or an IBM SSR configures the host system for the ESS by using the
   instructions in your host system publications.

Note: The IBM Subsystem Device Driver does not support the Sun host system in
a clustering environment. The IBM Subsystem Device Driver supports the
host system in a clustering environment. To have failover protection on an
open system, the IBM Subsystem Device Driver requires a minimum of two
fibre-channel adapters. The maximum number of fibre-channel adapters
supported is 16 for a total of 16 fibre-channel ports.:

- Sun host hardware platforms limited to 32-bit mode and all Sun host systems
  running Solaris 2.6.
- Sun host hardware platforms with 64-bit mode capabilities running Solaris 7 or
  Solaris 8.

Mapping hardware

Perform the following steps to map the hardware if your host is not turned on:

1. Turn on the Sun host system and wait for the host to perform the self-tests.
2. Press Stop+A.
3. Type `printenv` at the console prompt.
4. Review the list that displays to determine the value of the scsi_initiator_id.

   The target ID is reserved for the system and must not be used by another
   device.

Perform the following steps to map the hardware if your host is turned on:

1. Type `eeprom` at the console prompt.
2. Review the list that displays to determine the value of the scsi_initiator_id.

   The target ID is reserved for the system and must not be used by another
   device.

Configuring host device drivers

The following procedures tell you how to update the Solaris SCSI driver
configuration file to enable access to target and LUN pairs configured on the ESS.

1. Change to the directory by typing: `cd /kernel/drv`
2. Backup the sd.conf file in this subdirectory.
3. Edit the sd.conf file to add support for the target and LUN pairs configured on
   the host system. See Figure 20 on page 97 for an illustration that shows the
   lines required to access LUNs 0 - 7 on target 8.

   Note: Do not add duplicate target and LUN pairs.

```
name="sd" class="scsi"
target=8 lun=0;
name="sd" class="scsi"
target=8 lun=1;
name="sd" class="scsi"
target=8 lun=2;
name="sd" class="scsi"
target=8 lun=3;
name="sd" class="scsi"
target=8 lun=4;
name="sd" class="scsi"
target=8 lun=5;
name="sd" class="scsi"
target=8 lun=6;
name="sd" class="scsi"
target=8 lun=7;
```

Figure 20. Example of sd.conf file entries

4. Type **reboot -- -r** from Open Windows to shutdown and restart the Sun host
   system with the kernel reconfiguraiton option or type **boot -- -r** from the ok
   prompt after you shutdown.

The fibre-channel host bus adapter configuration file installed by the adapter
software package is tunable for host system reliability and performance.

The fibre-channel adapters supported for Sun attachment to the Enterprise Storage
Server are capable of full fabric support. It is recommended that all fibre-channel
driver configurations include WWPN, WWNN, Port ID, or host bus adapter binding
of target LUN pairs.

Binding of target LUN pairs is implemented in the Solaris SCSI driver configuration
file or in the fibre-channel host bus adapter configuration file installed by the
adapter software package. Refer to the vendor adapter documentation and utilities
for detailed configuration instructions.

The fibre-channel host bus adapter configuration files are tunable for host system
reliability and performance. See Table 14for the recommended host bus adapter
configuration settings to for a JNI FC64-1063 and for a JNI FCI-1063.

Table 14. Recommended host bus adapter configuration file parameters for JNI FC64-1063 and JNI FCI-1063.

Parameters	Recommended settings
fca_nport	0 - default, initializes on a loop. 1 - recommended for fabric, initializes as an N_Port.
public loop	0 - default, recommended, initializes according to what fca_nport is set for disabled.
ip_disable	0 - default, IP side of the driver is enabled. 1 - recommended for fabric, IP side of the adapters is completely disabled.
failover	60 - recommend without McData switch. 300 - recommended with McData switch.
busy_retry_delay	500 - recommended, delay between retries after device returns busy response for a command.
scsi_probe_delay	5000 - recommended, delay before SCSI probes are allowed during boot.

See Table 15 on page 98 for recommended host bus adapter configuration file
parameters for an Emulex LP-8000.

Table 15. Recommended host bus adapter configuration file parameters for Emulex-LP-8000

Parameters	Recommended settings
automap	1 - default. automatically assigns SCSI IDs to FCP targets.
fcp-on	1 - default, turn on FCP
lun-queue-depth	16 - recommended when there are less then 17 LUNs per adapter. Set value = 256/(Total LUNs per adapter) when there are greater then 16 LUNs per adapter. If your configuration includes more then one LP8000 adapter per server, calculate the lun-queue-depth value using the adapter with the most LUNs attached.
no-device-delay	15 - recommended, delay to failback and I/O
network-on	0 - default, recommended for fabric, do not turn on IP networking. 1 - turn on IP networking.
scan-down	2 - recommended, use inverted ALPA map and cause target assignment in private loop.
topology	2 - recommended for fabric, point-to-point mode only. 4 - recommended for non-fabric, arbitrated loop mode only.
zone-rscn	0 - default. 1 - recommended for fabric, check name server for RSCNs.

Installing the IBM Subsystem Device Driver

The following instructions explain how to install the IBM Subsystem Device Driver from a CD-R. You can use the IBM Subsystem Device Driver in conjunction with the IBM command-line interface program.

1. Type `ps -ef | grep vold` to ensure that volume manager is running.

   This command displays the /usr/sbin/vold process. If it does not display, type `/etc/init.d/volmgt start`

2. Insert the IBM Subsystem Device Driver CD-R into the CD-ROM drive.

   A File Manager window displays and shows the paths for the Subsystem Device Driver package subdirectories. 98 shows an example of the path.

   `/cdrom/unnamed_cdrom`

3. Change to the subdirectory that contains the Subsystem Device Driver package.

   a. For Sun host hardware platforms limited to 32-bit mode and for all Sun host systems running Solaris 2.6 type:

      `cd /cdrom/unnamed_cdrom/Sun32bit`

   b. For Sun host hardware platforms with 64-bit capabilities running Solaris 7 or Solaris 8 type:

      `cd /cdrom/unnamed_cdrom/Sun64bit`

4. Type `pkgadd -d` to initiate the package add menu.

5. Select the option number for the IBM DPO driver, (IBMdpo) and press `Enter`.

6. Select **y** to continue the installation for all prompts until the package installation is complete

7. Select **q** and press Enter to exit the package options menu.

8. Type **cd** to change back to the root directory.

9. Type **cd** to change back to the root directory.

10. Type `eject cdrom` and press Enter to remove the Subsystem Device Driver CD-R.

11. Edit the .profile file in the root directory and add the lines shown in 99 to include the IBM DPO subdirectory in the system path.

```
PATH=$PATH:/opt/IBMdpo/bin
export PATH
```

The IBM DPO driver subdirectory will be automatically added to the path at system boot.

Setting fibre-channel host bus adapter configuration parameters

The following section identifies the recommended fibre-channel host bus adapter configuration file parameter changes to attach a Sun host system to an ESS.

Setting the Sun host system parameters

The following procedures explain how to set the Sun host system parameters for optimum performance on the ESS.

1. Type **cd / etc** to change to the /etc subdirectory.
2. Backup the system file in the subdirectory.

   If the configuration includes JNI adapters, go to step 3. If the configuration only includes Emulex adapters, go to step 4 on page 100.

3. Edit the system file and set the following parameters for servers with configurations that use JNI adapters:

   - sd_max_throttle

     This parameter specifies the maximum number of commands that the sd driver will queue to the host bus adapter driver. The recommended value is 16 for fibre-channel configurations with less then 17 LUNs per adapter. For configurations with greater then 16 LUNs per adapter use the following formula: sd_max_throttle=256/(LUNs) for each adapter.

     Use the adapter with the highest number LUNs attached when calculating the lun-queue-depth value for servers with more then one adapter installed.

     ```
     SunOS format utility shows thirty two 2105 LUNs attached to controller 1,
     (c1t#d#), and forty eight 2105 LUNs attached to controller 2, (c2t#d#).
     The sd_max_throttle value would be set to 5:
     ```
     ```
     set sd:sd_max_throttle=5
     ```

   - sd_io_time

     This parameter specifies the timeout value for disk operations. Add the following lines to the /etc/system file to set the sd_io_time parameter for the ESS LUNs:
     ```
     set sd:sd:_io_time=0xf0
     ```

   - sd_retry_count

     This parameter specifies the retry count for disk operations. Add the following lines to the /etc/system file to set the sd_retry_count parameter for the ESS LUNs
     ```
     set sd:sd_retry_count=10
     ```

   - maxphys

     This parameter specifies the maximum number of bytes you can be transfer for each SCSI transaction. The default value is 126976 (124KB). If the I/O block size requested exceeds the default value, the request is broken into more then one request. The value should be tuned to the intended use and application requirements. For maximum bandwidth set the maxphys parameter by adding the following line to the /etc/system file:
     ```
     set maxphys=8388608
     ```

If you are using Veritas volume manager on the ESS LUNs, you must set the VxVM max I/O size parameter, (vol_maxio), to match the maxphys parameter. If you set the maxphys parameter to 8388608 you will need to add the following line to the /etc/system file to set the VxVM I/O size also to 8 MB:

```
set vxio:vol_maxio=16384
```

4. Edit the system file and set the following parameters for servers with configurations that only use Emulex adapters.

   - sd_io_time

     This parameter specifies the timeout value for disk operations. Add the following lines to the /etc/system file to set the sd_io_time parameter for the ESS LUNs:

     ```
     set sd:sd:_io_time=0xf0
     ```

   - sd_retry_count

     This parameter specifies the retry count for disk operations. Add the following lines to the /etc/system file to set the sd_retry_count parameter for the ESS LUNs

     ```
     set sd:sd_retry_count=10
     ```

   - maxphys

     This parameter specifies the maximum number of bytes you can be transfer for each SCSI transaction. The default value is 126976 (124KB). If the I/O block size requested exceeds the default value, the request is broken into more then one request. The value should be tuned to the intended use and application requirements. For maximum bandwidth set the maxphys parameter by adding the following line to the /etc/system file:

     ```
     set maxphys=8388608
     ```

     If you are using Veritas volume manager on the ESS LUNs, you must set the VxVM max I/O size parameter, (vol_maxio), to match the maxphys parameter. If you set the maxphys parameter to 8388608 you will need to add the following line to the /etc/system file to set the VxVM I/O size also to 8 MB:

     ```
     set vxio:vol_maxio=16384
     ```

Chapter 20. Attaching an ESS to an IBM RS/6000 host system with fibre-channel adapters

This chapter describes the host system requirements and provides the procedures for attaching an ESS to an IBM RISC System/6000 (RS/6000) or an IBM RISC System/6000 Series Parallel (SP) Complex host system.

Note: For an RS/6000 host system, you can use two topologies:

- Point-to-point (switched fabric) topology
- Arbitrated loop topology

   The RS/6000 host system does not support more than one host bus adapter on the loop. The RS/6000 host system does support a direct connection of the RS/6000 host system to an ESS using the fibre-channel arbitrated loop protocol.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system.

- Ensure that you have all of the items listed in the "Equipment requirements" on page 14.
- Ensure that you have the installation script files. These files are on the diskette and the compact disc you receive with the ESS.
- Ensure that you have 1 MB minimum of hard disk space available to install the AIX host attachment package.
- Ensure that you have the documentation for your host system and the *IBM Enterprise Storage Server User's Guide*. The User's Guide is on the compact disc that you receive with the ESS.

   For details about the release level for your operating system, see the following Web site:

   www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an IBM Enterprise Storage Server.

1. The IBM SSR installs the IBM Enterprise Storage Server by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or an IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.

3. Either you or an IBM SSR configures the host system for the IBM Enterprise Storage Server. Use the instructions in your host system publications.
4. Either you or an IBM SSR checks the LUN limitations for the RS/6000. See Table 1 on page 21.

Note: The IBM Subsystem Device Driver supports RS/6000 host system in a clustering environment. To have failover protection on an open system, the IBM Subsystem Device Driver requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel adapters supported is 16 for a total of 16 fibre-channel ports.

Instructions for installing the 2105 host attachment package

This section provides the instructions to install the host attachment package for the ESS on your host system. IBM recommends that you run the host attachment package on each host system attached to the ESS for which an installation script is provided.

Before installing the 2105 host attachment package

Before you install the host attachment package:

1. Attach the ESS to your host system.
2. Turn on the host system and all attachments.

Note: Before you install the host attachment package, you must have:

- Root access
- AIX system administrator knowledge
- Knowledge of the Software and Management Interface Tool (SMIT) to install the ESS host attachment package.

Replacing an older version of the 2105 installation package

If you want to replace an older version of the host attachment package (tar version) and have data that exists on all configured 2105 disks, the code prompts you to remove all ESS product-related hdisk devices. Perform the following steps to remove the devices:

1. Run umount on the file system.
2. Run varyoffvg 2105 volume group.
3. Type `rmdev -dl` on the command line to unconfigure the 2105 devices.

After you install the ibm2105.rte file and all of the 2105 devices are reconfigured, vary on the volume groups and remount the file systems. The data on the file systems should now be available again.

Perform the following steps by using SMIT to install the IBM 2105 host attachment on your system.

Installing the 2105 host attachment package

Note: The following procedure is an example. The example uses /dev/cd0 for the address of the CD-ROM drive. Your address may vary.

Install the host attachment package from a compact disc or a diskette. You must have superuser authority to complete the instructions.

1. From your desktop window, type `smit install_update` to go directly to the installation panel.
2. Click **Install and Update from the Latest Available Software** and press Enter.
3. Press F4 to display the Input Device/Directory for Software window.
4. Select the CD-ROM drive that you are using for the installation, for example, /dev/cd0. Press Enter.

   The Install and Update from the Latest Available Software window is displayed.
5. Click **Software to Install** and press F4.
6. Select **Software Packages** and press F7. Press Enter.

The Install and Update from the Latest Available Software panel is displayed with the name of the software you selected to install.

7. Check the default option settings to ensure that they are what you need.

8. Press Enter to install the software.

   SMIT responds with the following question: Are you sure?

9. Press Enter to continue.

   The installation process may take several minutes. A message is displayed on your screen when the installation process is complete.

10. Verify whether or not the installation is successful.

11. Press F10 when the installation process is complete.

12. Exit from SMIT.

13. Remove the compact disc.

14. Shut down the host system.

15. Turn on the host system.

Verifying the IBM ESS configuration

To verify the configuration of the ESS on the AIX host system, type the following command:

```
lsdev -Cc disk | grep 2105
```

A list of all IBM ESS devices is displayed. See Figure 21 for an example.

```
hdisk3 Available 30-68-01 IBM FC2105F20
hdisk4 Available 30-68-01 IBM FC2105F20
hdisk5 Available 30-68-01 IBM FC2105F20
...
...
```

Figure 21. Example of a list of devices displayed when you use the lsdev -Cc disk | grep 2105 command, fibre-channel

If a device is listed as another type of device, the message shown in Figure 22 is displayed.

This message indicates that the configuration was not successful.

```
hdisk3 Available 30-68-01, Other FCSCSI disk device
hdisk4 Available 30-68-01, Other FCSCSI disk device
hdisk5 Available 30-68-01, Other FCSCSI disk device
...
...
```

Figure 22. Example of a list of other devices displayed when you use the lsdev -Cc | grep 2105 command, fibre-channel

When you use the **lsdev -Cc disk | grep 2105** command, you know the installation is successful if you see the information listed in Figure 21.

When you use the **lsdev -Cc disk | grep 2105** command, you see only display lines that contain the value immediately after it. If you have not defined any 2105 devices, a message of none is displayed.

Configuring VSS devices and ESS devices with multiple paths per LUN

The Versatile Storage Server and Enterprise Storage Server support multiple path configurations for a LUN. This means that you can have multiple hdisks available on the AIX server for each physical LUN. If you create a PVID sector 0 of a LUN and you delete all hdisks from the system with the **rmdev** command, you must restart the system. If you want to restore all multiple paths for all LUNS, use the **cfgmgr** command for each fibre-channel adapter.

Chapter 21. Attaching an ESS to a NUMA-Q host system with fibre-channel adapters

This chapter tells you how to attach an ESS to a NUMA-Q host system with fibre-channel adapters. This chapter also tells you how to install and configure the IOC-0210–54 adapter card.

Note: You must use the switched fabric topology to attach the ESS to a NUMA-Q.

The ESS also offers the following interim support for fibre-channel attachment:

Feature Code 3019
> With the feature code 3019, you can perform an attachment of an ESS to a NUMA-Q host system through the NUMA-Q fibre-channel to SCSI bridge. This feature code includes one SCSI adapter that you purchase, and a no-cost loan of a NUMA-Q fibre Channel to SCSI bridge. IBM requires that you sign a loan agreement for the bridge.

Note: Feature code 3019 is not a standard feature. To get feature code 3019, contact your IBM sales representative.

For more information about how to attach a NUMA-Q host system with fibre-channel adapters, see the *NUMA-Q ESS Integration Release Notes* and the *Fibre Channel Subsystem Installation Guide.* To obtain a copy, see your IBM sales representative.

Attachment requirements

This section lists the requirements for attaching the ESS to your host system.

Either you or an IBM service support representative (SSR) must perform the following tasks to install and configure an ESS:
1. The IBM SSR installs the IBM ESS by using the procedures in the *IBM Enterprise Storage Server Service Guide*.
2. Either you or the IBM SSR defines the fibre-channel host system with the world-wide port name identifiers. For information about how to locate the world-wide port name for a NUMA-Q host system, see "Appendix B. Locating the world-wide port name (WWPN)" on page 135.
3. Either you or the IBM SSR defines the fibre-port configuration if you did not do it during the installation of the ESS or fibre-channel adapters.

   Note: You previously filled out the information on the logical configuration work sheet in the *IBM Enterprise Storage Server Configuration Planner*.
4. Configure your host system for the ESS by using the instructions in your host system publications.

NUMA-Q system requirements

The ESS is supported on the NUMA-Q host by a personality module of code incorporated into Service Pack 3 for DYNIX/ptx V4.5.1. To install Service Pack 3, insert the Service Pack 3 compact disc into the CD-ROM or CD-R drive. Open the readme file for instructions on installing Service Pack 3. See Table 16 on page 106 for the NUMA-Q system requirements. Support for Copy Services on DYNIX/ptx

V4.5.1 requires a special Technology Pack. You can obtain the Technology Pack through an IBM sales representative who handles your NUMA-Q purchases.

Table 16. NUMA-Q system requirements for the Enterprise Storage Server

NUMA-Q System Element	Requirement
DYNIX/ptx operating system	Version 4.5.2 or higher
NUMA-Q hardware models	All NUMA-Q Quad-based systems
Fibre-channel host adapter	Emulex LP7000-e with firmware SF 3.2.0
Fibre-channel switch	IBM 2109 Model S08 or IBM 2109 Model S16
Clustered NUMA-Q Hosts	ptx/CLUSTERS V2.2.1

Installing the IOC-0210-54 adapter card

Perform the following steps to install the IOC-0210-54 adapter card:

1. Contact your IBM SSR to install the IOC-0210-54 adapter card in the ESS.
2. Connect the cable to the ESS port.

   The SSR establishes the private LAN connection between both clusters on the ESS, the Ethernet hub, and the ESS personal computer console.

   Preconfigured multimode optical cables are available to connect the ESS to the NUMA-Q host system. The 8 m (24 ft) cable might be required. The way you connect the cable to the ESS through the fibre-channel switch depends on the level of I/O throughput.

   Note: For information about connection schemes, see the *Fibre Channel Subsystems Installation Guide* at the following Web site:

   techdocs.sequent.com/staticpath/shsvccd/start.htm
3. Restart the server.

Configuring the IOC-0210-54 adapter card

To configure the IOC-0210–54 adapter card, contact your IBM SSR or see the *IBM Enterprise Storage Server Web Interface User's Guide*.

Appendix A. Using the ESS Copy Services commands

This chapter describes the commands you can use from the ESS Web Copy Service command-line interface (CLI). The ESS Web Copy Services provides a CLI Java-based application package you can optionally install on your host system.

The CLI application provides a set of commands that allow you to write customized scripts for a host system that initiates pre-defined tasks in an ESS Web Copy Services server application. The set of CLI commands are used to indirectly control ESS peer-to-peer Remove Copy and FlashCopy configuration tasks within an ESS Web Copy Services server group. You can use the CLI commands for the following operating systems:

- AIX
- Windows NT 4.0
- HP-UX
- Sun Solaris
- Windows 2000

Requirements for Copy Services CLI

Copy Services command-line interface provides Java 1.1.8 based functions that allow you to invoke peer-to-peer remote copy or FlashCopy from your host system.

To obtain current information about the levels of software that are supported for the various host systems, go to:

www.storage.ibm.com/hardsoft/products/ess/supserver.htm

Pre-installation procedures for Windows NT and Windows 2000

Install Java 1.1.8 on your system.

Note: Record the directory to which Java 1.1.8 was installed. This will be requred during the ibm2105cli install wizard panels.

Installation procedures for Windows NT and Windows 2000

After you have completed the pre-installation procedures, perform these installation procedures:

1. Insert the CD-ROM into the CD-ROM drive.
2. Click Start --> Run
3. Click browse.
4. Select the CD-ROM drive.
5. Select winNt\IBMcli\Setup.exe
6. Click Open
7. Click OK
8. Follow the wizard instructions using the default directory location for the ibm2105 cli code.

Post-installation procedures for Windows NT and Windows 2000

After you have completed the installation procedures, perform the post-installation procedures-

1. Ensure that the CD-ROM install process has installed this package in the directory- C:\Program Files\IBM 2105 CLI

   Note: Do not move any files from the C:\Program Files\IBM 2105 CLI directory. The bat files and executable files depend on the directory tree.

After you complete the installation procedures, restart the host system.

Pre-installation procedures for AIX

Install Java 1.1.8 on your system.

Installation procedures for AIX

After you have completed the pre-installatino procedures, perform these installation procedures:

1. Log in as the root user.
2. Load the CD-ROM into your CD-ROM drive.
3. From your desktop window, type smitty install_update. The Install and Update Software menu is displayed.
4. Press Enter.
5. Highlight Install and Update from the latest Available Software and press Enter. The screen is displayed.
6. Press F4 to display the Input Device / Directory for Software panel.
7. Select the CD-ROM drive that you are using for the installation (for example, /dev/cd0) and press Enter.
8. Press Enter again. The Install and Update from the Latest Available Software screen is displayed.
9. Highlight the Software to Install and press F4. The Software to install screen displayed.
10. Select the ibm2105cli installation package for your operating system and press Enter. The Install and Update from Latest Available Software panel is displayed with the name of the software you selected to install.
11. Check the default option settings to ensure that they are what you need.
12. Press Enter to install. smitty responds with the following message:

    ```
    ARE YOU SURE?
    Continuing may delete information you may want to keep.
    This is your last chance to stop before continuing.
    ```
13. Press Enter to continue. The installation process can take several minutes to complete.
14. When the installation completes, press F10 to exit from smitty and remove the CD-ROM.

Post-installation procedures for AIX

After you have completed the installation procedures, perform the post-installation procedures-

1. The CD-ROM install process will install this package in the /usr/opt/ibm2105cli directory.

   Note: Do not move any files from the /usr/opt/ibm2105cli directory. The shell scripts and executables depend on the directory tree.

2. If the package was installed into a location /usr/opt/ibm2105cli, execute the following: -ln -s /usr/opt/ibm2105cli/libioser.a /usr/lib/libioser.a If the package was installed into a location other than /usr/opt/ibm2105cli, execute the following: -ln -s /your_install_directory/libioser.a /usr/lib/libioser.a

3. If for any reason, the package was installed into a location other than /usr/opt/ibm2105cli then do the following:

   a. Edit each shell script.
   b. Change the line that reads:
      ```
      export INSTALL=/opt/ibm2105cli
      ```

      to

      ```
      export INSTALL=/your_install_directory
      ```

4. If Java 1.1.8 is installed in a location other than /usr/jdk_base (AIX) then do the following:

   a. Edit each shell script or bat file
   b. Change the line that reads:
      ```
      export JAVA_HOME=/usr/java
      ```

      to

      ```
      export JAVA_HOME=/your_java_directory
      ```

Pre-installation procedures for Hewlett Packard

Install Java 1.1.8 on your system.

Installation procedures for Hewlett Packard

After you have completed the pre-installatino procedures, perform these installation procedures:

1. Log in as the root user.
2. Load the CD-ROM into your CD-ROM drive.
3. Mount the CD-ROM into the CD-ROM drive.
4. Type swinstall -s /SD_CDROM/hpux/IBMcli.depot. This will bring up the graphical interface.
5. Select IBMcli.tag. On the top menu bar, select Actions and then Install.
6. Follow the installation procedures.

Post-installation procedures for Hewlett Packard

After you have completed the installation procedures, perform the post-installation procedures-

1. The CD-ROM install process will install this package in the /opt/ibm2105cli directory.

   Note: Do not move any files from the /opt/ibm2105cli directory. The shell scripts and executables depend on the directory tree.

2. If the package was installed into a location /usr/opt/ibm2105cli, execute the following: -ln -s /usr/opt/ibm2105cli/libioser.a /usr/lib/libioser.a If the package was installed into a location other than /usr/opt/ibm2105cli, execute the following: -ln -s /your_install_directory/libioser.a /usr/lib/libioser.a

3. If for any reason, the package was installed into a location other than /opt/ibm2105cli then do the following:

    a. Edit each shell script.

    b. Change the line that reads:

       ```
       export INSTALL= /opt/ibm2105cli
       ```

       to

       ```
       export INSTALL=/your_install_directory
       ```

4. If Java 1.1.8 is installed in a location other than /opt/java, then do the following:

    a. Edit each shell script or bat file

    b. Change the line that reads:

       ```
       export JAVA_HOME=/opt/java
       ```

       to

       ```
       export JAVA_HOME=/your_java_directory
       ```

Pre-installation procedures for Sun

Install Java 1.1.8 on your system.

Installation procedures for Sun

After you have completed the pre-installatino procedures, perform these installation procedures:

1. Log in as the root user.

2. Load the CD-ROM into your CD-ROM drive.

   Note: A window display might pop-up for the CD-ROM drive. Do not worry about the new window.

3. Display the devices mounted to the system at a terminal window. To display type, mount. This will show you the path to all the devices connected to the Sun system.

4. Look for the path for the CD-ROM device. If you do not see the CD-ROM device path, repeat step two again.

5. Change your directory to the full path for the CD-ROM device. Example: cd /cdrom/unnamed_cdrom/

6. Type **pkgadd -d solaris7** for Solaris 7 or **pkgadd -d solaris6** for Solaris 6.

7. Select 1 just to install the ibm2105cli program.

8. Answer yes to the next few questions, unless you would like to custom install the program. If you choose to do a custom install, answer the question according to you needs.

9. Select q, when the installation program return to the option menu. This will allow you to exit the program.

10. To remove the CD-ROM, type eject cdrom at a terminal window. If the system responds with a busy statement, type cd then eject cdrom.

Post-installation procedures for Sun

After you have completed the installation procedures, perform the post-installation procedures-

1. The CD-ROM install process will install this package in the /opt/ibm2105cli directory.

   Note: Do not move any files from the /opt/ibm2105cli directory. The shell scripts and executables depend on the directory tree.

2. If the package was installed into a location /opt/ibm2105cli, execute the following: -ln -s /opt/ibm2105cli/libioser.so /usr/lib/libioser.so If the package was installed into a location other than /opt/ibm2105cli, execute the following: -ln -s /your_install_directory/libioser.so /usr/lib/libioser.so

3. If for any reason, the package was installed into a location other than /opt/ibm2105cli then do the following:

   a. Edit each shell script.

   b. Change the line that reads:
   ```
   export INSTALL= /opt/ibm2105cli
   ```

   to
   ```
   export INSTALL=/your_install_directory
   ```

4. If Java 1.1.8 is installed in a location other than /usr/java, then do the following:

   a. Edit each shell script or bat file.

   b. Change the line that reads:
   ```
   export JAVA_HOME=/usr/java
   ```

   to
   ```
   export JAVA_HOME=/your_java_directory
   ```

5. For Sun Solaris, execute the following additional installation steps:

   a. ln -s /opt/ibm2105cli/libioser.so /usr/lib/libioser.so

      Otherwise execute:

   b. ln -s /your_install_directory/libioser.so /usr/lib/libioser.so

Configuring your host system to use ESS Web Copy Services command-line interface

You must perform the following steps before you use the ESS Copy Services command-line interface:

- Configure the ESS volumes to the host system or verify that there are volumes already configured to the host system. See "Verifying ESS logical volumes connected to the host system" on page 113 and "Configuring ESS volumes to the host system" on page 112.
- Verify that Java and the command-line interface package are installed in the host system.
- Run the operating system command to configure the ESS volumes to the host system.
- Use the ESS Specialist to verify that the ESS Web Copy Services was configured by the IBM service support representative on the ESS that uses the Copy Services command-line interface.

For each ESS, establish a connection to the ESS Specialist and perform the following steps:

Note: You must have ESS Specialist administrator authority to perform these steps.

1. Click **question mark** (?) in the upper right corner of the panel.

   This links you to the user assistance or help facility.

2. Click **Task Help** tab.

3. Scroll to the end of the Task Help list. Click **Copy Services troubleshooting and disaster recovery** under Solve Problems at the ESS Specialist Web site.

4. Click **Recovering from an Unable to Connect to the Copy Services Server message**.

5. Click **Reset ESS Web Copy Services**.

   Use this option to verify that the ESS Web Copy Services servers are configured correctly.

6. On the next panel, there will be two tables. On the first table, verify that the primary and backup server are configured and that the IP addresses are correct.

   The IP address of the ESS Web Copy Services primary server or the IP address of the Copy Services backup server or both should be given when invoking each of the command-line interface commands.

   Once the ESS Web Copy Services Server is activated, an ESS Specialist user with Administration authority has the option of setting up password protection for the use of the command-line interface.

   The ESS Specialist administrative user uses the ESS Web Copy Services Configuration panel to activate the password protection for the command-line interface. Once the password protection is enabled, the administrative user must click the Authorize button, which will display another window to add the users and their corresponding passwords.

   Ask the ESS System Administrator if Host password protection was selected for the use of CLI with ESS Web Copy Services and what userids and passwords are available for using CLI.

   To verify that the ESS Web Copy Services is up and running, establish a browser connection to the ESS Specialist and click on the Copy Services selection.

   To verify that the ESS Web Copy Services can be used for command-line interface commands, execute the command-line interface command rsTestConnection from the host system.

Configuring ESS volumes to the host system

Use the ESS Specialist storage allocation panel to perform the following tasks:

- Use the Modify Host Systems panel to define the host systems to the ESS.
- Configure the SCSI or fibre port to use by the host systems.
- Configure Disk Groups (if there is no additional capacity available to create new volumes).
- Use the Add Volumes panel to create ESS volumes and assign them to the host system.

   This procedure requires that you specify the number of logical volumes, logical volume sizes, and the host system connections to which the volumes are assigned.

See the *IBM Enterprise Storage Server Web Interface User's Guide for ESS
Specialist and ESS Copy Services* and the *IBM Enterprise Storage Server Quick
Configuration Guide* for details about how to use the ESS Specialist to configure the
ESS.

Verifying ESS logical volumes connected to the host system

To verify that there are ESS logical volumes connected to the host system, follow
the following steps:

1. click **Storage Allocation** on the Welcome to IBM StorWatch ESS Specialist
   panel.

   If the host server is configured in the ESS, you will see icons that represent the
   host server.

2. Click on the Tabular View selection on the upper right hand corner. Sort the
   table using the first column (Host/SSID) as the first sort. Scroll down to find the
   host system on the first column. The serial numbers of the logical volumes
   configured to the host system are displayed on the third column.

3. On your host system, run the operating system commands to configure new
   logical volumes to the system.

4. On your host system, execute the CLI rsList2105s command to generate a list
   of ESS logical volumes configured to that host.

5. Verify that the logical volume serial numbers in the Tabular View of the ESS
   Specialist match the output from the rsList2105s command.

See the *IBM Enterprise Storage Server Web User's Interface Guide for ESS
Specialist and ESS Copy Services* and the *IBM Enterprise Storage Server Quick
Configuration Guide* for details on how to use the ESS Specialist to configure the
ESS.

AIX, UNIX, HP-UX, or Sun commands

This section describes the Copy Services commands you can use for an AIX or
UNIX system. This section also provides the command descriptions, parameters,
and error messages for each command.

AIX, UNIX, HP-UX, or Sun command descriptions

This section describes the Copy Services commands.

rsExecuteTask.sh

Use this command to accept and execute one or more pre defined ESS
Web Copy Services Server tasks. It waits for these tasks to complete
execution.

rsList2105s.sh

Use this command to display the mapping of a host disk name to a 2105
volume serial number.

rsPrimeServer.sh

Use this command to notify the ESS Web Copy Services Server of the
mapping of a host disk name to a 2105 volume serial number. This
command is useful when the ESS Web Copy Services Web screens are
used to perform FlashCopy, peer-to-per remote copy, or both functions.

rsQuery.sh

Use this command to query the status of one or more volumes.

rsQueryComplete.sh

Use this command to accept a pre-defined ESS Web Copy Services Server task name and determine whether all volumes defined in that task have completed their peer-to-peer remove copy initialization. If not, this command waits for that initialization to complete.

Note: When grouped tasks are run, the rsQueryComplete output will display the first subtask until it has reached the completion threshold, then display next subtask until it has reached the completion threshold and so on until all the subtasks are queried.

rsTestConnection.sh

Use this command to determine whether the ESS Web Copy Services Server can successfully be contacted.

AIX, UNIX, HP-UX, or Sun command parameter descriptions

The following describe the UNIX commands used with the command-line interface.

The user needs to specify the -u username and the -p password or -a securityfilepath flags only if the administrative user has enabled the password protection for host commands on Enterprise Storage Specialist Copy Services Web configuration panel. The -a securityfilepath flag should be specified only if the -u username and the -p password flags are not specified.

The user must specify at least one of the -s primaryserver or the -b backupserver flags. The user can also specify both the -s primaryserver and the -b backupserver flags at the same time.

If only the -s primaryserver flag is specified, the connection to the given primary server is checked. If the connection is established, the command is then sent to the primary server for processing. If the connection cannot be established, the command fails.

If only the -b backupserver flag is specified, the connection to the given backup server is checked. If the connection is established, the command is then sent to the backup server for processing. If the connection cannot be established, the command fails.

If both the -s primaryserver and the -b backupserver flags are specified, the connection to the given primary server is checked. If the connection to the primary server is established, the command is then sent to the primary server for processing. If the connection to the primary server cannot be established, the connection to the backup server is checked. If the connection to the backup server is established, the command is then sent to the backup server for processing. If the connection to the backup server cannot be established, the command fails.

The following parameters are case sensitive: password, tasknames, hostname, vpath name, volume name, and serial number.

The parameters password, tasknames, hostname, vpath name, volume name, and serial number are case sensitive.

The command rsQuery.bat can be invoked for vpath name, volume name or serial number. If System Device Driver is installed, the command rsQuery.bat can be invoked only on vpath name or serial number. If System Device Driver is not installed, the command rsQuery.bat can be invoked only on volume name or serial

number. If the command rsQuery.bat is invoked on vpath name or volume name, -m flag must be specified. If the command rsQuery.bat is invoked on serial number, -m flag does not need to be specified.

rsExecuteTask.sh [-v] -u username and -p password | -a securityfilepath -s primaryserver -b backupserver taskNames

-v = Verbose. This parameter is optional and verbose.

-u = Username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-p = Password. This parameter specifies the password of an authorized userid to execute host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags -u username and -p password are not specified. The format of this file is the following: - username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

-s = primaryserver. This parameter specifies the IP address or complete host name of the ESS Web Copy Services primary server.

Before this command can be used, an ESS Web Copy Services server must be identified and configured.

-b = backupserver. This parameter specifies the IP or complete host name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

taskNames = This parameter specifies the name of one or more ESS Web Copy Services predefined tasks to be executed.

Example of output when you invoke the rsExecuteTask.sh command
The following is an example of output you see when you invoke the rsExecuteTask.sh command:

```
Volume 000FCA04 found on FCA04:10 as volume number 0
    State=simplex, status=not_suspended, FlashCopy_state=source,
Size=0.5_GB
```

rsList2105s.sh
There are no parameters for the rsList2105s.sh command.

Note: If you have the IBM Subsystem Device Driver running on your HP, Sun, NT or Windows 2000 host system and you change the configuration for the host (add or remove volumes), you must reboot the host so that the IBM Subsystem Device Driver can recognize and add or remove the paths.

Example of output when you invoke the rsList2105s.sh command
The following is an example of output you see when you invoke the rs.List2105s.sh command:

```
disk name 2105 serial number
--------- ------------------
hdisk2    102FCA04
hdisk3    103FCA04
hdisk4    104FCA04
hdisk5    105FCA04
hdisk6    106FCA04
hdisk7    107FCA04
hdisk8    108FCA04
hdisk9    109FCA04
hdisk10    002FCA04
hdisk11    003FCA04
hdisk12    004FCA04
hdisk13    005FCA04
hdisk14    006FCA04
hdisk15    007FCA04
```

Example of primary script to support a FlashCopy backup solution for AIX 4.3.x

The following is an example of a primary script you can use to support a FlashCopy backup solution for AIX 4.3.x. You must run this script prior to the time you run the secondary.sh script.

```
# Enter here the File containing the Volume Groups
FileVolGrups=
# Enter here the Output File
# Default /tmp/primary_list.lst
OutputFile=/tmp/primary_list.lst


if [ -z "$FileVolGrups" ]
 then
 echo ERROR! Logical Volume Group Input File not specified!
 exit -1
fi

if [ -f $FileVolGrups ]
 then
 :
 else
 echo ERROR! Could not find specified Logical Volume Group Input File!
 exit -1
fi

if [ -z "$OutputFile" ]
 then
 echo ERROR! Output File not specified!
 exit -1
fi

if [ -f $OutputFile ]
 then
 rm $OutputFile
fi



VolGrups=$(cat $FileVolGrups)

if [ -z "$VolGrups" ]
 then
 echo ERROR! No volume Groups specified!
 exit -1
fi

echo $0 running .......
```

```
for Ix in $VolGrups
 do
 PhVol=$(lsvg -p $Ix|awk 'NR==3 {print $1}')
 PVId=$(lspv $PhVol|grep IDENTIFIER|awk '{print $3}')
 echo $Ix $PVId >> $OutputFile
done
```

Example of secondary script to support a FlashCopy backup solution for AIX 4.3.x

The following is an example of a secondary script you can use to support a FlashCopy backup solution for AIX 4.3.x. Before you run the script, you must run the primary.sh script.

```
#!ksh


# Specify the Primary host
PriHost=
# Specify the path and name of the output file created with primary.sh on the primary server
# Default /tmp/primary_list.lst
PriFile=/tmp/primary_list.lst
# Specify local file name
LocalFile=./LocalFile.lst
# Specify Temp File to be used
TempFile="$$"_Secondary.tmp
# Specify 1-use vpaths  0-do not use vpaths
# Use Vpath only if IBM Subsystem device Driver is installed
let UseVpath=0

if [ -z "$PriHost" ]
        then
        echo ERROR! Primary Host not specified!
        exit -1
fi


if [ -z "$PriFile" ]
        then
        echo ERROR! Primary host vg/pvid list file not specified!
        exit -1
fi
if [ -z "$LocalFile" ]
        then
        echo ERROR! Local File for primary host vg/pvid list not specified!
        exit -1
fi

if [ -z "$TempFile" ]
        then
        echo ERROR! Temp File not specified!
        exit -1
fi

echo $0 running ......

rcp "$PriHost":"$PriFile" $LocalFile

RetValue=$?

if [ $RetValue -ne 0 ]
 then
 echo ERROR! Could not rcp Config File!
 exit -1
fi

VolGr=$(cat $LocalFile|cut -d ' ' -f1)
```

```
if [ -z "$VolGr" ]
 then
 echo ERROR! Invalid Format of Input File!
 exit -1
fi


PhVolId=$(cat $LocalFile|cut -d ' ' -f2)

if [ -z "$PhVolId" ]
 then
 echo ERROR! Invalid Format of Input File!
 exit -1
fi

lspv > $TempFile

let Jxvg=1

for Ixpv in $PhVolId
 do
 Hdsk=$(grep $Ixpv $TempFile|awk 'NR==1{print $1}')

 if [ -z "$Hdsk" ]
  then
  echo ERROR! Could not find hdisk with PVID $Ixpv!
  rm $TempFile
  exit -1
 fi


 Vgname=$(echo $VolGr | cut -d ' ' -f $Jxvg)

 NeedImport=0


 ### Is there already an ODM Entry for the Volume Group

 DoesExist=$(lsvg|grep $Vgname)


 if [ -n "$DoesExist" ]

  ### Yes, ODM Entry for the volume group does exist
  then

  # Check if the volume group is already varyed on
  IsVaryOn=$(lsvg -o|grep $Vgname)

  if [ -n "$IsVaryOn" ]
   then
   echo ERROR! Volume Group $Vgname already Varied-On! Possible Data Corruption!
   echo Varry Off $Vgname and re-establish FlashCopy!
   rm $TempFile
   exit -1
  fi

  # Check VGDA Timeststamp
  # on the hdisk

  HdVGDA=$(lquerypv -h /dev/$Hdsk 11000 10|awk '{print $2}'|sed -e 'y/ABCDEF/abcdef/')

  # and in the ODM
  OdmVGDA=$(odmget -q "attribute like timestamp and name like $Vgname" CuAt|grep value|awk '{print $3

  ## Does VGDA Timestamp on the hdisk match VGDA Timestamp in the ODM
  if [ "$HdVGDA" != "$OdmVGDA" ]
```

```
                              ## No - then importvg
                              then
                              exportvg $Vgname
                              # update TempFile since Vgname has been deleted
                                      lspv > $TempFile
                              NeedImport=1

                              ## Yes - then just varyon
                              else
                              varyonvg $Vgname
                              RetValue=$?
                              if [ $RetValue -ne 0 ]
                               then
                                  echo ERROR! Could Not Vary-On Volume Group $Vgname
                               rm $TempFile
                               exit -1
                               fi


                           fi


                                 ### No, ODM Entry for the volume group does not exist
                           else
                           NeedImport=1
                           fi

                         if [ NeedImport -eq 1 ]
                          then

                          TmpVlmgrp=$(grep $Ixpv $TempFile|awk 'NR==1{print $3}')

                          if [ "$TmpVlmgrp" != "None"  ]
                           then
                           echo ERROR! Can Not Import Volume Group $Vgname
                           echo Hdisk $Hdsk already assigned to another volume group!
                           rm $TempFile
                           exit -1
                           fi

                          importvg -y $Vgname $Hdsk
                          RetValue=$?

                          if [ $RetValue -ne 0 ]
                           then
                              echo ERROR! Could Not Import Volume Group $Vgname
                           rm $TempFile
                           exit -1
                           fi

                          if [ $UseVpath -eq 1 ]
                           then
                           hd2vp $Vgname
                           fi


                           fi


                          let Jxvg=$Jxvg+1
                         done

                         rm $TempFile
                         exit 0
```

rsPrimeServer.sh [-v] -u username and -p password | -a securityfilepath -d hostname -primaryserver -backupserver

Note: If you have the IBM Subsystem Device Driver running on your HP, Sun, NT or Windows 2000 host system and you change the configuration for the host (add or remove volumes), you must reboot the host so that the IBM Subsystem Device Driver can recognize and add or remove the paths.

-v = verbose. This parameter is optional.

-u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-p = password. This parameter specifies the password of an authorized userid to execute host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified

-a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags -u username and -p password are not specified. The format of this file is the following: -username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

-d = hostname. This parameter specifies the IP address or complete name or hostname to be removed. Give this flag only when removing the hostname. The hostname needs to match exactly the one of the entries displayed in the focus list on the Volumes panels of the ESS Web Copy Services. It is recommended that after each configuration change to the host, you run rsPrimeServer -d, to remove the old configuration, then rsPrimeServer to generate the current mapping host volumes.

-s = primaryserver. This parameter specifies the IP address or complete host name of ESS Web Copy Services primary server. Before this command can be used, a ESS Web Copy Services Server must be identified and configured.

-b = backupserver. This parameter specifies the IP address or complete host name of ESS Web Copy Services backup server. Before you can use this server, the primary server must be down. This parameter is optional.

rsQuery.sh [-v] -m -u username and -p password | -a securityfilepath -q volume | -f filename -s primaryserver -b backupserver

-v = verbose. This parameter is optional.

-m = map. This parameter maps host volume names to 2105 volume serial numbers. This parameter permits host volume names to be used as volume parameters. This parameter is optional.

Note: Use this flag only if host volume names are specified. Do not use this flag if 2105 volume serial numbers are specified.

-u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-p = password. This parameter specifies the password of an authorized userid to execute host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags -u username and -p password are not specified. The format of this file is the following: - username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

-f = filename. This parameter specifies the name of a file containing pairs of volume serial numbers, all of which are to be queried. This parameter is required if the /**q** parameter is not used. The format of this file may be either:

```
sourceVolume1 targetVolume1
sourceVolume2 targetVolume2
. . .
```
sourceVolume*N* targetVolume*N*

or,

```
volume1
volume2
volume3
. . .
```
volume*N*

-q = This parameter specifies a single volume serial number. It is not valid if **-f** is also coded. Use this parameter if you do not use the **-f** parameter.

-s = This parameter specifies the IP or complete host name of the ESS Web Copy Services server. Before you use this command, you must identify and configure a ESS Web Copy Services server.

-b = This parameter specifies the IP or complete name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

Example of output when you invoke the rsQuery.sh command
The following is an example of output you see when you type the following rsQuery.sh command:

rsQuery.sh -v -m -q 002FCA04 -u user -p user -s ess1c1

```
Volume 002FCA04 found on FCA04:10 as volume number 2
     State=simplex, status=not_suspended, FlashCopy_state=source,
Size=1.0_GB
```

rsQueryComplete.sh [-v] -u username and -p password | -a securityfilepath -minutes] [-t threshold] -s primaryserver -b backupserver taskNames

-v = verbose. This parameter is optional.

-u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-p = password. This parameter specifies the password of an authorized userid to execute host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the -a securityfilepath is not specified.

-a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags -u username and -p password are not specified. The format of this file is the following: - username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

.

-m = minutes. This parameter specifies the number of minutes to wait between checks of whether peer-to-peer remote copy initialization has completed. Default: 1 minute. This parameter is optional.

-t = threshold. This parameter specifies the threshold percentage that defines completion. Default: 100%. This parameter is optional.

-s = primaryserver. This parameter specifies the complete IP address or complete host name of the ESS Web Copy Services Server. Before this command can be used, an ESS Web Copy Services Server must be identified and configured.

-b = backupserver. This parameter specifies the IP address or complete host name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

taskNames = This parameter specifies the name of one ore more ESS Web Copy Services pre-defined tasks to be executed. If more than one task is specified, the task names have to be separated with a blank space.

Example of output when you invoke the rsQueryComplete.sh command

The following is an example of output you see when you type the following rsQueryComplete.sh command:

rsQueryComplete.sh -v -u user -p password -t 99 -m 1 -s ess1c1 estpprcpairs

```
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 0
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 3
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 21
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 27
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 33
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 51
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 61
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
```

```
rsQueryComplete: Percentage complete = 67
rsQueryComplete: Sleeping 60000 milliseconds...
rsQueryComplete: Sampling volumes...
rsQueryComplete: Percentage complete = 100
rsClientImpl: rsClientImpl unregistered from server
rsQueryComplete: Command successful
```

rsTestConnection.sh [-v] -s serverName

-v = verbose. This parameter is optional.

-s = serverName. This parameter specifies the IP address or complete host name of any ESS Web Copy Services Server.

Error messages

0 = Task completed or command successful
The command executed successfully.

1 = Username not specified or missing parameter username
You specified the **-u** parameter, but you did not enter the username or you did not specify the required username for this parameter.

2 = Password not specified or missing parameter for password
You specified the **-p** parameter, but you did not specify the password or you entered the password incorrectly.

3 = Server name not specified
The IP address or complete host name of the Copy Services server is required but was not specified.

4 = No task names specified
You must specify at least one task to run. A task can be defined using the ESS Web Copy Services Web page panels.

5 = Missing parameter disk serial numbers
You collected the configuration information for the ESS LUNs configured on this host, but the ESS serial number for some of the volumes was not available. Verify that the ESS LUNs are configured to your host system correctly.

6 = Mismatching number of disk pairs specified
You collected the configuration information for the ESS LUNs configured on this host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

7 = Missing parameter local disks
You collected the configuration information for the ESS LUNs configured on the host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

8 = No disk pairs specified
You collected the configuration information for the ESS LUNs configured on this host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

9 = Missing parameter hostname to be deleted
You specified the **-d** option, which indicates you want to remove a host definition from the ESS Web Copy Services. You must specify the complete hostname of the host you want to delete.

10 = Missing parameters

You must specify either the **-q** parameter with a volume name or the **-f** option with a filename of the file containing the volumes you want to query.

11 = Missing parameter minutes between samples

You specified the **-m** parameter, but the argument to the parameter was not specified.

12 = Missing parameter threshold

You specified the **-t** parameter, but the argument to the parameter was not specified

13 = No 2105 volumes found

There are no ESS 2105 volumes configured to the host system.

14 = Volume list not specified

You must specify either the **-q** parameter with a volume name or the **-f** parameter with a filename of the file containing the volumes you want to query.

15 = Conflicting parameters

You specified the **-q** and **-f** parameters. These parameters conflict.

Example: **rsQuery.bat -q** volume ... or **rsQuery.bat -f** filename

16 = More volumes per line

The format of the file given with the **-f** flag is not correct. You must specify either one or two volumes per line of the file. You have specified more than two volumes in at least one or more lines of the file.

17 = Volume list file ″**$FILENAME**″ **does not exist**

The volume list file with the filename you specified does not exist.

18 = No volumes specified or no volumes specified in a given file

You must specify either the **-q** parameter with a volume name or the **-f** parameter with a filename of the file containing the volumes you want to query.

19 = Invalid parameter specified

You have specified a parameter that does not exist for the given command or you have given a space between ″-″ and the parameter or you have given a parameter without ″-″. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

20 = Missing argument for a parameter

You specified a parameter but did follow it by a required argument. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

21 = No parameter specified

You did not specify any parameter. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

22 = Missing parameter securityfilepath

You specified the -a parameter which indicates that the username and password should be read from a file. You must specify the full path to the file that contains the username and password.

23 = security file filename could not be found

You specified the -a parameter with a filename. The file cannot be found. Correct the name of the file and try again.

24 = format of security file filename is incorrect
> The format of the security file that you specified does not have the correct format. The format for this file is: username password where username and password should be on the same line separated by one or more spaces.

25 = some of the volumes could not be found
> Some of the volumes could not be found. You have issued rsQuery command on some volumes that could not be found on the ESS Web Copy Services server. Verify the volume names and try again.

40 = Failed to connect to server
> Connect failure can be because of one or more of the following reasons:
> - There is a problem in communication with the server.
> - The given username or password is not correct.
> - Username or password is not specified if the administrative user has enabled the password protection for host commands on the Enterprise Storage Specialist Copy Services Web configuration panel.

41 = The primary server is down and there is no backup server specified. The task did not finish.
> A communication problem occurred when you tried to connect to the server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server. Try again later or specify a backup server.

42 = The primary and backup servers are down. The task is not completed.
> A communication problem occurred when you tried to connect to the primary server and the backup server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server. Try again later.

43 = Failed while creating communication to server
> A communication problem occurred when you executed the command.

44 = Failed while disconnecting from server
> A communication problem occurred when you disconnected from the server.

45 = The backup server is down and there is no primary server specified. The task is not completed.
> A communication problem occurred when you tried to connect to the backup server. You did not specify the primary server. You may want to retry the command specifying the primary server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server.

50 = Heartbeat to the server failed.
> Connection to the server cannot be established at this time. Verify that the ESS Web Copy Services server is active. Refer to the *IBM Enterprise Storage Sever Web Interface User's Guide* for procedures. The problem might also be due to a temporary network problem.

51 = Failed while creating ORB
> The command failed because of an internal code or communication problem.

60 = A system exception occurred
> The command failed because of an internal code or communication problem.

61 = Exception occurred while reading the security file filename
>   The command failed because of an internal code or communication
>   problem.

80 = Command failed
>   A communication problem occurred when you executed the command.

80 = Command failed
>   A communication problem occurred when you executed the command.

Windows NT or Windows 2000 commands

This section describes the Copy Services commands you can use for a Windows
NT or Windows 2000 system. This section also provides the command descriptions,
parameters, and error messages for each command.

Windows NT or Windows 2000 command descriptions

The following describe the Windows NT commands used with the command-line
interface.

If Host password protection has been enabled for the use of ESS Web Copy
Services CLI commands, the user needs to specify a userid and a password every
time a CLI command is executed. The user has the option of specifying the /u
username and the /p password flags with the command. For additional security, the
user has the option of creating a file with the userid and password. When the user
executes a CLI commands, he/she will use the /a securityfilepath flag instead of the
/u username and the /p password flags.

The user must specify at least one of the /s primaryserver or the /b backupserver
flags. The user can also specify both the /s primaryserver and the /b backupserver
flags at the same time.

If only the /s primaryserver flag is specified, the connection to the given primary
server is checked. If the connection is established, the command is then sent to the
primary server for processing. If the connection cannot be established, the
command fails.

If only the /b backupserver flag is specified, the connection to the given backup
server is checked. If the connection is established, the command is then sent to the
backup server for processing. If the connection cannot be established, the
command fails.

If both the /s primaryserver and the /b backupserver flags are specified, the
connection to the given primary server is checked. If the connection to the primary
server is established, the command is then sent to the primary server for
processing. If the connection to the primary server cannot be established, the
connection to the backup server is checked. If the connection to the backup server
is established, the command is then sent to the backup server for processing. If the
connection to the backup server cannot be established, the command fails.

The following parameters are case sensitive: password, tasknames, hostname,
vpath name, volume name, and serial number.

The parameters password, tasknames, hostname, vpath name, volume name, and
serial number are case sensitive.

The command rsQuery.bat can be invoked for vpath name, volume name or serial number. If System Device Driver is installed, the command rsQuery.bat can be invoked only on vpath name or serial number. If System Device Driver is not installed, the command rsQuery.bat can be invoked only on volume name or serial number. If the command rsQuery.bat is invoked on vpath name or volume name, /m flag must be specified. If the command rsQuery.bat is invoked on serial number, /m flag does not need to be specified.

rsExecuteTask.bat

Use this command to execute one or more pre-defined ESS Web Copy Services server tasks.

rsList2105s.bat

Use this command to display the mapping of a host disk name to a 2105 volume serial number.

rsPrimeServer.bat

Use this command to notify the ESS Web Copy Services server of the mapping of host system disks to 2105 volume serial numbers. Use this command when the Web Copy Services are used to perform FlashCopy, PPRC or both functions.

rsQuery.bat

Use this command to query the status of one ore more volumes.

rsQueryComplete.bat

Use this command to determine whether peer-to-peer remote copy volumes have completed their copy initialization.

Note: When grouped tasks are run, the rsQueryComplete output will display the first subtask until it has reached the completion threshold, then display next subtask until it has reached the completion threshold and so on until all the subtasks are queried.

rsTestConnection.bat

Use this command to determine whether the ESS Web Copy Services server can successfully be contacted.

Windows NT or Windows 2000 command parameter descriptions

This section describes the Windows NT command parameters.

rsExecuteTask.bat [/v] /u username and /p password | /a securityefilepath /s primaryserver /b backupserver taskNames

/v = Verbose. This parameter is optional and verbose.

/u = This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the /a securityfilepath is not specified.

/p = Password. This parameter specifies the password of an authorized userid to execute host CLI commands. This parameter is required if the ESS administrator has enabled password protection for host CLI commands and the /a securityfilepath is not specified.

This parameter is required if the Enterprise Storage Server administrator requires it. When the Copy Services server is activated, an administrator uses the Enterprise Storage Specialist User Administration panel to set the password.

/a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services

Server. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags /u username″ and /p password are not specified. The format of this file is the following: /username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

.

/s = primaryserver. This parameter specifies the IP address or complete host name of the ESS Web Copy Services primary server.

Before this command can be used, an ESS Web Copy Services server must be identified and configured.

/b = backupserver. This parameter specifies the IP or complete host name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

taskNames = This parameter specifies the name of one or more ESS Web Copy Services predefined tasks to be executed. If more than one task is specified, the task names have to be separated with a blank space.

rsList2105s.bat

There are no parameters for the rsList2105s.bat command.

Note: If you have the IBM Subsystem Device Driver running on your HP, Sun, NT or Windows 2000 host system and you change the configuration for the host (add or remove volumes), you must reboot the host so that the IBM Subsystem Device Driver can recognize and add or remove the paths

rsPrimeServer.bat [/v] /u username and /p password | /a securityfilepath /d hostname /s primaryserver /b backupserver

Note: If you have the IBM Subsystem Device Driver running on your HP, Sun, NT or Windows 2000 host system and you change the configuration for the host (add or remove volumes), you must reboot the host so that the IBM Subsystem Device Driver can recognize and add or remove the paths.

/v = verbose. This parameter is optional.

/u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the /a securityfilepath is not specified.

/p = password. This parameter specifies the password defined at the ESS Web Copy Services Server. This parameter is required if the Enterprise Storage Server administrator requires it. When the ESS Web Copy Services Server is activated, an administrator uses the Enterprise Storage Specialist user administration panel to set the password.

/a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags /u username and /p password are not specified. The format of this file is the following: / username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

/d = hostname. This parameter specifies the IP address or complete name or hostname to be removed. Give this flag only when removing the hostname. The hostname needs to match exactly the one of the entries displayed in the focus list on the Volumes panels of the ESS Web Copy Services. It is recommended that after each configuration change to the host, you run rsPrimeServer /d, to remove the old configuration, then rsPrimeServer to generate the current mapping host volumes.

/s = primaryserver. This parameter specifies the IP address or complete host name of ESS Web Copy Services primary server. Before this command can be used, a ESS Web Copy Services Server must be identified and configured.

/b = backupserver. This parameter specifies the IP address or complete host name of ESS Web Copy Services backup server. Before you can use this server, the primary server must be down. This parameter is optional.

rsQuery.bat [/v] /m /u username and /p password | /a securityfilepath /q volume | /f filename /s primaryserver /b backupserver

/v = verbose. This parameter is optional.

/m = map. This parameter maps host volume names to 2105 volume serial numbers. This parameter permits host volume names to be used as volume parameters. This parameter is optional.

Note: Use this flag only if host volume names are specified. Do not use this flag if 2105 volume serial numbers are specified.

/u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the /a securityfilepath″ is not specified.

/p = password. This parameter specifies the password that is defined at the ESS Web Copy Services Server. This parameter is required if the Enterprise Storage Server administrator requires it. When the ESS Web Copy Services Server is activated, an administrator uses the Enterprise Storage Specialist user administration panel to set the password.

/a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags /u username and /p password are not specified. The format of this file is the following: /username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

/f = filename. This parameter specifies the name of a file containing pairs of volume serial numbers, all of which are to be queried. This parameter is required if the /**q** parameter is not used. The format of this file may be either:

```
sourceVolume1 targetVolume1
sourceVolume2 targetVolume2
. . .
sourceVolumeN targetVolumeN
or,
volume1
volume2
```

```
volume3
. . .
volumeN
```

/q = This parameter specifies a single volume serial number. It is not valid if **/f** is also coded. Use this parameter if you do not use the **/f** parameter.

/s = This parameter specifies the IP or complete host name of the ESS Web Copy Services server. Before you use this command, you must identify and configure a ESS Web Copy Services server.

/b = This parameter specifies the IP or complete name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

rsQueryComplete.bat [/v] /u username and /p password | /a securityfilepath [/m minutes] [/t threshold] /s primaryserver /b backupserver taskNames

/v = verbose. This parameter is optional.

/u = username. This parameter specifies the userid authorized to execute ESS Web Copy Services host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the /a securityfilepath is not specified.

/p = password. This parameter specifies the password that is defined at the ESS Web Copy Services Server. This parameter is required if the Enterprise Storage Server administrator requires it. When the ESS Web Copy Services Server is activated, an administrator uses the Enterprise Storage Specialist user administration panel to set the password.

/a = securityfilepath. This parameter specifies the full path to the file that contains the username and password defined at the ESS Web Copy Services for the use of host CLI commands. This parameter is required if the Enterprise Storage Server administrator has enabled password protection for host CLI commands and the flags /u username and /p password are not specified. The format of this file is the following: /username password

Note: The username and password should be given on same line and should be separated by one or more spaces.

/m = minutes. This parameter specifies the number of minutes to wait between checks of whether peer-to-peer remote copy initialization has completed. Default: 1 minute. This parameter is optional.

/t = threshold. This parameter specifies the threshold percentage that defines completion. Default: 100%. This parameter is optional.

/s = primaryserver. This parameter specifies the complete IP address or complete host name of the ESS Web Copy Services Server. Before this command can be used, an ESS Web Copy Services Server must be identified and configured.

/b = backupserver. This parameter specifies the IP address or complete host name of the ESS Web Copy Services backup server. Before you use this server, the primary server must be down. This parameter is optional.

taskNames = This parameter specifies the name of one ore more ESS Web Copy Services pre-defined tasks to be executed. If more than one task is specified, the task names have to be separated with a blank space.

rsTestConnection.bat [/v] /s serverName

/v = verbose. This parameter is optional.

/s = serverName. This parameter specifies the IP address or complete host name of any ESS Web Copy Services Server.

Error messages

0 = Task completed or command successful
The command executed successfully.

1 = Username not specified or missing parameter username
You specified the **/u** parameter, but you did not enter the username or you did not specify the required username for this parameter.

2 = Password not specified or missing parameter for password
You specified the **/p** parameter, but you did not specify the password or you entered the password incorrectly.

3 = Server name not specified
The IP address or complete host name of the Copy Services server is required but was not specified.

4 = No task names specified
You must specify at least one task to run. A task can be defined using the ESS Web Copy Services Web page panels.

5 = Missing parameter disk serial numbers
You collected the configuration information for the ESS LUNs configured on this host, but the ESS serial number for some of the volumes was not available. Verify that the ESS LUNs are configured to your host system correctly.

6 = Mismatching number of disk pairs specified
You collected the configuration information for the ESS LUNs configured on this host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

7 = Missing parameter local disks
You collected the configuration information for the ESS LUNs configured on the host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

8 = No disk pairs specified
You collected the configuration information for the ESS LUNs configured on this host, but some of the information was not available. Verify that the ESS LUNs are configured to your host system correctly and try the command again.

9 = Missing parameter hostname to be deleted
You specified the **/d** option, which indicates you want to remove a host definition from the ESS Web Copy Services. You must specify the complete hostname of the host you want to delete.

10 = Missing parameters
You must specify either the **/q** parameter with a volume name or the **/f** option with a filename of the file containing the volumes you want to query.

11 = Missing parameter minutes between samples
You specified the **/m** parameter, but the argument to the parameter was not specified.

12 = Missing parameter threshold

You specified the **/t** parameter, but the argument to the parameter was not specified

13 = No 2105 volumes found

There are no ESS 2105 volumes configured to the host system.

14 = Volume list not specified

You must specify either the **/q** parameter with a volume name or the **/f** parameter with a filename of the file containing the volumes you want to query.

15 = Conflicting parameters

You specified the **/q** and **/f** parameters. These parameters conflict.

Example: **rsQuery.bat /q** volume ... or **rsQuery.bat /f** filename

16 = More volumes per line

The format of the file given with the **/f** flag is not correct. You must specify either one or two volumes per line of the file. You have specified more than two volumes in at least one or more lines of the file.

17 = Volume list file ″**$FILENAME**″ **does not exist**

The volume list file with the filename you specified does not exist.

18 = No volumes specified or no volumes specified in a given file

You must specify either the **/q** parameter with a volume name or the **/f** parameter with a filename of the file containing the volumes you want to query.

19 = Invalid parameter specified

You have specified a parameter that does not exist for the given command or you have given a space between ″-″ and the parameter or you have given a parameter without ″-″. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

20 = Missing argument for a parameter

You specified a parameter but did follow it by a required argument. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

21 = No parameter specified

You did not specify any parameter. Refer to the usage for the command. You can issue the command with no arguments and will get the usage or correct syntax for the command.

22 = Missing parameter securityfilepath

You specified the -a parameter which indicates that the username and password should be read from a file. You must specify the full path to the file that contains the username and password.

23 = security file filename could not be found

You specified the -a parameter with a filename. The file cannot be found. Correct the name of the file and try again

24 = format of security file filename is incorrect

The format of the security file that you specified does not have the correct format. The format for this file is: username password where username and password should be on the same line separated by one or more spaces.

25 = some of the volumes could not be found

Some of the volumes could not be found. You have issued rsQuery

command on some volumes that could not be found on the ESS Web Copy Services server. Verify the volume names and try again.

40 = Failed to connect to server
Connect failure can be because of one or more of the following reasons:
- There is a problem in communication with the server.
- The given username or password is not correct.
- Username or password is not specified if the administrative user has enabled the password protection for host commands on the Enterprise Storage Specialist Copy Services Web configuration panel.

41 = The primary server is down and there is no backup server specified. The task did not finish.
A communication problem occurred when you tried to connect to the server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server. Try again later or specify a backup server.

42 = The primary and backup servers are down. The task is not completed.
A communication problem occurred when you tried to connect to the primary server and the backup server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server. Try again later.

43 = Failed while creating communication to server
A communication problem occurred when you executed the command.

44 = Failed while disconnecting from server
A communication problem occurred when you disconnected from the server.

45 = The backup server is down and there is no primary server specified. The task is not completed.
A communication problem occurred when you tried to connect to the backup server. You did not specify the primary server. You may want to retry the command specifying the primary server. The problem might be a temporary network problem, or it might be a problem with the Copy Services server.

50 = Heartbeat to the server failed.
Connection to the server cannot be established at this time. Verify that the ESS Web Copy Services server is active. Refer to the *IBM Enterprise Storage Sever Web Interface User's Guide* for procedures. The problem might also be due to a temporary network problem.

51 = Failed while creating ORB
The command failed because of an internal code or communication problem.

60 = A system exception occurred
The command failed because of an internal code or communication problem.

61 = Exception occurred while reading the security file filename
The command failed because of an internal code or communication problem.

80 = Command failed
A communication problem occurred when you executed the command.

Appendix B. Locating the world-wide port name (WWPN)

This chapter tells you how to locate the WWPN value for a host system fibre-channel adapter for the following operating systems:

- RS/6000
- Windows NT
- Windows 2000
- Novell NetWare
- Hewlett Packard 9000
- Sun
- NUMA-Q

Fibre-channel port name identification

The WWPN consists of exactly 16 hexadecimal characters (0-9 and A-F). It is used by the ESS to uniquely identify the fibre-channel adapter card installed in your host system. The ESS automatically finds the WWPN for your host fibre-channel adapter when you attach your host system to the ESS.

Note: If your host system uses more than one fibre-channel adapter to connect to your ESS, you must add multiple entries to the host system list for this host, one for each fibre-channel adapter. Each adapter will have its own unique WWPN.

The format and content of the fibre-channel port identifier are determined by the manufacturer of the link control facility for the applicable fibre-channel port. The identifier is an eight-byte field, which the fibre-channel protocols use to uniquely identify the fibre-channel port. An example is the ESS fibre-channel port.

You can manually assign a unique world-wide port name for the ESS by performing the steps in the following sections.

Locating the WWPN for an RS/6000 host system

To locate the WWPN for an RS/6000 host system, perform the following steps:

- Login as root.
- Type `lscfg -vl fcsx`, where *x* is the adapter number.

  The network address is the fibre-channel adapter port WWPN value.

Note: The lscfg -vl fcsx ROS level notes the fibre-channel adapter firmware level.

Locating the WWPN for a Windows NT host system

To locate the WWPN for a Windows NT host system with a Qlogic adapter, perform the following steps:

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** command panel.

   If you have more than one fibre-channel adapter installed, you will see a screen that displays all the fibre-channel adapters. Scroll down to the adapter you want. Press Enter.
3. From the **Fast Util!** menu, scroll down and select **Select Host Adapter**.

4. Scroll up and highlight **Configuration Settings**. Press Enter.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.
6. Write down the host adapter name, for example: 200000E08B00C2D5.
7. Scroll down and click **Host Adapter Settings**. Press Enter.

Locating the WWPN for a Windows 2000 host system

To locate the WWPN for a Windows 2000 host system with a Qlogic adapter, perform the following steps:

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** command panel.

   If you have more than one fibre-channel adapter installed, you will see a screen that displays all the fibre-channel adapters. Scroll down to the adapter you want. Press Enter.
3. From the **Fast Util!** menu, scroll down and select **Select Host Adapter**.
4. Scroll up and highlight **Configuration Settings**. Press Enter.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.
6. Write down the host adapter name, for example: 200000E08B00C2D5.
7. Scroll down and click **Select Host Adapter Settings**. Press Enter.

Locating the WWPN for a Novell NetWare host system

To locate the WWPN for a Novell NetWare host system with a Qlogic adapter, perform the following steps:

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** command panel.

   If you have more than one fibre-channel adapter installed, you will see a screen that displays all the fibre-channel adapters. Scroll down to the adapter you want. Press Enter.
3. From the **Fast Util!** menu, scroll down and select **Select Host Adapter**.
4. Scroll up and highlight **Configuration Settings**. Press Enter.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.
6. Write down the host adapter name, for example: 200000E08B00C2D5.
7. Scroll down and click **Host Adapter Settings**. Press Enter.

Locating the WWPN for a Hewlett Packard host system

To locate the WWPN for a Hewlett Packard host system, perform the following steps:

1. Go to the root directory.
2. Type: `ioscan -f | more`
3. Look under description for Fibre Channel Mass Storage adapter.
4. Record the driver name related to the description.
5. Type: `ioscan -f | more`
6. Type: `ioscan -fknd` *td* where *td* is the driver name from step 4.
7. Look for the path. For example, look for /dev/td1
8. Type: `fcmsutil` */dev/td1* where */dev/td1* is the path.

The N_Port port-world-wide name is the fibre-channel adapter for WWPN value.

Locating the WWPN for a Sun host system

To locate the WWPN for a Sun host system, perform the following steps:

Notes:
1. There is no method to locate the WWPN for a QLogic QLA2100F adapter installed on a Sun host system.
2. The following steps apply only to the JNI fibre-channel adapter cards.

1. Go to the root directory.
2. Type: `dmesg | more`

   The command lists all the devices in the directory. When you type `dmesg | more`, you might find the world-wide port name of other fibre-channel adapters if the driver displays the world-wide port name during a restart.
3. Scan the output message file for `fcaw` or `jnic`, and the sixty bit number if you have a different JNI fibre-channel driver. Then look for the world-wide port name, for example 20000E06940028.

   Note: If you have multiple host adapters installed, you will see more than one WWPN.

Locating the WWPN for a NUMA-Q host system

To locate the WWPN for a NUMA-Q host system with an IOC-0210-54 adapter, perform the following steps:

1. From the Enterprise Storage Specialist Welcome panel, click **Storage Allocation**.
2. From the Storage Allocation graphical view panel, click **Open System Storage**.
3. From the Open System Storage panel, click **Modify Host Systems**.
4. In the **Host Nickname** field, type the nickname.
5. In the **Host Name** field, click either **IBM NUMA Server (WinNt)** or **IBM NUMA Server (UNIX)** from the drop-down list.
6. From the **Host Attachment** field, click the Down Arrow to the right of the field to open the drop-down list.
7. From the drop-down list, highlight and click **Fibre-channel Attached**.
8. In the **Hostname/IP Address** field, type the hostname.
9. In the **World-Wide Port Name** field, click the Down Arrow to the right of the field to open the drop-down list.
10. Select the world-wide port name from the list.
11. Click **Perform Configuration Update**.

Appendix C. Migrating from SCSI to fibre-channel

This chapter describes how to migrate disks or logical volumes within the ESS from SCSI to fibre-channel.

Before you migrate, you must have at least one ESS with SCSI adapters already installed.

Software requirements

This section lists the software requirements for migrating from SCSI adapters to fibre-channel adapters:

- Internet browser (Netscape or Internet Explorer)
- SAN Gateway Explorer
- Disk Administrator

Preparing a host system to change from SCSI to fibre-channel attachment

Before you can use ESS Specialist to change a host system attached to the ESS from SCSI to fibre-channel, perform the following steps to prepare your host system:

1. Upgrade the microcode and install the IBM Subsystem Device Driver (optional). For more information about the IBM Subsystem Device Driver, see the Web site:

   www.ibm.com/storage/support/techsup/swtechsup.nsf/support/sddupdates/

2. Reset your host system or execute the appropriate command to initiate device discovery.

Refer to the following sections of this guide and the *ESS Fibre-Channel Migration Scenarios* white paper for information about changing your host system attachment to the ESS from SCSI and SAN Data Gateway to native fibre-channel attachment. The white paper is available at the following ESS Web site:

   www.storage.ibm.com/hardsoft/products/ess/refinfo.htm

Non-concurrent migration

This section tells you how to migrate disks using a non-concurrent method. This method is non-concurrent from the operating system. Other servers attached to the same ESS can continue their work while this procedure is performed.

The following migration procedures have been tested successfully. There are other ways you can migrate disks to fibre-channel.

These procedures are valid if the following assumptions are true:

- Your server has disks that are located on an ESS that is in use. They are attached to the server with one SCSI interface.
- The server has one or more fibre-channel adapters installed.
- The ESS has a fibre-channel adapter, feature code 3022, installed and the interconnections between them has been established.

- All appropriate software prerequisites, drivers, and program temporary fixes have been implemented.
- The following procedure will be executed by an experienced system administrator for their area of expertise related to the operating system.

The procedures include some commands that the administrator can use.

Migrating from native SCSI to fibre-channel general overview

The following steps tell you how to perform a non-concurrent migration from native SCSI to fibre-channel.

1. Stop the applications that are using the disks.
2. Perform all operating system actions required to free the disks. For example,
   a. Unmount file systems
   b. Vary off the volume group
   c. Export the volume group
3. Unassign the disks using the ESS Specialist.

   This step makes the volumes inaccessible from the server. The disks are still available inside the ESS and the data on these volumes is also retained.
4. Use the ESS Specialist to assign these disks to fibre-channel.
5. Perform the following steps to make the volumes usable by the operating system:
   a. Restart the host system.
   b. Import the volume group.
   c. Mount the file system.

Migrating from SCSI to fibre-channel on an AIX host system

The following steps tell you how to perform a migration from SCSI to fibre-channel on an AIX host system.

1. Shutdown databases and applications that use the disks that you are migrating.
2. Unmount the file systems.
3. Identify all the disks that are assigned to the affected volume group using the **lsvg -p <volumegroup name>** command. For example, type:

   ```
   lsvg -p <volume group> | grep hdisk | cut -f1 -d" " > /tmp/disk1
   ```
4. Execute the script shown in Figure 23.

```
for i in 'cat /tmp/disk1'
do
SN='lscfg -vl $i | grep Serial'
echo $i, $SN >> /tmp/output
done
/#
```

Figure 23. Sample script to get the Hdisk number and the serial number

The output of the script should look like what is shown in Figure 24 on page 141.

```
hdisk101, Serial Number...............017FCA49
hdisk102, Serial Number...............018FCA49
hdisk103, Serial Number...............019FCA49
hdisk104, Serial Number...............01AFCA49
hdisk105, Serial Number...............01BFCA49
hdisk106, Serial Number...............01CFCA49
hdisk107, Serial Number...............01DFCA49
hdisk108, Serial Number...............01EFCA49
hdisk109, Serial Number...............01FFCA49
hdisk110, Serial Number...............734FCA49
hdisk111, Serial Number...............735FCA49
hdisk112, Serial Number...............736FCA49
hdisk113, Serial Number...............634FCA49
hdisk114, Serial Number...............635FCA49
hdisk115, Serial Number...............636FCA49
hdisk116, Serial Number...............534FCA49
hdisk117, Serial Number...............535FCA49
hdisk118, Serial Number...............536FCA49
hdisk119, Serial Number...............434FCA49
hdisk120, Serial Number...............435FCA49
hdisk121, Serial Number...............436FCA49
hdisk122, Serial Number...............334FCA49
```

Figure 24. Example list of the Hdisk and serial numbers on the ESS

5. Vary off the volume group (`varyoffvg <volume group name>`).

6. Export the volume group (`exportvg <volume group name>`).

7. Use the ESS Specialist to unassign all disks (LUNs) on the ESS that were listed when you ran the script in step 4 on page 140.

8. Delete all disks that belong to the volume group just exported (`rmdev -l hdisk1 -d`).

9. Assign all those disks documented in step 3 on page 140 to the host system that needs access to them. Use the world-wide port name to identify the host bus adapter.

10. Run the **cfgmgr** command at the AIX command prompt, execute the function to install or configure devices that were added after IPL using SMIT, or restart the server.

11. After successful command execution or restart, check to see that the disks are available that were part of the volume group. Compare to the document created by step 4 on page 140.

12. When you see that all disks are available, you can import the volume group (`importvg <volumegroup> hdisk1`).

13. At the command prompt, verify that all disks are available (imported) to use in the volume group (`lsvg -p <volumegroup>`).

14. Mount all file systems that were unmounted in step 2 on page 140.

15. Start your application or databases.

Migrating from SCSI to fibre-channel on a Windows NT or Windows 2000 host system

The following section tells you how to perform a migration from SCSI to fibre-channel adapters on a Windows NT or Windows 2000 host system. Before you migrate, ensure that the following pre-requisites are complete:

- Your server has disks or logical volumes that are located on an ESS that is already in use.

- The disk or logical volumes are attached to the server with two or more SCSI interfaces.
- The IBM Subsystem Device Driver is installed and running properly.
- The server has one or more fibre-channel adapters installed, including feature code 3022.
- All appropriate software prerequisites, drivers, and program temporary fixes have been implemented.

Figure 25 shows an example of a setup between the Windows NT or Windows 2000 host system and the ESS before you perform the steps to migrate from SCSI to fibre-channel.
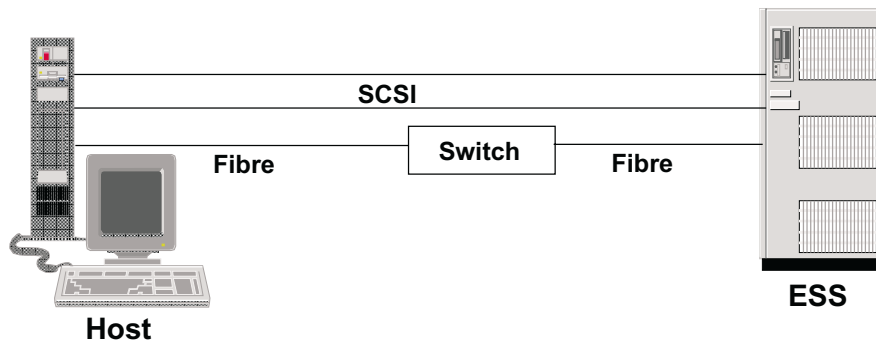
S009027

Figure 25. SCSI setup between the Windows NT or Windows 2000 host system and the ESS

You can view the volumes through one of three methods:
- Internet browser
- SAN Gateway Explorer
- Disk Administrator.

Perform the following steps to view the setup of volumes that are attached to SCSI adapters on the host:
1. From your desktop, click **My Computer**.
2. Click **Control panel**.
3. Click **SCSI adapters**.

Figure 26 on page 143 shows an example of how volumes are attached to SCSI adapters on the host. In the example, disks were already labeled and drive letters were previously assigned.
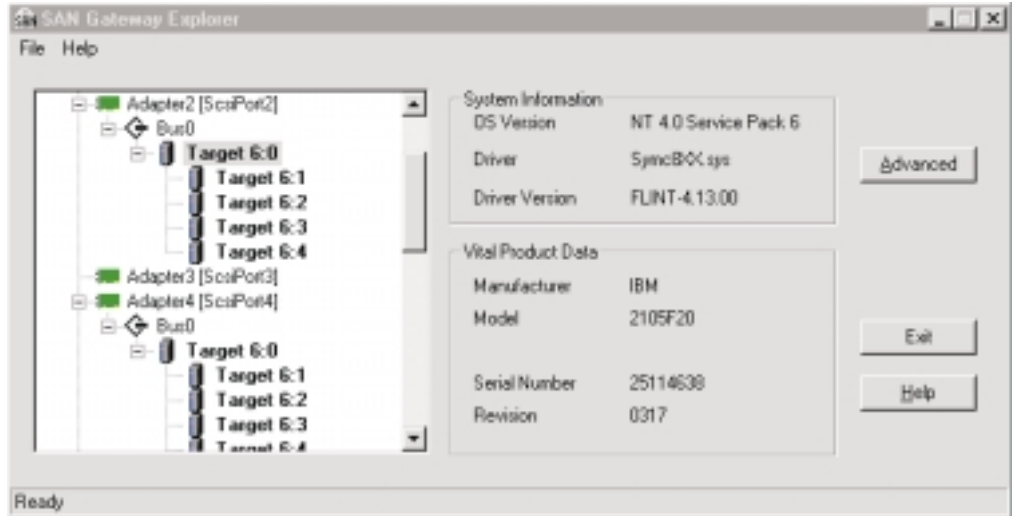
S009028

Figure 26. Initial setup of volumes attached to SCSI adapters on the host

See Figure 27 for an example of how this information looks in the Disk Administrator window.
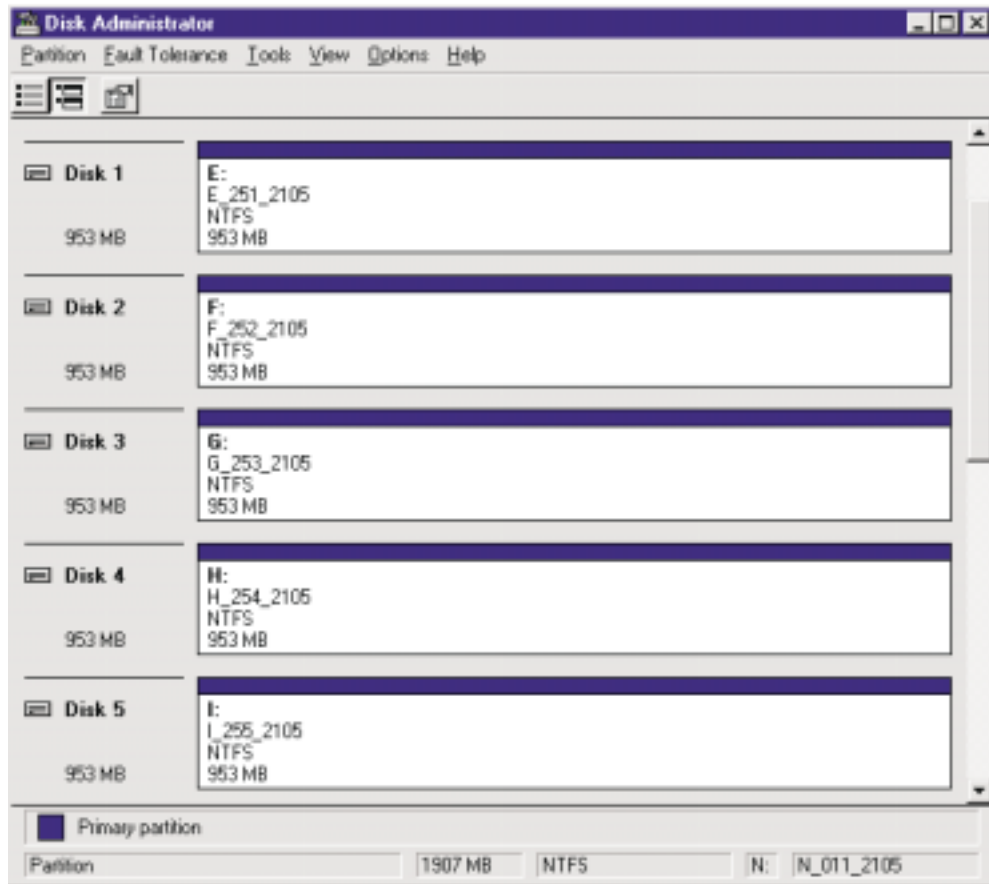
S009029

Figure 27. Disk administrator panel showing the initial setup

Figure 27 on page 143 shows the volumes (only 5 out of 10 are shown here because of the limit of the Disk Administrator window). In this example, the volumes are labeled using their logical driver letter and volume identifier (3 characters in length).

Table 17 shows the relationship between the volumes and their mapping.

Table 17. Volume mapping before migration

Volume ID	SCSI port on the ESS	SCSI target ID and LUN	Disk Administrator logical drive assignment	Disk Administrator disk number
251	A	6,0	E	1
252	A	6,1	F	2
253	A	6,2	G	3
254	A	6,3	H	4
255	A	6,4	I	5
00D	B	6,0	J	6
00E	B	6,1	K	7
00F	B	6,2	L	8
010	B	6,3	M	9
011	B	6,4	N	10

Perform the following steps to map the disks:

1. Shutdown database and applications that use the disks that you are migrating.
2. Unassign the volumes from the SCSI host.
    a. Go the ESS Specialist.
    b. Click **Storage Allocation**.
    c. Click **Open System Storage**.
    d. Click **Modify Volume Assignments**.
    e. Select the volumes from the list.
    f. From the Action menu, select **Unassign selected volume(s)**.
    g. Click **Perform Configuration Update**. Click **OK**.
3. Assign the volumes to the fibre-channel host.
    a. Click **Modify Volume Assignments**.
    b. Select the volumes from the list.
    c. From the Action menu, select **Assign selected volume(s) to target host**.
    d. Select the fibre-channel host adapter to which you want to assign the volumes.
    e. Click **Perform Configuration Update**.
    f. Restart the host system for the changes to take effect.
    g. Open the SAN Gateway Explorer to view the mapped disks.

Migrating from SCSI to fibre-channel on a Hewlett Packard host system

The following steps describe how to perform a migration from SCSI to fibre-channel on a Hewlett Packard host system.

1. Shutdown databases or applications that use the disks that you are migrating.
2. Unmount the file systems. (`unmount <file system>`) with the System Administration Menu utilities.
3. Use the ESS Specialist to identify all the disks on the ESS that are assigned to the affected volume group.
4. Deactivate the volume group using the sequential access method (SAM).
5. Export the volume group.

   Enter a file name (full path) where you want to store the logical volume information for the volume group being exported. See Figure 28 on page 146 for an example of the information that is displayed.
6. Disconnect the SCSI cable and connect a fibre-channel cable to the server and to the ESS. You do not need to remove the SCSI cable.
7. Use the ESS Specialist to unassign all the LUNs on the ESS that were assigned to the server through the SCSI cable. Assign them to a fibre-channel port. Use the world-wide port name to configure the ESS.
8. After the configuration completes successfully, you will be able to see those disks the next time you check the disk devices.
9. Type `sam` at your server command prompt. Click **Disks and File Systems**. Press Enter.
10. Click **Volume Groups** then use the tab key to select an item from the drop down-menu.
11. Click **Actions** and press Enter. From the list of options, click **Import**. Press Enter.

    The volume groups that are available to import are displayed.
12. Click the volume group you exported to see all the disks associated to that volume group.
13. Use the tab key to go to **New Volume Group Name**.
14. Type the volume group name.

    You can use the same name or any name you like.
15. Tab to the next field and type in the map file name that was created while exporting the volume group. Figure 28 on page 146 shows an example of the information that will be displayed.
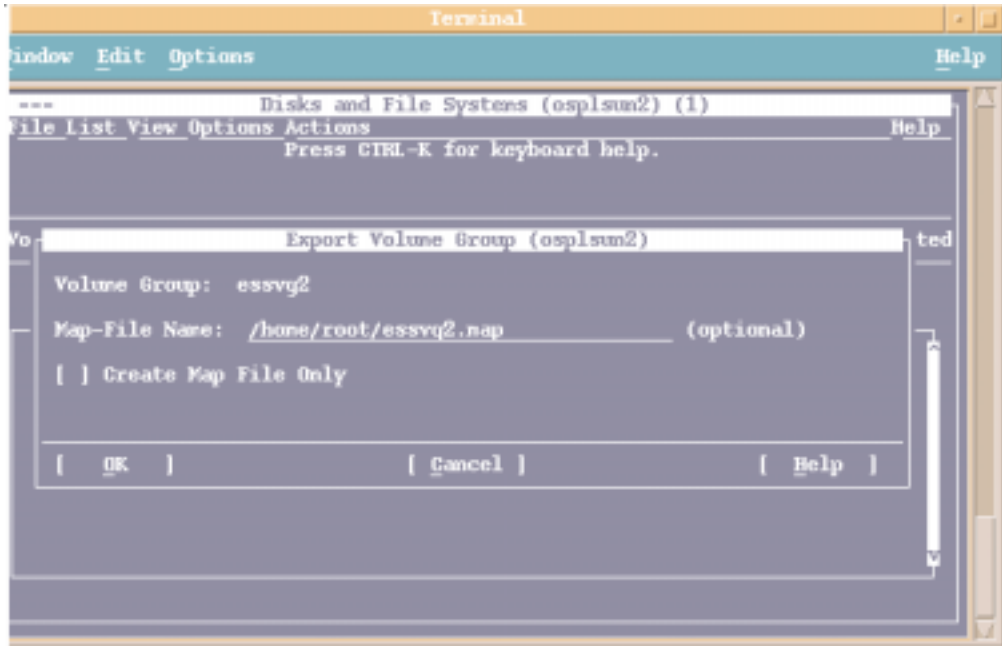
S009030

Figure 28. SAM display of an export volume group

16. Use the tab key to select OK. Press Enter to import the volume group.

    See Figure 29 for an example of what is displayed by SAM when you import a volume group.
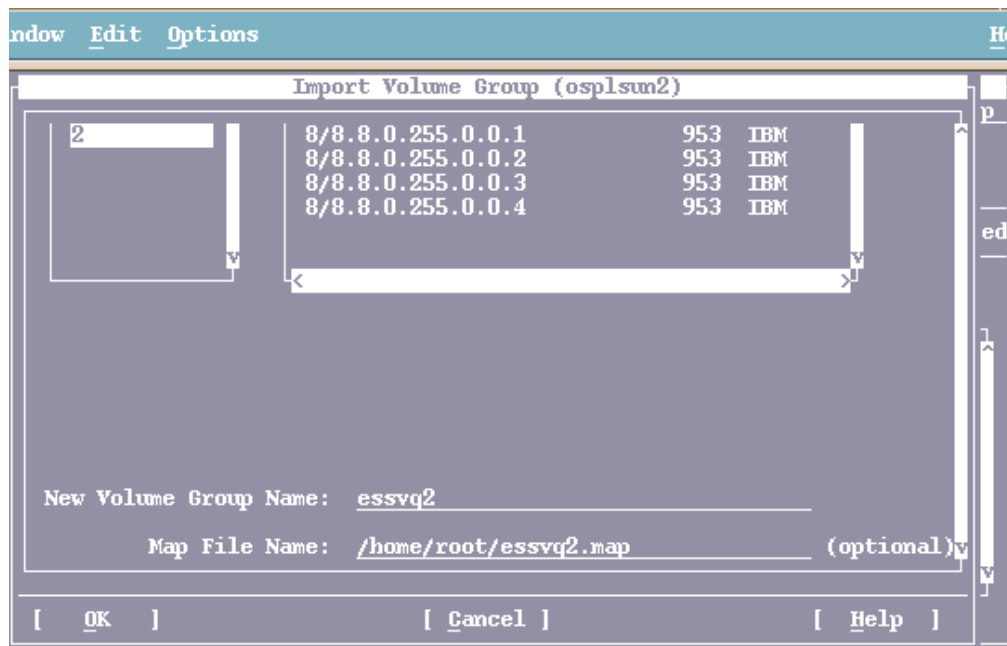
S009031

Figure 29. SAM display of an import volume group

After successful command completion the essvg volume group is active.

17. Mount all your file systems that were unmounted in the beginning of this migration process.

18. Restart your databases and applications when all file systems are available.

Concurrent migration

This section describes the process of migrating disks or volumes using a concurrent method. Before you migrate, ensure that the following pre-requisites are complete:

- Your server has disks or logical volumes that are located on an ESS that is already in use.
- The disk or logical volumes are attached to the server with two or more SCSI interfaces.
- The IBM Subsystem Device Driver is installed and running properly.

   Notes:

   1. If you use the IBM Subsystem Device Driver for AIX, you cannot perform a concurrent migration because it does not support the simultaneous attachment to LUNs through SCSI and fibre-channel paths.

   2. You cannot use the IBM Subsystem Device Driver with NUMA-Q, Hewlett Packard, Sun and Novell NetWare host systems.

- The server has one or more fibre-channel adapters installed, including feature code 3022.
- All appropriate software prerequisites, drivers, and program temporary fixes have been implemented.

Perform the following steps to migrate disks or volumes using a concurrent method.

1. Test the connectivity on both SCSI paths.
2. Remove the disks from one of the SCSI ports on the ESS.
3. Assign the disks to the world-wide port name of one of the fibre-channel host bus adapters.
4. Test the system to ensure that you have connectivity on the SCSI path and the fibre-channel path.
5. Remove the disks from the second SCSI port on the ESS.
6. Assign the disks to the world-wide port name of the second fibre-channel host bus adapter.
7. Test the system to ensure that you have connectivity on both fibre-channel paths.

Note: See the *Implementing Fibre-Channel Attachment on the ESS* white paper for scenarios on how to migrate from SCSI to fibre-channel for a Windows NT or Windows 2000 host system. The white paper does not have an IBM order number. You can get the publication from the following Web site:

www.storage.ibm.com/hardsoft/products/ess/support/essfcwp.pdf

Appendix D. Migrating from SAN Data Gateway to fibre-channel

This chapter describes how to migrate a Storage Area Network (SAN) Data Gateway to fibre-channel. For a SAN, you must use a bridge or SAN Data Gateway to connect between the fibre channel and SCSI, SSA, and other interfaces on storage devices.

IBM SAN Data Gateway overview

The SAN Data Gateway is a protocol converter between fibre-channel and SCSI interfaces. It supports the following tape drives:
- MP3570
- Magstar 3590

It also supports the following tape libraries:
- Magstar MP3575
- Magstar 3494
- IBM 3502 DLT

The SAN Data Gateway also supports disk subsystems on Intel-based servers running Windows NT and UNIX-based machines. For the latest list of supported operating systems and storage products, visit the IBM SAN Data Gateway Web site at:

www.ibm.com/storage/SANGateway

The SAN Data Gateway is a fully scalable product with up to three fibre-channel and four ultra-SCSI differential interfaces for disk and tape storage attachment. Each fibre-channel interface supports dual or single shortwave ports (for a maximum of six shortwave ports), and single longwave ports (for a maximum of two longwave ports). The following is a list of details about the interfaces on a SAN Data Gateway.
- Fibre-channel
  - Supports both loop (private and public) and point-to-point topologies
  - Supports distances between the node or switch up to 500 m (50 micron) for shortwave and 10 km for longwave
- SCSI
  - Has automatic speed negotiation capability for wide or narrow bus widths and standard, fast, or ultra speeds
  - Supports up to 15 target IDs and up to 32 LUNs per ID (subject to an overall total of 255 devices)
  - Supports cable lengths up to 25 m

Note: Although the SAN Data Gateway has a limitation of 255 LUNs, you must consider the limitations on your host operating system, adapter, and storage subsystem. Whichever is the lowest dictates the maximum number of LUNS that you can use. Table 18 on page 150 shows an example of a configuration.

Table 18. LUN limitations for various components

System component	LUN limit
Windows NT 4.0 with SP3	120 (15 target IDs times 8 LUNs)
Host bus adapter	256
ESS	960 (15 target IDs times 64 LUNs)
SAN Data Gateway	255

The example in Table 18 shows a maximum LUN limit of 120 because it is the lowest number supported by one of the components of the system. However, fixes are available to eliminate problems and limitations. Service Pack 4 and above already supports up to 256 devices.

The following shows the details of the Ethernet and service port:

Ethernet
> 10BASE-T port for out-band management (using StorWatch SAN Data Gateway Specialist)

Service port
> 9 pin D-shell connector for local service, configuration and diagnostics

Also, the SAN Data Gateway allows channel zoning, as well as LUN masking between its fibre-channel and SCSI ports. Channel zoning and masking enable you to specify which fibre-channel hosts could connect to LUNs defined on which SCSI ports. This is important if you do not want multiple hosts accessing the same LUNs.

For more information about the IBM SAN Data Gateway, see the *IBM Storage Area Network Data Gateway Installation and User's Guide.*

Migration considerations

The steps are similar when migrating from a SAN Data Gateway to a fibre-channel as they are when migrating from native SCSI to fibre-channel.

Perform the following steps on the ESS to migrate volumes from the SAN Data Gateway to native fibre-channel:

1. Define the new fibre-channel host bus adapter to the ESS using the ESS Specialist.
2. Assign the volumes to the newly defined host. In practice, this means assigning the volumes to the world-wide port name of the host adapter.
3. Unassign the volumes from the SCSI host.

This procedure assumes that there is a spare slot in the ESS host bays for the fibre-channel adapter to coexist with the SCSI adapter. If the SCSI adapter has to be removed before the fibre-channel adapter can be installed, care must be taken to list the volume assignments before the SCSI adapter is removed.

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The following cross-reference is used in this glossary:

See   This refers the reader to (a) a related term, (b) a term that is the expanded form of an abbreviation or acronym, or (c) a synonym or more preferred term.

A

AAS. See *Advanced Administrative Systems*.

access. (1) To obtain the use of a computer resource. (2) In computer security, a specific type of interaction between a subject and an object that results in flow of information from one to the other.

Advanced Administrative Systems (AAS). A system used by IBM for order entry for machines and external cables either by a regular order or by an MES.

alert. (1) A message or log that a storage facility generates as the result of error event collection and analysis. An alert indicates that you need to perform some service action. (2)

allegiance. In the ESA/390 architecture, a relationship that is created between a device and one or more channel paths during the processing of certain conditions. Refer to implicit allegiance, contingent allegiance, and reserved allegiance.

allocated storage. On an IBM storage server, the space allocated to volumes, but not yet assigned. See *assigned storage*.

American National Standard Code for Information Interchange (ASCII). The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), that is used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters. (A)

American National Standards Institute (ANSI). An organization consisting of producers, consumers, and general interest groups, that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. (A)

ANSI. See *American National Standards Institute*.

APAR. See *authorized program analysis report*.

arbitrated loop. For fibre-channel connection, arbitrated loop is a topology that allows you to interconnect a set of nodes.

array. An ordered collection, or group, of physical devices (disk drive modules) that are used to define logical volumes or devices.

ASCII. See *American National Standard Code for Information Interchange (ASCII)*.

assigned storage. On an IBM storage server, the space allocated to a volume and assigned to a port.

authorized program analysis report (APAR). A report of a problem caused by a suspected defect in a current, unaltered release of a program.

availability. The degree to which a system or resource is capable of performing its normal function. Also see *data availability*.

B

bay. Physical space on an IBM Enterprise Storage server. A bay contains SCSI and ESCON host adapter cards. See *service boundary*.

bit. Either of the digits 0 or 1 when used in the binary numeration system. (T)

block. A group of consecutive bytes.

byte. A group of eight adjacent binary digits that represent one EBCDIC character.

C

cache. A buffer storage that contains frequently accessed instructions and data; it is used to reduce access time.

cache fast write. A form of the fast-write operation in which the subsystem writes the data directly to cache where it is available for later destaging.

cache memory. Typically refers to volatile memory that a subsystem uses to improve access times to instructions or data. The cache memory is typically smaller and faster than the primary memory or storage medium. A storage subsystem uses the cache memory to improve the performance of accesses to data that ultimately resides on the storage devices in the storage facility.

cascading. The connecting of network controllers to each other in a succession of levels, to concentrate many more lines than a single level permits. In high-availability cluster multiprocessing (HACMP), pertaining to a cluster configuration in which the cluster node with the highest priority for a particular resource acquires the resource if the primary node fails but relinquishes the resource to the primary node upon reintegration of the primary node into the cluster

CCR. See *channel-command retries.*

CCW. See *channel command word.*

CEC. See *computer-electronic complex.*

channel. In the ESA/390 architecture, the part of a channel subsystem that manages a single I/O interface between a channel subsystem and a set of controllers.

channel-command retries (CCR). In the ESA/390 architecture, the protocol used between a channel and a controller that allows the controller to request that the channel reissue the current command.

channel command word (CCW). In the ESA/390 architecture, a data structure that is used to specify an I/O operation to the channel subsystem.

channel path. In the ESA/390 architecture, the interconnection between a channel and its associated controllers.

channel subsystem. In the ESA/390 architecture, the part of a host computer that manages I/O communication between the program and any attached controllers.

channel-subsystem image. In the ESA/390 architecture, the logical functions that a system requires to perform the function of a channel subsystem. With EMIF, one channel subsystem image exists in the channel subsystem for each LPAR. Each image appears to be an independent channel subsystem program, but all images share a common set of hardware facilities.

CKD. See *count key data.*

CLI. See *command-line interface.*

cluster. (1) A partition in a storage server that is capable of performing all function of a storage server. When there are multiple clusters in a storage server, any remaining clusters in the configuration can take over the processing of any failing clusters. (2) On an AIX platform, a cluster is a group of nodes within a complex.

cluster processor complex (CPC). The unit within a cluster that provides the management function for the storage server. It consists of cluster processors, cluster memory, and related logic.

command-line interface. The command-line interface on the open-systems hosts that initiates and manages PPRC and FlashCopy on the ESS.

compact disc, read-only memory. High-capacity read-only memory in the form of an optically read compact disc.

compression. (1) The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks. (2) Any encoding to reduce the number of bits used to represent a given message or record.

computer-electronic complex (CEC). The set of hardware facilities associated with a host computer.

concurrent copy. Concurrent Copy allows a program such as DFDSS to make a backup of a data set while maintaining continuous read and write access to the data. The data is frozen at the point in time that the commands were issued to the controller.

| **concurrent download of licensed internal code.**
| Capability to download and install licensed internal code
| on an ESS while applications continue to run

concurrent maintenance. Service that is performed on a unit while it is operational.

concurrent media maintenance. Service performed on a disk drive module (DDM) without losing access to the data.

configure. To define the logical and physical configuration of the input/output (I/O) subsystem through the user interface provided for this function on the storage facility.

consistent copy. A copy of a data entity (for example a logical volume) that contains the contents of the entire data entity at a single instant in time.

console. A user interface to a server, such as a personal computer.

contingent allegiance. In the ESA/390 architecture, a relationship that is created in a controller between a device and a channel path when unit-check status is accepted by the channel. The allegiance causes the controller to guarantee access; the controller does not present the busy status to the device. This enables the controller to retrieve sense data that is associated with the unit-check status on the channel path with which the allegiance is associated.

controller. In the ESA/390 architecture, a storage controller with ESCON or OEMI interfaces. See *cluster*.

controller image. In the ESA/390 architecture, a logical subsystem that you access with an ESCON I/O interface. One or more control-unit images exist in each controller. Each image appears to be an independent controller, but all images share a common set of hardware facilities.

control unit (CU). In System/390 architecture, a storage control unit with ESCON or OEMI interfaces. Also referred to as a controller.

Copy Services server group. A collection of ESS clusters that participate in Copy Services functions that include the volumes within the clusters.

count field. The first field of a CKD record. This eight-byte field contains a four-byte track address (CCHH). It defines the cylinder and head that are associated with the track, and a one-byte record number (R) that identifies the record on the track. It defines a one-byte key length that specifies the length of the record's key field (0 means no key field). It defines a two-byte data length that specifies the length of the record's data field (0 means no data field). Only the end-of-file record has a data length of zero.

count key data (CKD). In the ESA/390 architecture, a logical device that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a track that can contain one or more records, each consisting of a count field, a key field (optional), and a data field (optional).

CPC. See *cluster processor complex*.

CRC. See *cyclic redundancy check*.

CU. See *control unit*.

customer console. See *console*.

CUT. See *Universaile Tempes du Coordinaire*.

cyclic redundancy check (CRC). A redundancy check in which the check key is generated by a cyclic algorithm. (T)

cylinder. A unit of storage on a CKD device. A cylinder has a fixed number of tracks.

D

DA. See *device adapter* and *SSA adapter*.

daisy chain. A method of device interconnection for determining interrupt priority by connecting the interrupt sources serially.

DASD. See *direct access storage device* and *disk drive module*.

DASD-fast write. A function of a storage controller that allows caching of active write data without exposure of data loss by journaling of the active write data in nonvolatile storage.

data availability. The degree to which data is available when needed. For better data availability when you attach multiple hosts that share the same data storage, configure the data paths so that data transfer rates are balanced among the hosts.

data compression. A technique or algorithm that you use to encode data such that you can store the encoded result in less space than the original data. This algorithm allows you to recover the original data from the encoded result through a reverse technique or reverse algorithm. See *compression*.

Data Facility Storage Management Subsystem. An operating environment that helps automate and centralize the management of storage. To manage storage, SMS provides the storage administrator with control over data class, storage class, management class, storage group, and automatic class selection routine definitions.

data field. The third (optional) field of a CKD record. You determine the field length by the data length that is specified in the count field. The data field contains data that the program writes.

data record. A subsystem stores data records on a track by following the track-description record. The subsystem numbers the data records consecutively, starting with 1. A track can store a maximum of 255 data records. Each data record consists of a count field, a key field (optional), and a data field (optional).

data sharing. The ability of homogenous or divergent host systems to concurrently utilize information that they store on one or more storage devices. The storage

facility allows configured storage to be accessible to any, or all, attached host systems. To use this capability, you need to design the host program to support data that it is sharing.

DDM. See *disk drive module.*

DDM group. See *disk drive module group.*

dedicated storage. Storage within a storage facility that is configured such that a single host system has exclusive access to the storage.

demote. The action of removing a logical data unit from cache memory. A subsystem demotes a data unit in order to make room for other logical data units in the cache. It could also demote a data unit because the logical data unit is not valid. A subsystem must destage logical data units with active write units before they are demoted.

destaging. The moving of data from an online or higher priority device to an offline or low priority device.

device. In the ESA/390 architecture, a disk drive.

device adapter (DA). A physical subunit of a storage controller that provides the ability to attach to one or more interfaces used to communicate with the associated storage devices.

device address. In the ESA/390 architecture, the field of an ESCON device-level frame that selects a specific device on a control-unit image.

device interface card. A physical subunit of a storage cluster that provides the communication with the attached DDMs.

device number. (1) In the ESA/390 architecture, a four-hexadecimal-character identifier, for example 13A0, that you associate with a device to facilitate communication between the program and the host operator. (2) The device number that you associate with a subchannel.

device sparing. A subsystem function that automatically copies data from a failing DDM to a spare DDM. The subsystem maintains data access during the process.

direct access storage device (DASD). A mass storage medium on which a computer stores data.

disk drive module (DDM). The primary nonvolatile storage medium that you use for any host data that is stored within a subsystem. The number and type of storage devices within a storage facility may vary.

disk drive module group. A group of eight disk drive modules (DDMs). Each DDM group is a RAID array.

domain. (1) That part of a computer network in which the data processing resources are under common control. (2) In TCP/IP, the naming system used in hierarchical networks.

drawer. A unit that contains multiple DDMs and provides power, cooling, and related interconnection logic to make the DDMs accessible to attached host systems.

drive. (1) A peripheral device, especially one that has addressed storage media. (2) The mechanism used to seek, read, and write information on a storage medium.

duplex. A communication mode in which data can be sent and received at the same time.

dynamic sparing. The ability of a storage server to move data from a failing disk drive module (DDM) to a spare DDM while maintaining storage functions.

E

EBCDIC. See *extended binary-coded decimal interchange code.*

EC. See *engineering change.*

ECKD. See *extended count key data.*

electrostatic discharge (ESD). An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

emergency power off (EPO). A means of turning off power during an emergency, usually a switch.

EMIF. See *ESCON multiple image facility.*

enclosure. A unit that houses the components of a storage subsystem, such as a controller, disk drives, and power source.

end of file. A coded character recorded on a data medium to indicate the end of the medium. On a CKD direct access storage device, the subsystem indicates the end of a file by including a record with a data length of zero.

engineering change (EC). An update to a machine, part, or program.

Enterprise Systems Architecture/390 (ESA/390). An IBM architecture for mainframe computers and peripherals. Processor systems that follow this architecture include the ES/9000® family.

Enterprise Systems Connection (ESCON). (1) An ESA/390 computer peripheral interface. The I/O interface uses ESA/390 logical protocols over a serial interface that configures attached units to a communication fabric. (2) A set of IBM products and

services that provide a dynamically connected environment within an enterprise.

EPO. See *emergency power off*.

ERP. See *error recovery procedure*.

error recovery procedure (ERP). Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record information on machine malfunctions.

ESA/390. See *Enterprise Systems Architecture/390*.

ESCD. See *ESCON director*.

ESCON. See *Enterprise Systems Connection*.

ESCON director (ESCD). An I/O interface switch that allows the interconnection of multiple ESCON interfaces in a distributed-star topology.

ESCON multiple image facility (EMIF). In the ESA/390 architecture, a function that allows LPARs to share an ESCON channel path by providing each LPAR with its own channel-subsystem image.

ESD. See *electrostatic discharge*.

ESS Specialist. See *StorWatch Enterprise Storage Server Specialist*.

extended binary-coded decimal interchange code (EBCDIC). A coded character set of 256 8-bit codes.

extended count key data (ECKD). An extension of the CKD architecture.

Extended Remote Copy (XRC). A function of a storage controller that assists a control program to maintain a consistent copy of a logical volume on another storage facility. All modifications of the primary logical volume by any attached host are presented in order to a single host. The host then makes these modifications on the secondary logical volume.

F

fabric. In fibre-channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are said to be *cascaded*.

failover. The routing of all transactions to a second controller when the first controller fails. See *cluster*.

fast write. A write operation at cache speed that does not require immediate transfer of data to a DDM. The subsystem writes the data directly to cache, to nonvolatile storage, or to both. The data is then available for destaging. A fast-write operation reduces the time an application must wait for the I/O operation to complete.

FBA. See *fixed-block address*.

FC-AL. See *Fibre Channel - Arbitrated Loop*.

FCP. See *fibre-channel protocol*.

FCS. See *fibre-channel standard*.

Fibre Channel - Arbitrated Loop (FC-AL). An implementation of the fibre-channel technology that uses a ring topology for communication. In this topology two or more fibre-channel end points are interconnected through a looped interface. The ESS supports this topology.

fibre-channel protocol (FCP). For fibre-channel communication the protocol has five layers. The layers define how fibre-channel ports interact through their physical links to communicate with other ports.

fibre-channel standard (FCS). An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. The protocol has two layers. The IP layer defines basic interconnection protocols. The upper layer supports one or more logical protocols. Refer to ANSI X3.230-199x.

FICON. Fibre-channel connection for mainframe computers and peripherals that use ESCON architecture, such as the IBM ES/9000 family.

field replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit may contain other field replaceable units.

FIFO. See *first-in-first-out*.

firewall. A protection against unauthorized connection to a computer or a data storage system. The protection is usually in the form of software on a gateway server that grants access to users that meet authorization criteria.

first-in-first-out (FIFO). A queuing technique in which the next item to be retrieved is the item that has been in the queue for the longest time. (A)

fixed-block address (FBA). An architecture for logical devices that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size). The subsystem can access them independently.

FlashCopy. An optional feature for the ESS. With FlashCopy you can make an instant copy of data, that is, a point-in-time copy of a volume.

FRU. See *field replaceable unit*.

full duplex. See *duplex*.

G

GB. See *gigabyte*.

gigabyte (GB). A gigabyte of storage is 10^9 bytes. A gigabyte of memory is 2^{30} bytes.

group. See *DDM group*.

H

HA. See *host adapter*.

hard disk drive (HDD). (1) A storage medium within a storage server used to maintain information that the storage server requires. (2) A mass storage medium for computers that is typically available as a fixed disk (such as the disks used in system units of personal computers or in drives that are external to a personal computer) or a removable cartridge.

HDA. See *head and disk assembly*.

HDD. See *hard disk drive*.

hdisk. An AIX term for storage space.

head and disk assembly (HDA). The portion of an HDD associated with the medium and the read/write head.

home address. A nine-byte field at the beginning of a track that contains information that identifies the physical track and its association with a cylinder.

host adapter (HA). A physical subunit of a storage controller that provides the ability to attach to one or more host I/O interfaces.

host processor. A processor that controls all or part of a user application network. In a network, the processing unit in which the data communication access method resides. See *host system*.

host system. (1) A data processing system used to prepare programs and operating environments for use on another computer or controller. (2) The data processing system to which a network is connected and with which the system can communicate. (3) The controlling or highest level system in a data communication configuration.

hot plug. Pertaining to the ability to add or remove a hardware facility or resource to a unit while power is on.

I

IBM product engineering (PE). The third-level of IBM service support. Product engineering is composed of IBM engineers who have experience in supporting a product or who are knowledgeable about the product.

ID. See *identifier*.

identifier (ID). A unique name or address that identifies things such as programs, devices, or systems.

implicit allegiance. In the ESA/390 architecture, a relationship that a controller creates between a device and a channel path when the device accepts a read or write operation. The controller guarantees access to the channel program over the set of channel paths that it associates with the allegiance.

initial program load (IPL). The initialization procedure that causes an operating system to commence operation.

initiator. A SCSI term for the part of a host computer that communicates with its attached targets.

i-node. The internal structure in an AIX operating system that describes the individual files in the operating system. It contains the code, type, location, and owner of a file.

input/output (I/O). Pertaining to (a) input, output, or both or (b) a device, process, or channel involved in data input, data output, or both.

Internet Protocol (IP). In the Internet suite of protocols, a protocol without connections that routes data through a network or interconnecting networks and acts as an intermediary between the higher protocol layers and the physical network.

invalidate. The action of removing a logical data unit from cache memory because it cannot support continued access to the logical data unit on the device. This removal may be the result of a failure within the storage controller or a storage device that is associated with the device.

I/O. See *input/output*.

I/O device. An addressable read and write unit, such as a disk drive device, magnetic tape device, or printer.

I/O interface. An interface that you define to allow a host to perform read and write operations with its associated peripheral devices.

IP. See *Internet Protocol*.

IPL. See *initial program load*.

K

KB. See *kilobyte*.

key field. The second (optional) field of a CKD record. The key length is specified in the count field. The key length determines the field length. The program writes the data in the key field. The subsystem uses this data to identify or locate a given record.

kilobyte (KB). (1) For processor storage, real, and virtual storage, and channel volume, 2^{10} or 1024 bytes. (2) For disk storage capacity and communications volume, 1000 bytes.

KPOH. See *thousands of power-on hours*.

L

LAN. See *local area network*.

last-in first-out (LIFO). A queuing technique in which the next item to be retrieved is the item most recently placed in the queue. (A)

least recently used (LRU). (1) The algorithm used to identify and make available the cache space that contains the least-recently used data. (2) A policy for a caching algorithm that chooses to remove from cache the item that has the longest elapsed time since its last access.

LCU. See *logical control unit*.

LED. See *light-emitting diode*.

LIC. See *licensed internal code*.

licensed internal code (LIC). Microcode that IBM does not sell as part of a machine, but licenses to the customer. LIC is implemented in a part of storage that is not addressable by user programs. Some IBM products use it to implement functions as an alternate to hard-wired circuitry.

LIFO. See *last-in first-out*.

light-emitting diode (LED). A semiconductor chip that gives off visible or infrared light when activated.

link address. On an ESCON interface, the portion of a source or destination address in a frame that ESCON uses to route a frame through an ESCON director. ESCON associates the link address with a specific switch port that is on the ESCON director. Equivalently, it associates the link address with the channel-subsystem or controller-link-level functions that are attached to the switch port.

link-level facility. The ESCON hardware and logical functions of a controller or channel subsystem that allow communication over an ESCON write interface and an ESCON read interface.

local area network (LAN). A computer network located on a user's premises within a limited geographic area.

local e-mail. An e-mail configuration option for storage servers that are connected to a host-system network that does not have a domain name server (DNS).

local address. On an ESCON interface, the portion of a source or destination address in a frame used to select a specific channel-subsystem or control-unit image.

logical control unit (LCU). See *controller image*.

logical data unit. A unit of storage that is accessible on a given device.

logical device. A file for conducting input or output with a physical device, or a file for mapping user I/O between virtual and real devices.

logical partition (LPAR). A set of functions that create the programming environment that is defined by the ESA/390 architecture. ESA/390 architecture uses this term when more than one LPAR is established on a processor. An LPAR is conceptually similar to a virtual machine environment except that the LPAR is a function of the processor. Also the LPAR does not depend on an operating system to create the virtual machine environment.

logical subsystem (LSS). The logical functions of a storage controller that allow one or more host I/O interfaces to access a set of devices. The controller aggregates the devices according to the addressing mechanisms of the associated I/O interfaces. One or more logical subsystems exist on a storage controller. In general, the controller associates a given set of devices with only one logical subsystem.

logical unit. The open-systems term for a logical disk drive.

logical unit number (LUN). The SCSI term for the field in an identifying message that is used to select a logical unit on a given target.

logical volume. The storage medium associated with a logical disk drive. A logical volume typically resides on one or more storage devices. A logical volume is referred to on an AIX platform as an hdisk, an AIX term for storage space. A host system logical volume can be a physical volume.

logical volume manager (LVM). A set of system commands, library routines, and other tools that allow the user to establish and control logical volume storage.

The LVM maps data between the logical view of storage space and the physical disk drive module (DDM).

LPAR. See *logical partition*.

LRU. See *least recently used*.

LSS. See *logical subsystem*.

LUN. See *logical unit number*.

LVM. See *logical volume manager*.

M

machine level control (MLC). A database that contains the EC level and configuration of products in the field.

maintenance analysis procedure (MAP). A hardware maintenance document that gives an IBM service representative a step-by-step procedure for tracing a symptom to the cause of a failure.

management information base (MIB). The physical and logical characteristics of a system make up a collection of information called a management information base (MIB). The individual pieces of information that comprise an MIB are called MIB objects and they reside in the SNMP Agent. See *simple network management protocol.*

MAP. See *maintenance analysis procedure*.

MB. See *megabyte*.

MCA. See *Micro Channel architecture*.

mean time between failures (MTBF). (1) A projection of the time that an individual unit remains functional. The time is based on averaging the performance, or projected performance, of a population of statistically independent units. The units operate under a set of conditions or assumptions. (2) For a stated period in the life of a functional unit, the mean value of the lengths of time between consecutive failures under stated conditions. (I) (A)

medium. For a storage facility, the disk surface on which data is stored.

megabyte (MB). (1) For processor storage, real and virtual storage, and channel volume, 2^{20} or 1 048 576 bytes. (2) For disk storage capacity and communications volume, 1 000 000 bytes.

MES. See *miscellaneous equipment system*.

MIB. See *management information base*.

Micro Channel architecture (MCA). The rules that define how subsystems and adapters use the Micro Channel bus in a computer. The architecture defines the services that each subsystem can or must provide.

mirrored pair. Two units that contain the same data. The system refers to them as one entity.

mirroring. In the AS/400 host systems, the process of writing the same data to two disk units within the same auxiliary storage pool at the same time.

miscellaneous equipment specification.

MLC. See *machine level control*.

mobile service terminal (MoST). The mobile terminal used by IBM service personnel.

MoST. See *mobile service terminal*.

MTBF. See *mean time between failures*.

multiple virtual storage (MVS). Consisting of MVS/System Product Version 1 and MVS/370 Data Facility Product operating on an IBM System/370 processor.

MVS. See *multiple virtual storage*.

N

node. The unit that is connected in a fibre-channel network. An ESS is a node in a fibre-channel network.

non-RAID. A collection of disk drives in a non-RAID group or array.

non-removable medium. A recording media that you cannot add to or remove from a storage device.

non-retentive data. Data that the control program can easily recreate in the event it is lost. The control program may cache non-retentive write data in volatile memory.

nonvolatile storage (NVS). (1) Typically refers to nonvolatile memory on a processor rather than a nonvolatile storage device. On a storage facility, nonvolatile storage is used to store active write data to avoid data loss in the event of a power loss. (2) A storage device whose contents are not lost when power is cut off.

NVS. See *nonvolatile storage*.

O

OEMI. See *original equipment manufacturer's information*.

open system. A system whose characteristics comply with standards made available throughout the industry and that therefore can be connected to other systems complying with the same standards.

organizationally unique identifier (OUI). An identifier that identifies an organization according to IEEE standards.

original equipment manufacturer's information (OEMI). A reference to an IBM guideline for a computer peripheral interface. More specifically, refer to *IBM System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufactures' Information*. The interface uses ESA/390 logical protocols over an I/O interface that configures attached units in a multi-drop bus topology.

OUI. See *organizationally unique identifier*.

P

parallel access volume (PAV). Created by associating multiple devices of a single control-unit image with a single logical device. Up to 8 device addresses can be assigned to a parallel access volume.

parity. A data checking scheme used in a computer system to ensure the integrity of the data. The RAID implementation uses parity to recreate data if a disk drive fails.

path group. The ESA/390 term for a set of channel paths that are defined to a controller as being associated with a single LPAR. The channel paths are in a group state and are online to the host.

path-group identifier. The ESA/390 term for the identifier that uniquely identifies a given LPAR. The path-group identifier is used in communication between the LPAR program and a device. The identifier associates the path-group with one or more channel paths, thereby defining these paths to the control-unit as being associated with the same LPAR.

PAV. See *parallel access volume*.

PCI. See *program-controlled interruption*.

PE. See *IBM product engineering*.

Peer-to-Peer Remote Copy (PPRC). A function of a storage controller that maintains a consistent copy of a logical volume on the same controller or on another controller. You access the controllers over an ESCON I/O interface. All modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume.

peripheral component interconnection. *see program-conrolled interruption*.

point-to-point connection. A fibre-channel topology that allows you to interconnect ports directly.

POST. See *power-on self test*.

power-on self test (POST). A diagnostic test run by servers or computers when they are turned on.

PPRC. See *Peer-to-Peer Remote Copy*.

predictable write. A write operation that can cache without knowledge of the existing format on the medium. All writes on FBA DASD devices are predictable. On CKD DASD devices, a write is predictable if it does a format write for the first data record on the track.

product engineering. See *IBM product engineering*.

program. A generic term for the software that controls the operation of a host computer. Typically, the program is an operating system that allows sharing of the host resources between multiple tasks.

program-controlled interruption (PCI). An interruption that occurs when an I/O channel fetches a channel command word with the program-controlled interruption flag on. PCI is also called peripheral component interconnection.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of a program

promote. The action of adding a logical data unit to cache memory.

PTF. See *program temporary fix*.

R

R0. See *track-descriptor record*.

rack. See *enclosure*.

RAID. See *redundant array of independent disks* and *array*.

random access. A mode of accessing data on a medium in a manner that requires the storage device to access nonconsecutive storage locations on the medium.

rank. See *array*.

redundant array of independent disks (RAID). A collection of disk drives that operate independently. The IBM Enterprise Storage Server protects all storage with redundant arrays of independent disks (RAID). The ESS attaches serial storage architecture (SSA) disk drive modules (DDMs) in RAID-5 configurations. The implementation of RAID-5 configurations distributes (stripes) parity across all DDMs in the array. Also see *array*.

remote technical assistance information network (RETAIN). Initial Service Tracking for IBM service support.

reserved allegiance. In the ESA/390 architecture, a relationship that is created in a controller between a device and a channel path when a Sense Reserve command is completed by the device. The allegiance causes the control-unit to guarantee access (busy status is not presented) to the device. Access is over the set of channel paths that are associated with the allegiance; access is for one or more channel programs, until the allegiance ends.

RETAIN. See *remote technical assistance information network*

S

SAM. See *sequential access method.*

SBCON. See *Single-Byte Command Code Sets Connection.*

SCSI. See *small computer system interface.*

SCSI ID. A unique identifier assigned to a SCSI device that is used in protocols on the SCSI interface to identify or select the device. The number of data bits on the SCSI bus determines the number of available SCSI IDs. A wide interface has 16 bits, with 16 possible IDs. A SCSI device is either an initiator or a target.

Seascape architecture. A storage system architecture developed by IBM for open-systems servers and S/390 host systems. It provides storage solutions that integrate software, storage management, and technology for disk, tape, and optical storage.

sequential access method (SAM). A sequential access method to find information.

self-timed interface (STI). An interface that has one or more conductors that transmit information serially between two interconnected units without requiring any clock signals to recover the data. The interface performs clock recovery independently on each serial data stream and uses information in the data stream to determine character boundaries and inter-conductor synchronization.

server group. See *Copy Services server group.*

sequential access. A mode of accessing data on a medium in a manner that requires the storage device to access consecutive storage locations on the medium.

serial storage architecture (SSA). An IBM standard for a computer peripheral interface. The interface uses a SCSI logical protocol over a serial interface that configures attached targets and initiators in a ring topology.

server. (1) A type of host that provides certain services to other hosts that are referred to as clients. (2) A functional unit that provides services to one or more clients over a network.

service boundary. Physical space on an ESS rack. It consists of a bay that contains SCSI and ESCON host adapter cards and the attached devices (DDMs). If a single component in a service boundary is being serviced, none of its components are available to the ESS.

service-information message (SIM). A message sent by a storage server to service personnel.

service processor. A dedicated processing unit used to service a storage facility.

service support representative (SSR). Individuals or a company that you have authorized to service your ESS. This term also refers to a service provider, a service representative, or an IBM service support representative (SSR). An IBM SSR installs your ESS.

shared storage. Storage within a storage facility that is configured such that multiple homogenous or divergent hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must have a common model for the information on a storage device. You need to design the programs to handle the effects of concurrent access.

short wave. A technology that allows you to connect a variety of communication protocols.

SIM. See *service-information message.*

simple network management protocol (SNMP). (1) An SNMP Manager is part of a network administration software product, such as Tivoli TME 10 Netview. (2) SNMP permits you to define management information base (MIB) extensions, or enterprise-specific MIBs. By loading a MIB file on a manager station, you can monitor the MIB objects. The SNMP Agent accesses MIB objects when a request is received from an SNMP Manager. (3) In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

Single-Byte Command Code Sets Connection (SBCON). The ANSI standard for the ESCON I/O interface.

small computer system interface (SCSI). (1) An ANSI standard for a logical interface to computer peripherals and for a computer peripheral interface. The interface uses a SCSI logical protocol over an I/O interface that configures attached targets and initiators in a multi-drop bus topology. (2) A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

SMIT. See *System Management Interface Tool.*

SMP. See *System Modification Program*.

SNMP. See *simple network management protocol*.

software transparency. Criteria applied to a processing environment that states that changes do not require modifications to the host software in order to continue to provide an existing function.

spare. A disk drive that is used to receive data from a device that has experienced a failure that requires disruptive service. A spare can be pre-designated to allow automatic dynamic sparing. Any data on a disk drive that you use as a spare is destroyed by the dynamic sparing copy process.

SSA. See *serial storage architecture*.

SSA adapter. The adapter that connects stored data on devices, such as disk drive modules for access and control by the storage server. See *serial storage architecture*.

SSID. See *subsystem identifier*.

SSR. See *service support representative*.

stacked status. In the ESA/390 architecture, the condition when the control-unit is holding status for the channel and the channel responded with the stack-status control the last time the control-unit attempted to present the status.

staging. The action of moving data from an offline or low-priority device back to an online or higher priority device, usually on demand of the system or on request of the user.

STI. See *self-timed interface*.

storage complex. Multiple storage facilities.

storage controller. A physical unit that provides an interface between one or more storage devices and a host computer by providing the function of one or more logical subsystems. The storage controller may provide functions that are not provided by the storage device. The storage controller has one or more clusters.

storage device. A physical unit that provides a mechanism to store data on a given medium such that it can be subsequently retrieved. See *disk drive module*.

storage facility. (1) A physical unit that consists of a storage controller integrated with one or more storage devices to provide storage capability to a host computer. (2) A storage server and its attached storage devices.

storage server. A unit that manages attached storage devices and provides access to the storage or storage-related functions for one or more attached hosts.

StorWatch Enterprise Storage Server Specialist. The Web-based management interface to the IBM Enterprise Storage Server.

striping. A technique that distributes data in bit, byte, multibyte, record, or block increments across multiple disk drives.

subchannel. A logical function of a channel subsystem associated with the management of a single device.

subsystem identifier (SSID). A number that uniquely identifies a logical subsystem within a computer installation.

support catcher telephone number. The telephone number that service personnel use to send heartbeat call-home records that are non-problem related, directly to the support catcher server rather than to the RETAIN catcher server. These records might include such information as a trace or a dump package.

synchronous write. A write operation that stores data in cache and in nonvolatile storage (NVS). Later the data is stored on a device, using normal destage algorithms.

System Management Interface Tool (SMIT). An interface tool of the AIX operating system for installing, maintaining, configuring, and diagnosing tasks.

System Modification Program (SMP). A program used to install software and software changes on MVS systems.

T

target. A storage device to which information is written.

TB. See *terabyte*.

TCP/IP. See *Transmission Control Protocol/Internet Protocol*.

terabyte (TB). (1) For processor storage, real and virtual storage, and channel volume, 2^{40} or 1 099 511 627 776 bytes. (2) For disk storage capacity and communications volume, 1 000 000 000 000 bytes.

thousands of power-on hours (KPOH). A unit of time used to measure the mean time between failures (MTBF).

time sharing option (TSO). An operating system option, the option provides interactive time sharing from remote terminals.

TPF. See *transaction processing facility*.

track. A unit of storage on a CKD device that can be formatted to contain a number of data records. See *home address, track-descriptor record*, and *data record*.

track-descriptor record (R0). A special record on a track that follows the home address. The control program uses it to maintain certain information about the track. The record has a count field with a key length of zero, a data length of 8, and a record number of 0. This record is sometimes referred to as R0.

transaction processing facility (TPF). A high-availability, high-performance system, designed to support real-time, transaction driven applications. The specialized architecture of TPF is intended to optimize system efficiency, reliability, and responsiveness for data communication and database processing. TPF provides real-time inquiry and update to a large, centralized database, where message length is relatively short in both directions, and response time is generally less than three seconds. Formerly known as the Airline Control Program/Transaction Processing Facility (ACP/TPF).

Transmission Control Protocol/Internet Protocol (TCP/IP). (1) The Transmission Control Protocol and the Internet Protocol, which together provide reliable end-to-end connections between applications over interconnected networks of different types. (2) The suite of transport and application protocols that run over the Internet Protocol.

transparency. See *software transparency*.

TSO. See *time sharing option*.

U

UFS. UNIX filing system.

Ultra-SCSI. An enhanced small computer system interface.

unit address. The ESA/390 term for the address associated with a device on a given controller. On ESCON interfaces, the unit address is the same as the device address. On OEMI interfaces, the unit address specifies a controller and device pair on the interface.

Universaile Tempes du Coordinaire (UTC). The basis for coordinated world wide time. This system, formerly known as Greenwich Mean Time (GMT), was officially renamed to UTC, for 'Universaile Tempes du Coordinaire' because the world clock is now in Paris, France. It is also known as coordinated universal time (CUT).

UTC. See *Universaile Tempes du Coordinaire*.

utility device. The ESA/390 term for the device used with the Extended Remote Copy facility to access information that describes the modifications performed on the primary copy.

V

virtual machine (VM). A virtual data processing machine that appears to be for the exclusive use of a particular user, but whose functions are accomplished by sharing the resources of a real data processing system.

vital product data (VPD). Information that uniquely defines the system, hardware, software, and microcode elements of a processing system.

VM. See *virtual machine*.

volume. In the ESA/390 architecture, the information recorded on a single unit of recording medium. Indirectly, it can refer to the unit of recording medium itself. On a nonremovable-medium storage device, the terms may also refer, indirectly, to the storage device that you associate with the volume. When you store multiple volumes on a single storage medium transparently to the program, you may refer to the volumes as logical volumes.

VPD. See *vital product data*.

W

world-wide port name (WWPN). A unique 64-bit identifier for a fibre-channel port that is assigned in an implementation and protocol-independent manner.

write hit. A write operation in which the data that you requested is in the cache.

write penalty. The performance impact of a classical RAID write operation.

WWPN. See *world-wide port name*.

X

XRC. See *Extended Remote Copy*.

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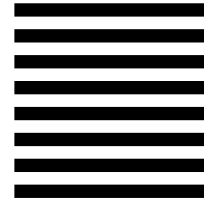
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