IBM TotalStorage DS4000

Problem Determination Guide

GC26-7703-01

IBM TotalStorage DS4000

Problem Determination Guide

GC26-7703-01

Note
Before using this information and the product it supports, be sure to read the general information in "Notices" on page 335.

Second Edition (June 2005)

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Safety

Before installing this product, read the Safety information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information
(安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

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Caution and danger notices

The caution and danger statements that this document contains can be referenced in the multilingual *IBM® Safety Information* document that is provided with your IBM TotalStorage® Storage Subsystem. Each caution and danger statement is numbered for easy reference to the corresponding statements in the translated document.

- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure, step, or situation.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

CAUTION:
Handling the cord on this product or cords associated with accessories sold with product will expose you to lead, a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. *Wash hands after handling*.

The following Cautions notice are printed in English throughout this document. For a translation of these notices, see *IBM Safety Information*.

Statement 1:

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	**To Disconnect:**
1. Turn everything OFF. 2. First, attach all cables to devices. 3. Attach signal cables to connectors. 4. Attach power cords to outlet. 5. Turn device ON.	1. Turn everything OFF. 2. First, remove power cords from outlet. 3. Remove signal cables from connectors. 4. Remove all cables from devices.

Statement 3:

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 Laser statement

Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

IEC 825-11993 CENELEC EN 60 825

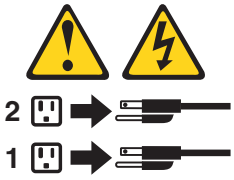
Statement 4:

		
≥ 18 kg (39.7 lb)	≥ 32 kg (70.5 lb)	≥ 55 kg (121.2 lb)

CAUTION:
Use safe practices when lifting.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 8:

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Safety information

Before you service an IBM computer, you must be familiar with the following safety information.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
  1. Ensure that you can stand safely without slipping.
  2. Distribute the weight of the object equally between your feet.
  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 in.) from the end.

- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing. **Remember:** Metal objects are good electrical conductors.
- Wear safety glasses when you are doing any of the following: hammering, drilling soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Electrical safety

Important
Use only approved tools and test equipment. Some hand tools have handles that are covered with a soft material that does not insulate you when working with live electrical currents. Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

Observe the following rules when working on electrical equipment.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before doing any of the following tasks:
  - Performing a mechanical inspection
  - Working near power supplies
  - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
  - Ensure that another person, familiar with the power-off controls, is near you.

    Remember: Another person must be there to switch off the power, if necessary.
  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

    Remember: There must be a complete circuit to cause electrical shock. By observing the previous rule, you might prevent a current from passing through your body.
  - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive and can cause personal injury and machine damage.
- Do not service the following parts (or similar units) *with the power on* when they are removed from their normal operating places in a machine. This practice ensures correct grounding of the units.
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators
- If an electrical accident occurs:
  - **Use caution; do not become a victim yourself.**
  - **Switch off power.**
  - **Send another person to get medical aid.**

Handling ESD-sensitive devices

Any computer part that contains transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person that is handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices that you use have been certified (ISO 9000) as fully effective.

Use the following precautions when handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

  Note: The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the ac plug on ac-operated computers.

- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.

Safety inspection procedure

Use this safety inspection procedure to identify potentially unsafe conditions on a product. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This procedure addresses only those items. However, good judgment should be used to identify any potential safety hazards due to attachment of non-IBM features or options not covered by this inspection procedure.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged cathode ray tube (CRT) face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

Complete the following checks with the power off, and with the power cord disconnected.

1. Check the exterior covers for damage (loose, broken, or sharp edges).
2. Check the power cord for the following conditions:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
   b. The power cord should be the appropriate type as specified in the parts listings.
   c. Insulation must not be frayed or worn.
3. Remove the cover.
4. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
5. Check the inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
6. Check for worn, frayed, or pinched cables.
7. Check that the power supply cover fasteners (screws or rivets) have not been removed or tampered with.

About this document

This document provides information about problem determination for the IBM TotalStorage DS4000 product line. Use this document for the following tasks:

- Diagnose and troubleshoot system faults
- Configure and service hardware
- Determine system specifications
- Interpret system data

FAStT product renaming

IBM is in the process of renaming some FAStT family products. Table 1 identifies each new DS4000 product name with its corresponding FAStT product name. Note that this change of **product name only** indicates no change in functionality or warranty. All products listed below with new names are functionally-equivalent and fully-interoperable. Each DS4000 product retains full IBM service as outlined in service contracts issued for analogous FAStT products.

Table 1. Mapping of FAStT names to DS4000 Series names

Current FAStT Product Name	New DS4000 Product Name
IBM TotalStorage FAStT Storage Server	IBM TotalStorage DS4000
FAStT	DS4000
FAStT Family	DS4000 Mid-range Disk System
FAStT Storage Manager vX.Y (for example v9.10)	DS4000 Storage Manager vX.Y (for example v9.10)
FAStT100	DS4100
FAStT600	DS4300
FAStT600 with Turbo Feature	DS4300 Turbo
FAStT700	DS4400
FAStT900	DS4500
EXP700	DS4000 EXP700
EXP710	DS4000 EXP710
EXP100	DS4000 EXP100
FAStT FlashCopy	FlashCopy for DS4000
FAStT VolumeCopy	VolumeCopy for DS4000
FAStT Remote Mirror (RM)	Enhanced Remote Mirroring for DS4000
FAStT Synchronous Mirroring	Metro Mirroring for DS4000
	Global Copy for DS4000 (New Feature = Asynchronous Mirroring without Consistency Group)
	Global Mirroring for DS4000 (New Feature = Asynchronous Mirroring with Consistency Group)

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Who should read this document

This document is intended for system operators and service technicians who have extensive knowledge of fibre channel and network technology.

How this document is organized

The *IBM TotalStorage DS4000 Problem Determination Guide* contains information that you can use to isolate and solve problems that might occur in your fibre channel configurations. It provides problem determination and resolution information for the issues most commonly encountered with IBM fibre channel devices and configurations.

Attention: Beginning with the first edition of this document, the *IBM TotalStorage DS4000 Hardware Maintenance Manual* and the *IBM TotalStorage DS4000 Problem Determination Guide* are published as separate documents. In addition, the hardware maintenance information for new IBM DS4000 products released with or after this document is included in the Installation, User's, and Maintenance Guide for those products.

This document contains the following chapters:

Chapter 1, "About problem determination," on page 1 provides a starting point for the problem determination information found in this document.

Chapter 2, "Problem determination starting points," on page 3 provides an introduction to problem determination tools and techniques that are contained in this document.

Chapter 3, "Problem determination maps," on page 7 provides a series of flowcharts that help you to isolate and resolve hardware issues.

Chapter 4, "Introduction to FAStT MSJ," on page 39 introduces the IBM Fibre Array Storage Technology Management Suite Java™ (FAStT MSJ).

Chapter 5, "PD hints: Common path/single path configurations," on page 55 provides problem determination hints for common path or single path configurations.

Chapter 6, "PD hints: RAID controller errors in the Windows 2000, Windows 2003, or Windows NT event log," on page 57 provides problem determination hints for event log errors stemming from the RAID controller.

Chapter 7, "PD hints: Configuration types," on page 71 provides the various configuration types that can be encountered.

Chapter 8, "PD hints: Passive RAID controller," on page 77 provides instructions on how to isolate problems that occur in a passive RAID controller.

Chapter 9, "PD hints: Performing sendEcho tests," on page 81 contains information on how to perform loopback tests.

Chapter 10, "PD hints: Tool hints," on page 85 contains information on generalized tool usage.

Chapter 11, “PD hints: Drive side hints and RLS diagnostics,” on page 97 contains problem determination information for the drive or device side as well as read link status diagnostics.

Chapter 12, “PD hints: Hubs and switches,” on page 127 provides information on hub and switch problem determination.

Chapter 13, “PD hints: Wrap plug tests,” on page 133 provides information about tests that you can perform with wrap plugs.

Chapter 14, “Heterogeneous configurations,” on page 137 contains information on heterogeneous configurations.

Chapter 15, “Using IBM Fast!UTIL,” on page 141 provides detailed configuration information for advanced users who want to customize the configuration of the IBM fibre-channel PCI adapter (FRU 01K7354), the IBM DS4000 host adapter (FRU 09N7292), and the IBM DS4000 FC2-133 Adapter (FRU 24P0962).

Chapter 16, “Frequently asked questions about DS4000 Storage Manager,” on page 147 contains frequently asked questions about DS4000 Storage Manager.

Chapter 17, “pSeries supplemental problem determination information,” on page 157 discusses fibre channel-specific problems and information that might be necessary to resolve them.

“Chapter 18, MEL data format,” on page 281 discusses MEL data format.

DS4000 installation process overview

The following flow chart gives an overview of the DS4000 hardware and the DS4000 Storage Manager software installation process. Lined arrows in the flow chart indicate consecutive steps in the hardware and software installation process. Labeled arrows indicate which current documents provide detailed information about those steps.

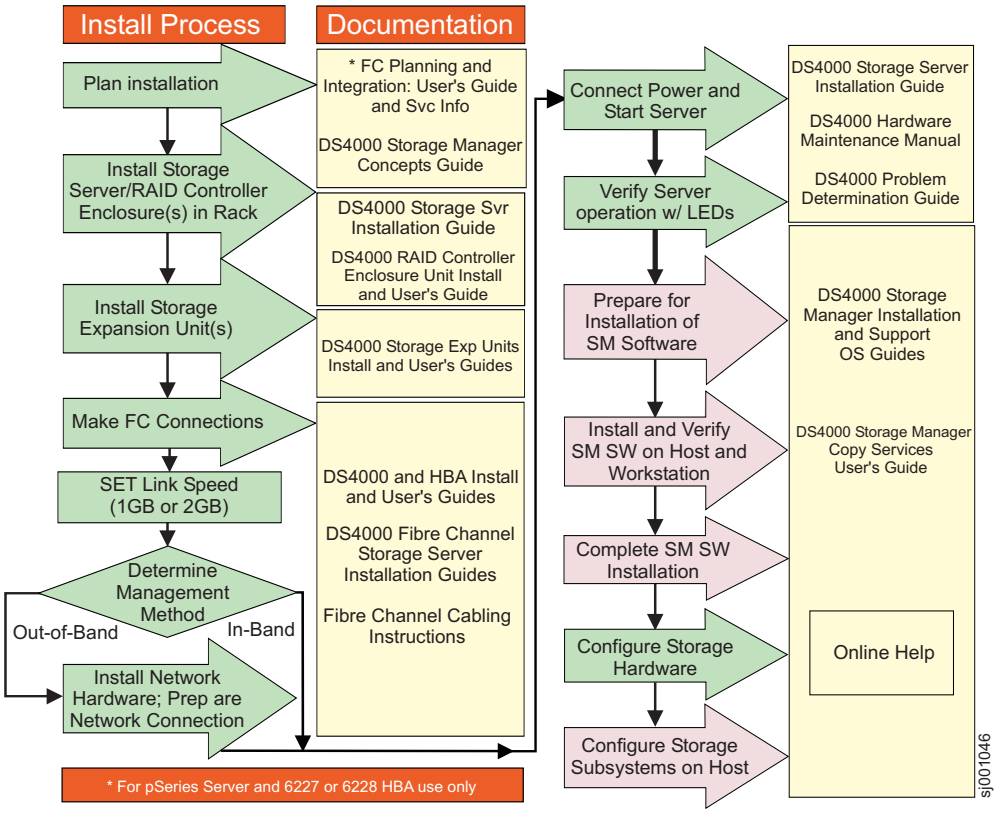

Figure 1. Installation process flow by current publications

DS4000 Storage Subsystem publications

The following tables present an overview of the DS4500, DS4400, DS4300, DS4100, and DS4800 Storage Subsystem product libraries, as well as other related documents. Each table lists documents that are included in the libraries and what common tasks they address.

You can access the documents listed in these tables at one of the following Web sites:

www.ibm.com/servers/storage/support/disk/

www.ibm.com/shop/publications/order/

DS4500 Storage Server library

Table 2 on page xxv associates each document in the DS4500 (previously FAStT900) Storage Server library with its related common user tasks.

Table 2. TotalStorage DS4500 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage DS4500 Installation and Support Guide, GC26-7727	✓	✓		✓		
IBM TotalStorage DS4500 Fibre Channel Cabling Instructions, GC26-7729	✓	✓				
IBM TotalStorage DS4500 Storage Server User's Guide, GC26-7726				✓	✓	✓
IBM TotalStorage DS4500 Rack Mounting Instructions, GC26-7728	✓	✓				

DS4400 Storage Server library

Table 3 associates each document in the DS4400 (previously FAStT700) Storage Server library with its related common user tasks.

Table 3. TotalStorage DS4400 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM DS4400 Fibre Channel Storage Server User's Guide, GC26-7730	✓	✓		✓	✓	✓
IBM DS4400 Fibre Channel Storage Server Installation and Support Guide, GC26-7731	✓	✓		✓	✓	
IBM DS4400 Fibre Channel Cabling Instructions, GC26-7732	✓	✓				

DS4300 Storage Server library

Table 4 associates each document in the DS4300 (previously FAStT600) Storage Server library with its related common user tasks.

Table 4. TotalStorage DS4300 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage DS4300 Fibre Channel Storage Server Installation and User's Guide, GC26-7722	✓	✓		✓		
IBM TotalStorage DS4300 Rack Mounting Instructions, GC26-7724	✓	✓				
IBM TotalStorage DS4300 Fibre Channel Cabling Instructions, GC26-7725	✓	✓				
IBM TotalStorage DS4300 SCU Base Upgrade Kit, GC26-7740		✓	✓			
IBM TotalStorage DS4300 SCU Turbo Upgrade Kit, GC26-7741		✓	✓			
IBM TotalStorage DS4300 Turbo Models 6LU/6LX Upgrade Kit, GC26-7723		✓	✓			

DS4100 Storage Server library

Table 5 associates each document in the DS4100 (previously FAStT100) Storage Server library with its related common user tasks.

Table 5. TotalStorage DS4100 SATA Storage Server document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage DS4100 Installation, User's and Maintenance Guide, GC26-7733	✓	✓		✓	✓	✓
IBM TotalStorage DS4100 Fibre Channel Cabling Instructions, 24P8973		✓				

DS4800 Storage Subsystem library

Table 6 associates each document in the DS4800 Storage Subsystem library with its related common user tasks.

Table 6. TotalStorage DS4800 Storage Subsystem document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage DS4800 Installation, User's and Maintenance Guide, GC26-7748	✓	✓		✓	✓	✓
IBM TotalStorage DS4800 Installation and Cabling Overview, 22R4738		✓				

DS4000 Storage Manager Version 9 publications

Table 7 associates each document in the DS4000 Storage Manager (previously FAStT Storage Manager) library with its related common user tasks.

Table 7. TotalStorage DS4000 Storage Manager Version 9 titles by user tasks

Title	User tasks					
	Planning	**Hardware installation**	**Software installation**	**Configuration**	**Operation and administration**	**Diagnosis and maintenance**
IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for Windows 2000/Server 2003, NetWare, ESX Server, and Linux, GC26-7706	✓		✓	✓		
IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for AIX, UNIX, Solaris and Linux on POWER, GC26-7705	✓		✓	✓		
IBM TotalStorage DS4000 Storage Manager Version 9 Copy Services User's Guide, GC26-7707	✓		✓	✓	✓	
IBM TotalStorage DS4000 Storage Manager Version 9 Concepts Guide, GC26-7734	✓	✓	✓	✓	✓	✓

Other DS4000 and DS4000-related documents

Table 8 associates each of the following documents with its related common user tasks.

Table 8. TotalStorage DS4000 and DS4000–related document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM Safety Information, 33P2406					✓	
IBM TotalStorage DS4000 Quick Start Guide, GC26-7738	✓	✓				
IBM TotalStorage DS4000 Hardware Maintenance Manual,GC26-7702						✓
IBM TotalStorage DS4000 Problem Determination Guide, GC26-7703						✓
IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✓	✓			✓	✓
IBM TotalStorage DS4000 FC2-133 Host Bus Adapter Installation and User's Guide, GC26-7736		✓			✓	
IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7737		✓			✓	
IBM TotalStorage DS4000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview GC26-7713	✓	✓	✓	✓		
Fibre Channel Solutions - IBM DS4000 EXP500 Installation and User's Guide, 59P5637	✓	✓		✓	✓	✓

Table 8. TotalStorage DS4000 and DS4000–related document titles by user tasks (continued)

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage DS4000 EXP700 and EXP710 Storage Expansion Enclosures Installation, User's, and Maintenance Guide, GC26-7735	✓	✓		✓	✓	✓
IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosures Installation and Migration Guide, GC26-7704	✓	✓				
IBM DS4000 Management Suite Java User's Guide, 32P0081					✓	✓
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✓				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

Notices used in this document

This document can contain the following notices that are designed to highlight key information:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your IBM @server xSeries® or IntelliStation® system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Check for technical information, hints, tips, and new device drivers at the following Web site:

  www.ibm.com/servers/storage/support/disk/
- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documents that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the documentation

Information about the xSeries or IntelliStation system and preinstalled software, if any, is available in the documents that come with your system. This includes printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions on how to use the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software.

Web sites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates.

- For DS4000 information, go to the following Web site:

  www.ibm.com/servers/storage/support/disk/

  The support page has many sources of information and ways for you to solve problems, including:
  - Diagnosing problems using the IBM Online Assistant
  - Downloading the latest device drivers and updates for your products
  - Viewing frequently asked questions (FAQ)
  - Viewing hints and tips to help you solve problems
  - Participating in IBM discussion forums

  - Setting up e-mail notification of technical updates about your products
- You can order publications through the IBM Publications Ordering System at the following web site:

  www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi/
- For the latest information about IBM xSeries products, services, and support, go to the following Web site:

  www.ibm.com/eserver/xseries/
- For the latest information about IBM pSeries® products, services, and support, go to the following Web site:
  www.ibm.com/eserver/pseries/
- For the latest information about the IBM IntelliStation information, go to the following Web site:

  www-132.ibm.com/content/home/store_IBMPublicUSA/
  en_US/IntelliStation_workstations.html
- For the latest information about operating system and HBA support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage DS4000 Interoperability Matrix at the following Web site:

  www.ibm.com/servers/storage/disk/ds4000/interop-matrix.html

Software service and support

Through IBM Support Line, for a fee you can get telephone assistance with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to the following Web site:

www.ibm.com/services/sl/products/

For more information about the IBM Support Line and other IBM services, go to the following Web sites:

- www.ibm.com/services/
- www.ibm.com/planetwide/

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to the following Web site for support telephone numbers:

www.ibm.com/planetwide/

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

Fire suppression systems

A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, or a local building inspector, or both, should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire suppression systems.

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Chapter 1. About problem determination

The procedures in this document are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this document and the appropriate IBM server hardware maintenance manual.

This guide provides problem determination and resolution information for the issues most commonly encountered with IBM fibre channel devices and configurations. This manual contains useful component information, such as specifications, replacement and installation procedures, and basic symptom lists.

Note: For information about how to use and troubleshoot problems with the FC 6228 2 Gigabit fibre channel adapter in IBM **@server** pSeries AIX hosts, see *Fibre Channel Planning and Integration: User's Guide and Service Information*, SC23-4329.

Where to start

To use this document correctly, begin by identifying a particular problem area from the lists provided in "Starting points for problem determination" on page 5. The starting points direct you to the related PD maps, which provide graphical directions to help you identify and resolve problems. The problem determination maps in Chapter 2 might also refer you to other PD maps or to other chapters or appendices in this document. When you complete tasks that are required by the PD maps, it might be helpful to see the component information that is provided in the *IBM TotalStorage DS4000 Hardware Maintenance Manual*.

Related documents

For information about managed hubs and switches that might be in your network, see the following publications:

- *IBM 3534 SAN Fibre Channel Managed Hub Installation and Service Guide*, SY27-7616
- *IBM SAN Fibre Channel Switch 2109 Model S08 Installation and Service Guide*, SC26-7350
- *IBM SAN Fibre Channel Switch 2109 Model S16 Installation and Service Guide*, SC26-7352

This installation and service information can also be found at the following Web site:

www.ibm.com/storage/ibmsan/products.htm

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Product updates

Important

In order to keep your system up to date with the latest firmware and other product updates, use the information below to register and use the **My support** web site.

Download the latest versions of the DS4000 Storage Manager host software, DS4000 Storage Server controller firmware, DS4000 drive expansion enclosure ESM firmware, and drive firmware at the time of the initial installation and when product updates become available.

To be notified of important product updates, you must first register at the IBM Support and Download Web site:

www-1.ibm.com/servers/storage/support/disk/index.html

In the **Additional Support** section of the Web page, click **My support**. On the next page, if you have not already done so, register to use the site by clicking **register now**.

Perform the following steps to receive product updates:

1. After you have registered, type your user ID and password to log into the site. The **My support** page opens.
2. Click **add products**. A pull-down menu displays.
3. In the pull-down menu, select **Storage**. Another pull-down menu displays.
4. In the new pull-down menu, and in the subsequent pull-down menus that display, select the following topics:
   - **Computer Storage**
   - **Disk Storage Systems**
   - **TotalStorage DS4000 Midrange Disk Systems & FAStT Stor Srvrs**

   Note: During this process a check list displays. Do not check any of the items in the check list until you complete the selections in the pull-down menus.
5. When you finish selecting the menu topics, place a check in the box for the machine type of your DS4000 series product, as well as any other attached DS4000 series product(s) for which you would like to receive information, then click **Add products**. The **My support** page opens again.
6. On the **My support** page, click the **Edit profile** tab, then click **Subscribe to email**. A pull-down menu displays.
7. In the pull-down menu, select **Storage**. A check list displays.
8. Place a check in each of the following boxes:
   a. **Please send these documents by weekly email**
   b. **Downloads and drivers**
   c. **Flashes**

   and any other topics that you may be interested in, and then click **Update**.
9. Click **Sign out** to log out of My Support.

Chapter 2. Problem determination starting points

This chapter contains information to help you perform the tasks required when you follow PD procedures. Review this information before you attempt to isolate and resolve fibre channel problems. This chapter also provides summaries of the tools that might be useful in following the PD procedures provided in Chapter 3, "Problem determination maps," on page 7.

Note: The PD maps in this document are not to be used in order of appearance. *Always begin working with the PD maps from the starting points provided in this chapter* (see "Starting points for problem determination" on page 5). Do not use a PD map unless you are directed there from a particular symptom or problem area in one of the lists of starting points, or from another PD map.

Problem determination tools

The PD maps in Chapter 3, "Problem determination maps," on page 7 rely on numerous tools and diagnostic programs to isolate and fix the problems. You use the following tools when performing the tasks directed by the PD maps.

Loopback Data Test

Host bus adapters type 2200 and above support loopback testing, which can be run from the FAStT MSJ diagnostics. (For more information on FAStT MSJ, see Chapter 4, "Introduction to FAStT MSJ," on page 39.)

Wrap plugs

Wrap plugs are required to run the Loopback test at the host bus adapter or at the end of cables. There are two types of wrap plugs: SC and LC. SC wrap plugs are used for the larger connector cables. LC wrap plugs are smaller than SC wrap plugs and are used for the IBM DS4400 Storage Server and the IBM DS4000 FC-2 HBA. A coupler is provided for each respective form-factor to connect the wrap plugs to cables. The part numbers for the wrap plugs are:

- SC: 75G2725 (wrap and coupler kit)
- LC
  - 24P0950 (wrap connector and coupler kit)
  - 11P3847 (wrap connector packaged with DS4400 Storage Server)
  - 05N6766 (coupler packaged with DS4400 Storage Server)

Note: Many illustrations in this document depict the SC wrap plug. Substitute the LC wrap plug for the DS4400 Storage Server (1742) and the IBM DS4000 FC-2 HBA (2300).

FAStT Management Suite Java (FAStT MSJ)

FAStT MSJ is a network-capable application that can connect to and configure remote systems. With FAStT MSJ, you can perform loopback and read/write buffer tests to help you isolate problems.

See Chapter 4, "Introduction to FAStT MSJ," on page 39 for further details on FAStT MSJ.

IBM DS4000 Storage Manager

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DS4000 Storage Manager enables you to monitor events and manage storage in a heterogeneous environment. These diagnostic and storage management capabilities fulfill the requirements of a true SAN, but also increase complexity and the potential for problems. Chapter 14, "Heterogeneous configurations," on page 137 shows examples of heterogeneous configurations and the associated profiles from the DS4000 Storage Manager. These examples can help you identify improperly configured storage by comparing the customer's profile with those supplied (assuming similar configurations).

Event Monitoring has also been implemented in these versions of DS4000 Storage Manager. The Event Monitor handles notification functions (e-mail and SNMP traps) and monitors storage subsystems whenever the Enterprise Management window is not open. The Event Monitor is a separate program bundled with the DS4000 Storage Manager client software; it is a background task that runs independently of the Enterprise Management window.

DS4000 Storage Manager implements controller run-time diagnostics. DS4000 Storage Manager also implements Read Link Status (RLS), which enables diagnostics to aid in troubleshooting drive-side problems. DS4000 Storage Manager establishes a time stamped ″baseline″ value for drive error counts and keeps track of drive error events. The end user receives deltas over time as well as trends.

Considerations before starting PD maps

Because a wide variety of hardware and software combinations are possible, use the following information to assist you in problem determination. Before you use the PD maps, perform the following actions:

- Verify any recent hardware changes.
- Verify any recent software changes.
- Verify that the BIOS is at the latest level. See "File updates" on page 5 and specific server hardware maintenance manuals for details about this procedure.
- Verify that device drivers are at the latest levels. See the device driver installation information in the installation guide for your device.
- Verify that the configuration matches the hardware.
- Verify that FAStT MSJ is at the latest level. For more information, see Chapter 4, "Introduction to FAStT MSJ," on page 39.

As you go through the problem determination procedures, consider the following questions:

- Do diagnostics fail?
- Is the failure repeatable?
- Has this configuration ever worked?
- If this configuration has been working, what changes were made prior to it failing?
- Is this the original reported failure? If not, try to isolate failures using the lists of indications (see "General symptoms" on page 5, "Specific problem areas" on page 5, and "PD maps and diagrams" on page 6).

Important

To eliminate confusion, systems are considered identical only if the following are *exactly* identical for *each* system:

- Machine type and model
- BIOS level
- Adapters and attachments (in same locations)
- Address jumpers, terminators, and cabling
- Software versions and levels

Comparing the configuration and software setup between working and non-working systems will often resolve problems.

File updates

You can download diagnostic, BIOS flash, and device driver files from the following Web site:

www.ibm.com/pc/support/

Starting points for problem determination

The lists of indications contained in this section provide you with entry points to the problem determination maps found in this chapter. (Links to useful appendix materials are also provided.) Use the following lists of problem areas as a guide for determining which PD maps will be most helpful.

General symptoms

- **RAID controller passive**

  If you determine that a RAID controller is passive, go to "RAID Controller Passive PD map" on page 9.
- **Failed or moved cluster resource**

  If you determine that a cluster resource failed or has been moved, go to "Cluster Resource PD map" on page 10.
- **Startup long delay**

  If the host experiences a long delay at startup (more than 10 minutes), go to "Boot-up Delay PD map" on page 11.
- **Systems Management or DS4000 Storage Manager performance problems**

  If you discover a problem through the Systems Management or Storage Management tools, go to "Systems Management PD map" on page 12.

Specific problem areas

- **DS4000 Storage Manager**

  See "Systems Management PD map" on page 12.

  See also Chapter 16, "Frequently asked questions about DS4000 Storage Manager," on page 147.
- **Port configuration (Linux)**

  See "Linux Port Configuration PD map 1" on page 26.
- **Microsoft® Windows® 2000, Windows 2003, or Windows NT® Event Log**

  See Chapter 6, "PD hints: RAID controller errors in the Windows 2000, Windows 2003, or Windows NT event log," on page 57.

- **Indicator lights on devices**

  See “Indicator lights and problem indications” on page 100.
- **Major Event Log (MEL)**

  See ″MEL data format″ on page 281.
- **Control panel or SCSI adapters**

  See the driver installation information in the appropriate hardware chapter of the installation guide for your device.
- **Managed hub or switch logs**

  See Chapter 12, “PD hints: Hubs and switches,” on page 127.
- **Cluster Administrator**
- **IBM pSeries servers with 6228 HBAs**

  “pSeries PD map” on page 29

PD maps and diagrams

- **Configuration Type Determination**

  To determine whether your configuration is type 1 or type 2, go to “Configuration Type PD map” on page 8.

  In order to break larger configurations into manageable units for debugging, see Chapter 7, “PD hints: Configuration types,” on page 71.
- **Hub or Switch PD**

  If you determine that a problem exists within a hub or switch, go to “Hub/Switch PD map 2” on page 15.
- **Fibre Path PD**

  If you determine that a problem exists within the Fibre Path, go to “Fibre Path PD map 1” on page 18.
- **Device PD**

  If you determine that a problem exists within a device, go to “Device PD map 1” on page 24.

Chapter 3. Problem determination maps

This chapter contains a series of PD maps that guide you through problem isolation and resolution. Before you use any of the following PD maps, you should have reviewed the information in Chapter 2, "Problem determination starting points," on page 3.

The PD maps in this chapter are not to be used in order of appearance. *Always begin working with the PD maps from the starting points provided in the previous chapter* (see "Starting points for problem determination" on page 5). Do not use a PD map unless you are directed there from a particular symptom or problem area in one of the lists of starting points, or from another PD map.

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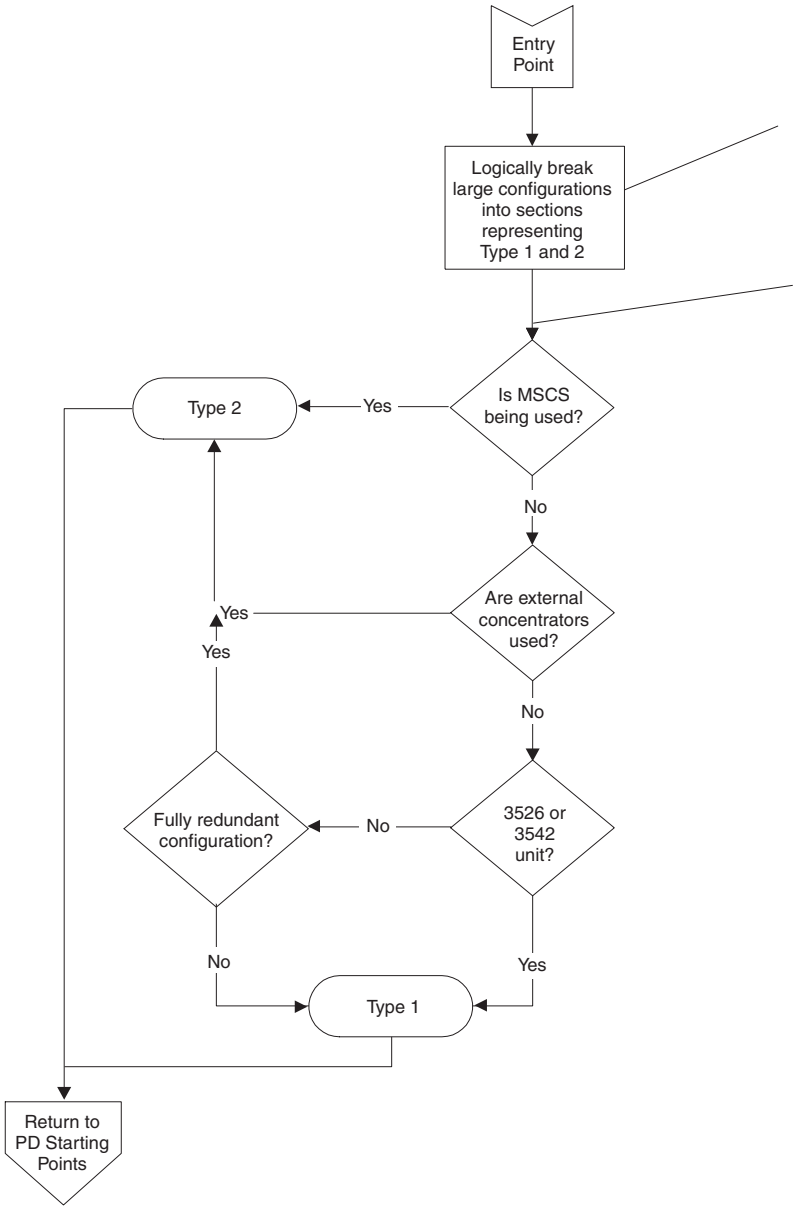
Configuration Type PD map

To perform certain problem determination procedures, you need to determine whether your fibre configuration is Type 1 or Type 2. Use this map to make that determination. You will need this information for later PD procedures.

Configuration Type PD map



Additional information: See Chapter 7, "PD hints: Configuration types," on page 71.

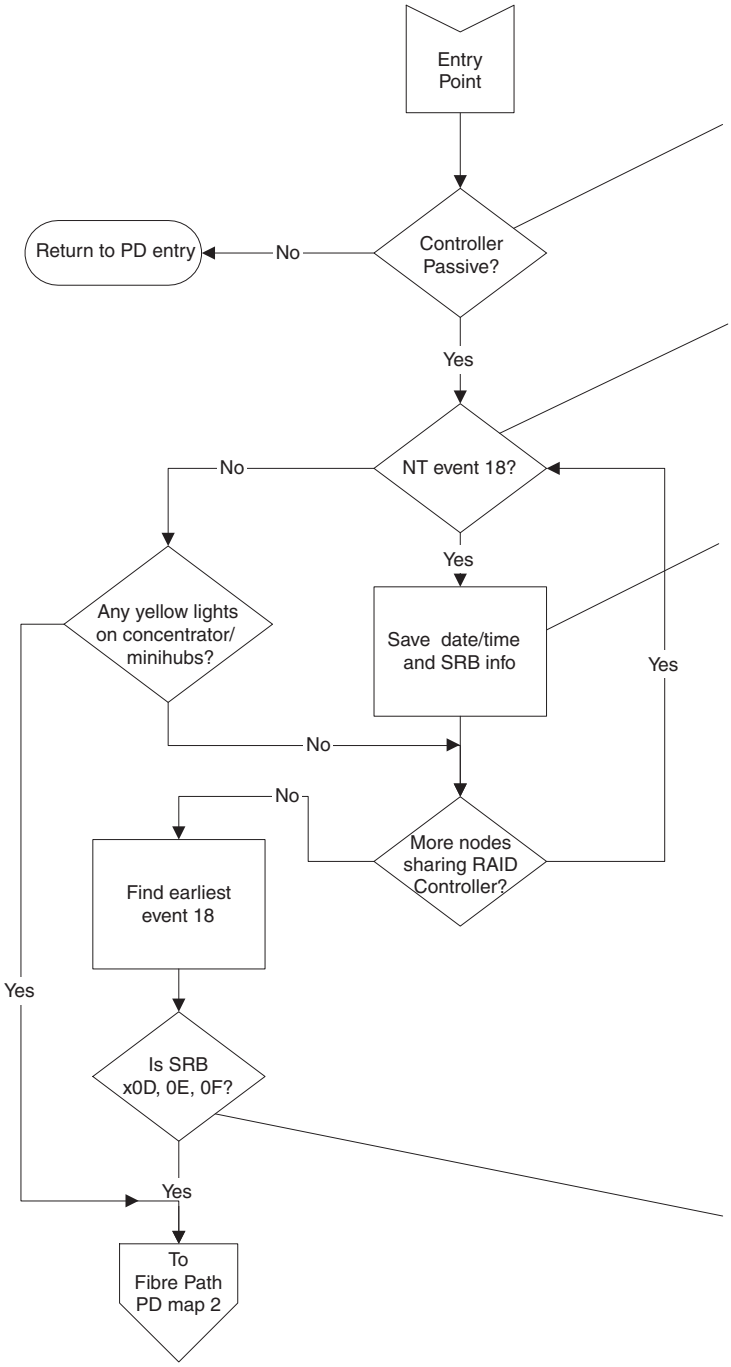
Note: Repeat this process for each section.

To return to the PD starting points, go to page 3.

RAID Controller Passive PD map

From: "General symptoms" on page 5; "Cluster Resource PD map" on page 10.

Controller Passive PD map



Additional information: See Chapter 8, "PD hints: Passive RAID controller," on page 77.

Additional information: Use MEL information to find the approximate fail time in the Windows event log. See "MEL data format" on page 281.

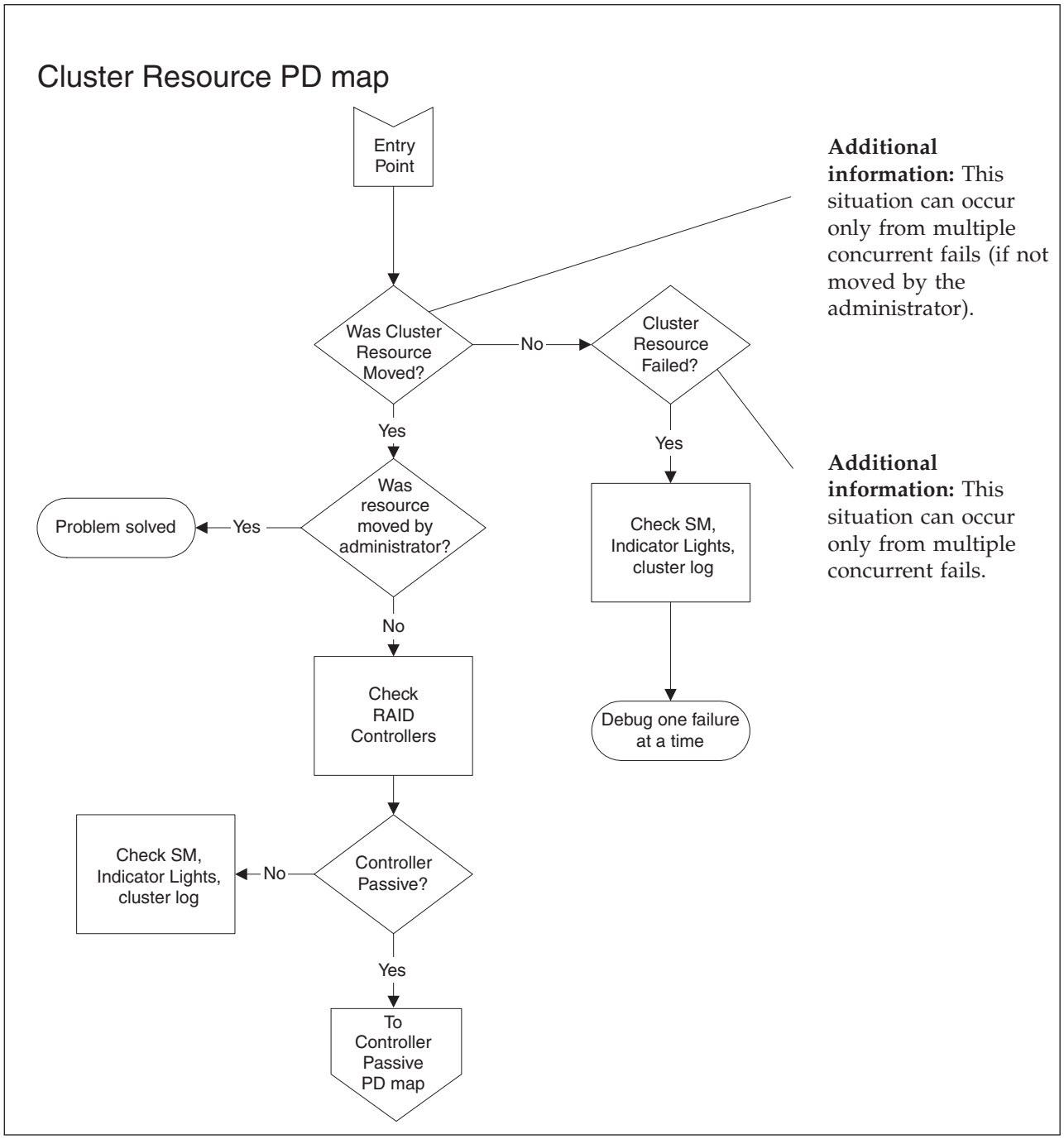
Additional information: See Chapter 6, "PD hints: RAID controller errors in the Windows 2000, Windows 2003, or Windows NT event log," on page 57.

Additional information: See Chapter 6, "PD hints: RAID controller errors in the Windows 2000, Windows 2003, or Windows NT event log," on page 57.

To see Fibre Path PD map 2, go to "Fibre Path PD map 2" on page 19.

Cluster Resource PD map

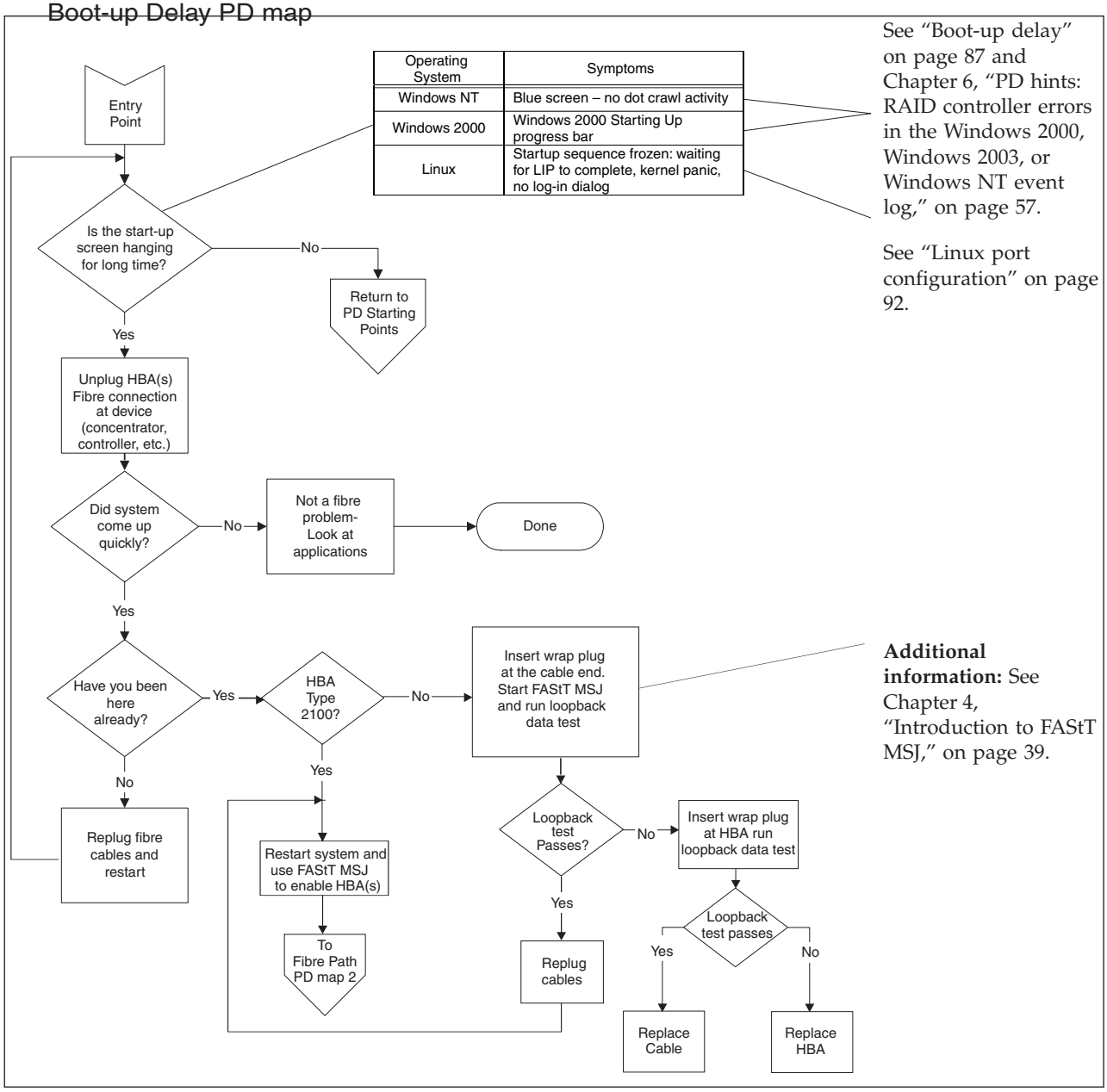
From: "General symptoms" on page 5.



To see the RAID Controller Passive PD map, go to "RAID Controller Passive PD map" on page 9.

Boot-up Delay PD map

From: "General symptoms" on page 5.



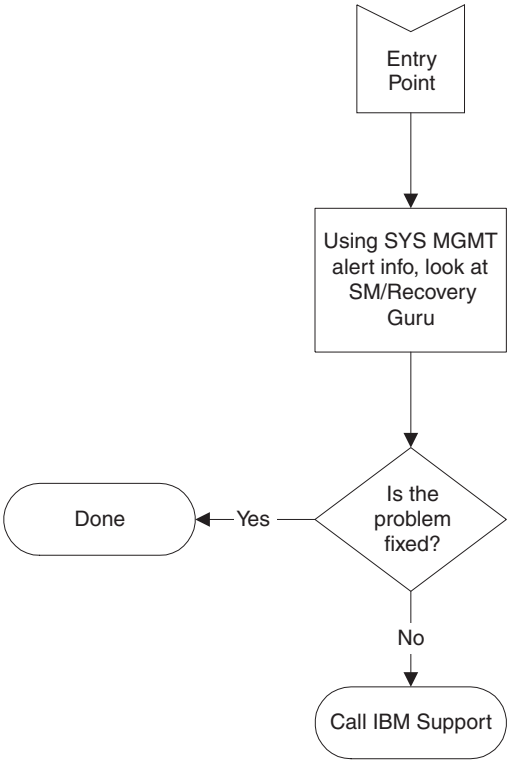
To return to the options for PD entry, go to page 3.

To see Fibre Path PD map 2, go to "Fibre Path PD map 2" on page 19.

Systems Management PD map

From: "General symptoms" on page 5.

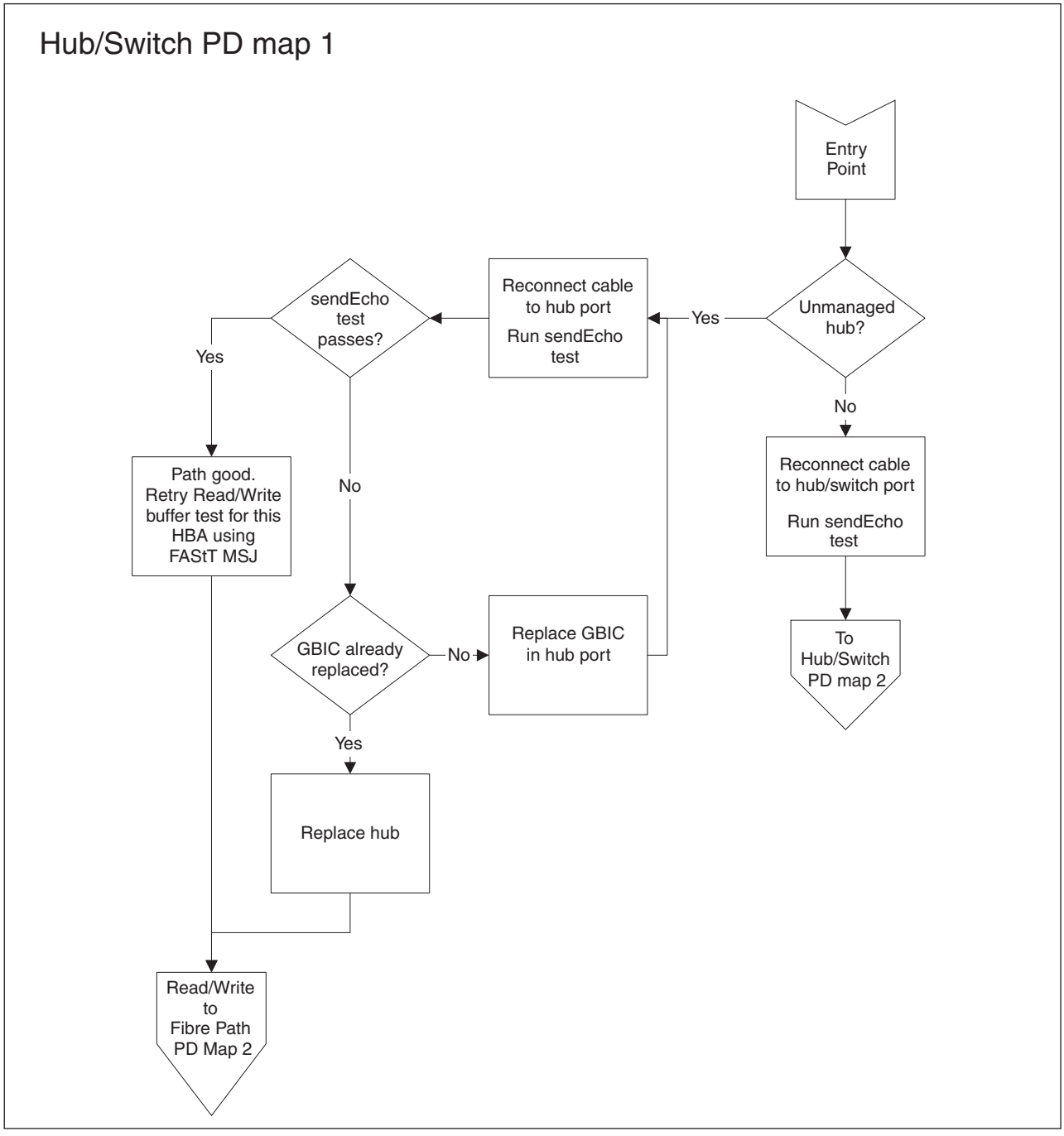
Systems Management



Additional information: See Chapter 16, "Frequently asked questions about DS4000 Storage Manager," on page 147.

Hub/Switch PD map 1

From: "PD maps and diagrams" on page 6; "Single Path Fail PD map 2" on page 21.



For information about sendEcho tests, see Chapter 9, "PD hints: Performing sendEcho tests," on page 81.

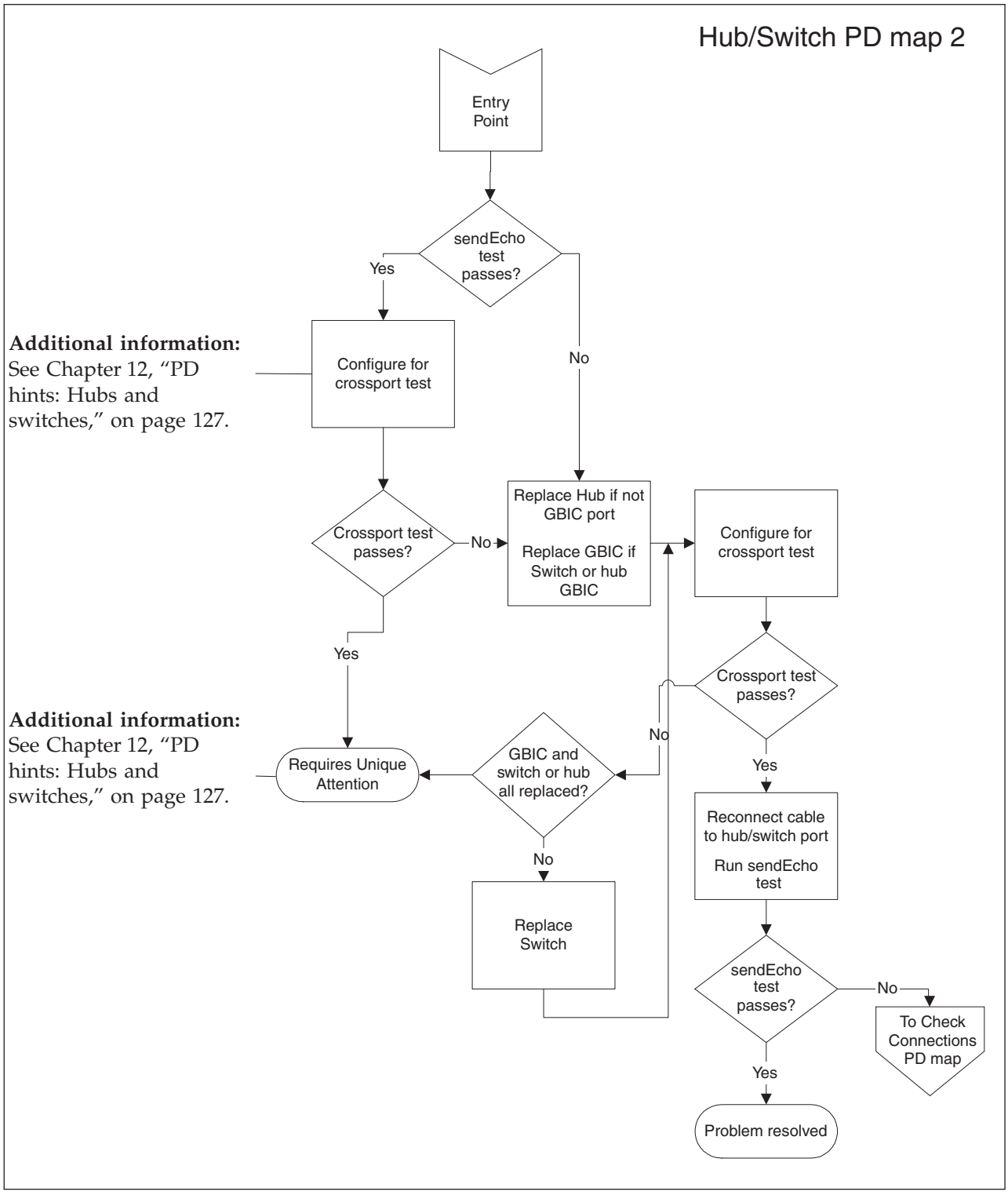
For information about Read/Write Buffer tests, see Chapter 4, "Introduction to FAStT MSJ," on page 39.

To see Hub/Switch PD map 2, go to "Hub/Switch PD map 2" on page 15.

To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 19.

Hub/Switch PD map 2

From: "Hub/Switch PD map 1" on page 13.

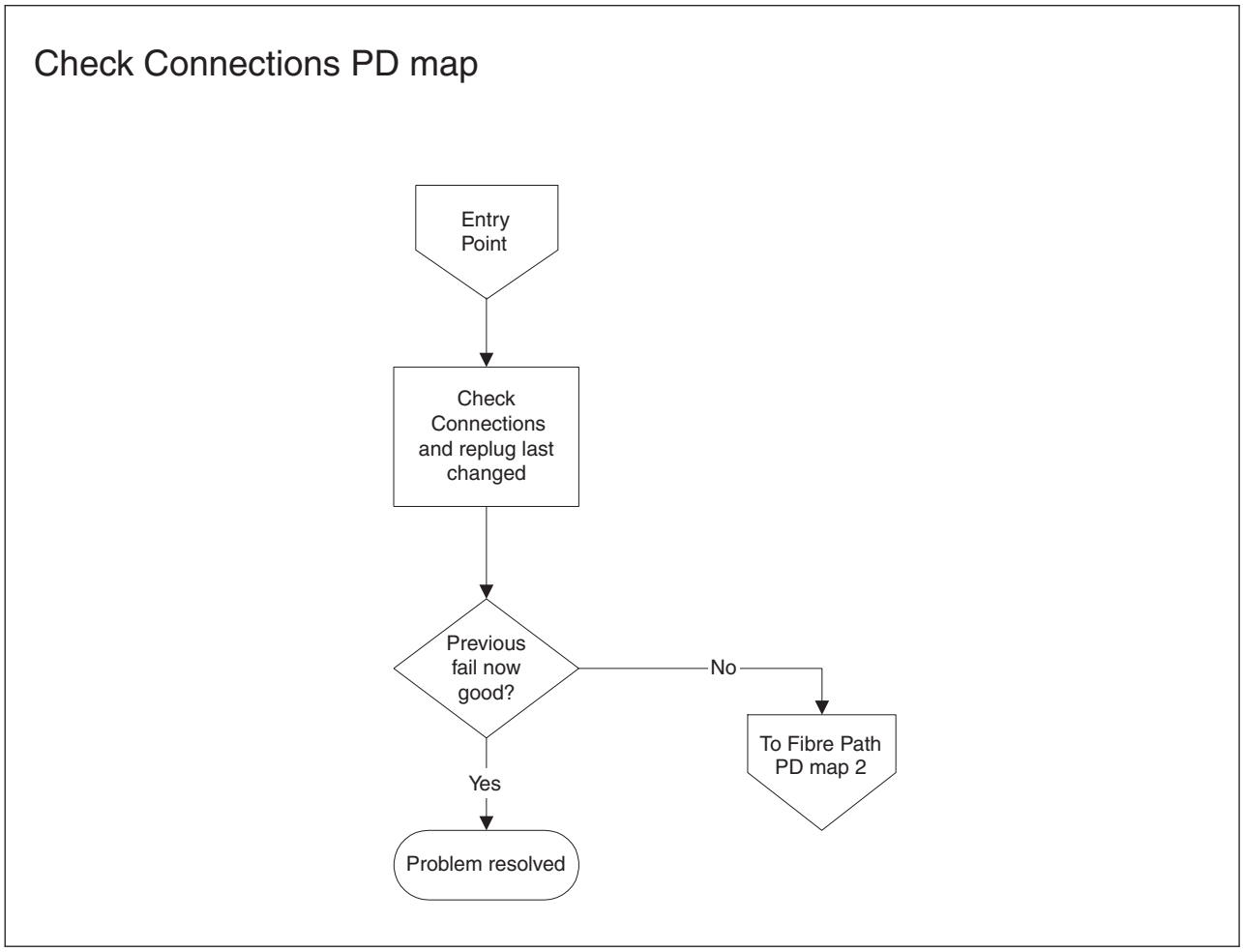


For information about sendEcho tests, see Chapter 9, "PD hints: Performing sendEcho tests," on page 81.

To see the Check Connections PD map, see “Check Connections PD map” on page 17.

Check Connections PD map

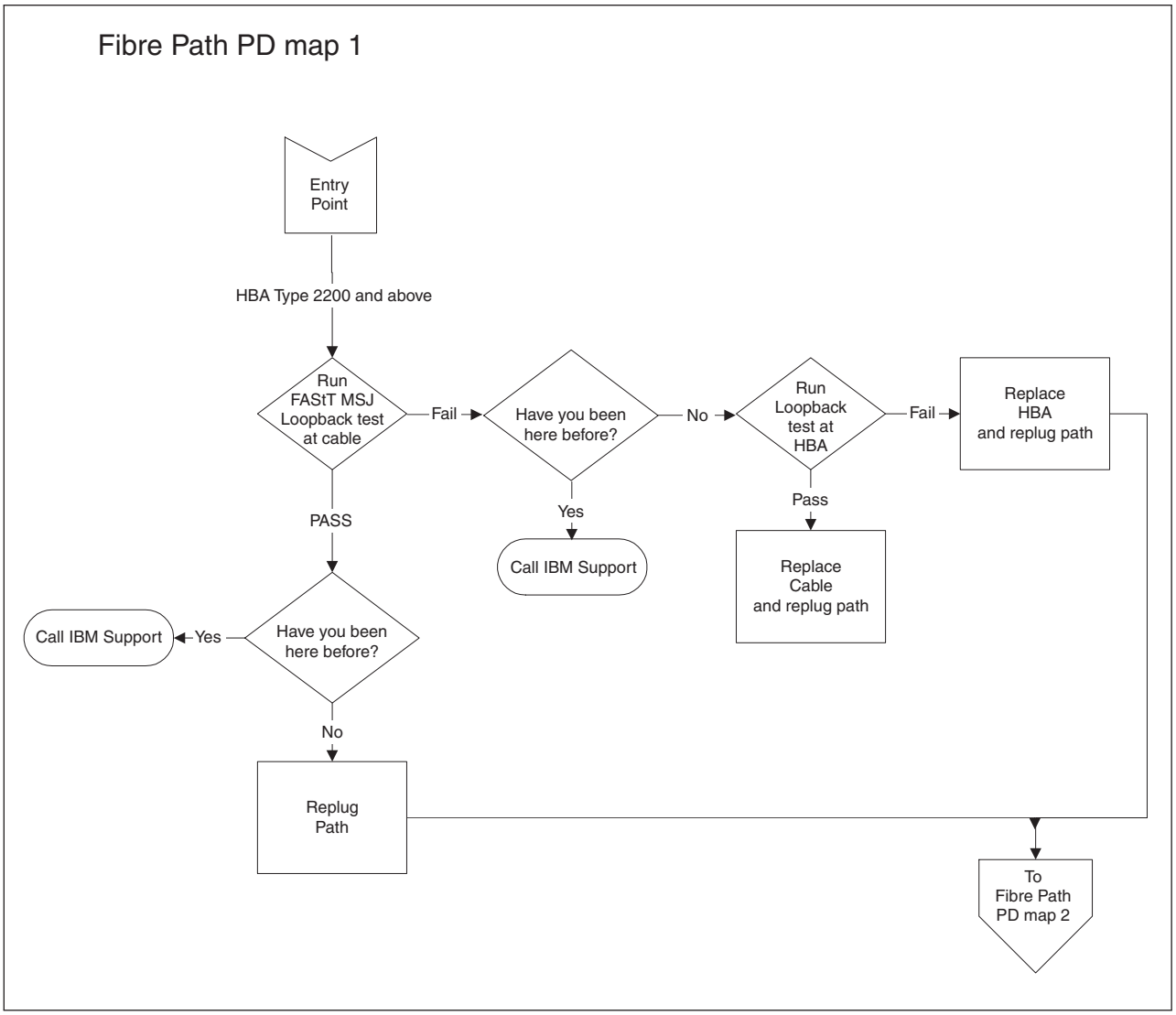
From: "Hub/Switch PD map 2" on page 15.



To see Fibre Path PD map 2, go to "Fibre Path PD map 2" on page 19.

Fibre Path PD map 1

From: "Common Path PD map 2" on page 23.

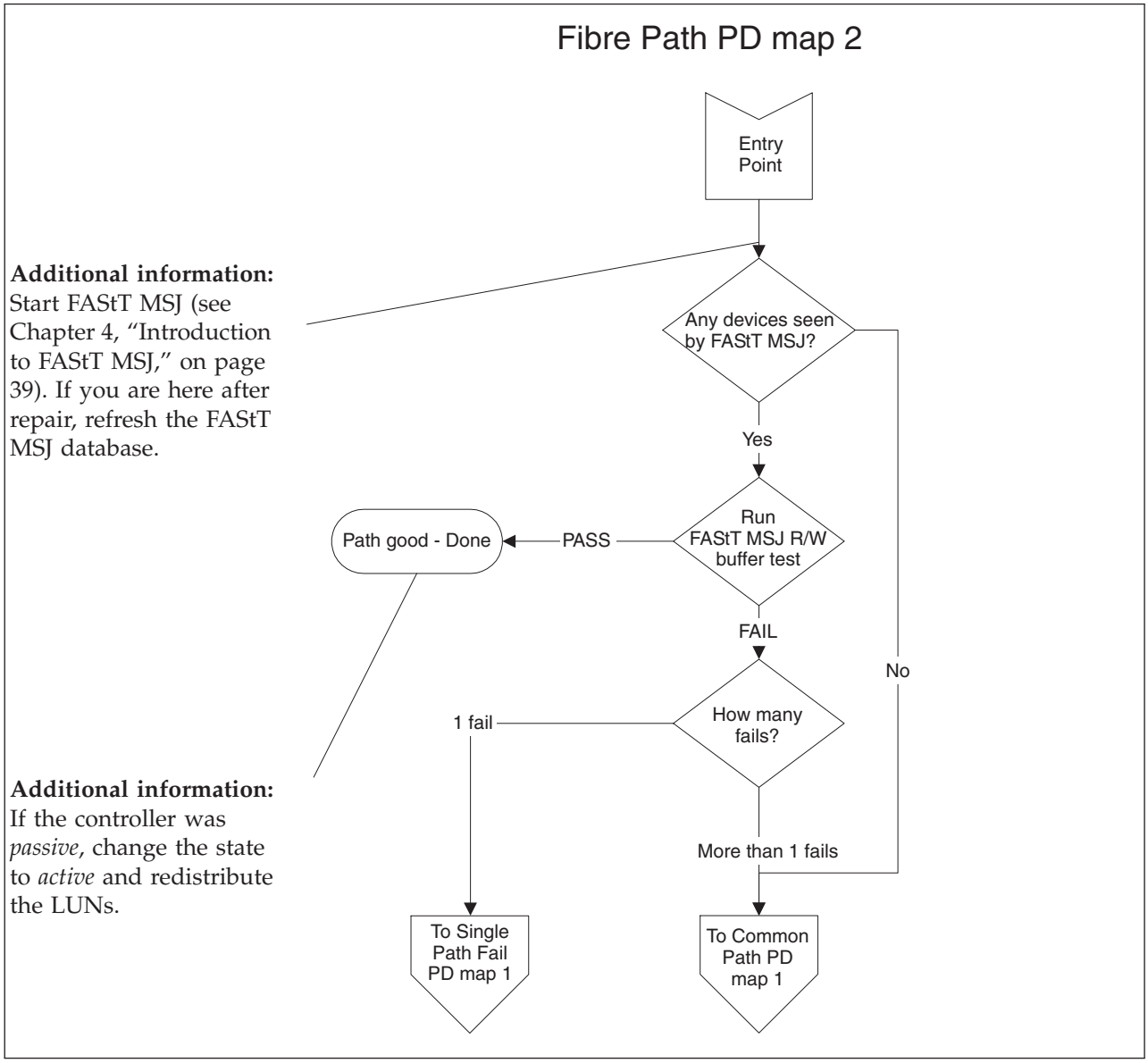


For information about how to run loopback tests, see Chapter 4, "Introduction to FAStT MSJ," on page 39.

To see Fibre Path PD map 2, go to "Fibre Path PD map 2" on page 19.

Fibre Path PD map 2

From: “Fibre Path PD map 1” on page 18; “Check Connections PD map” on page 17; “RAID Controller Passive PD map” on page 9; “Boot-up Delay PD map” on page 11; “Hub/Switch PD map 1” on page 13.

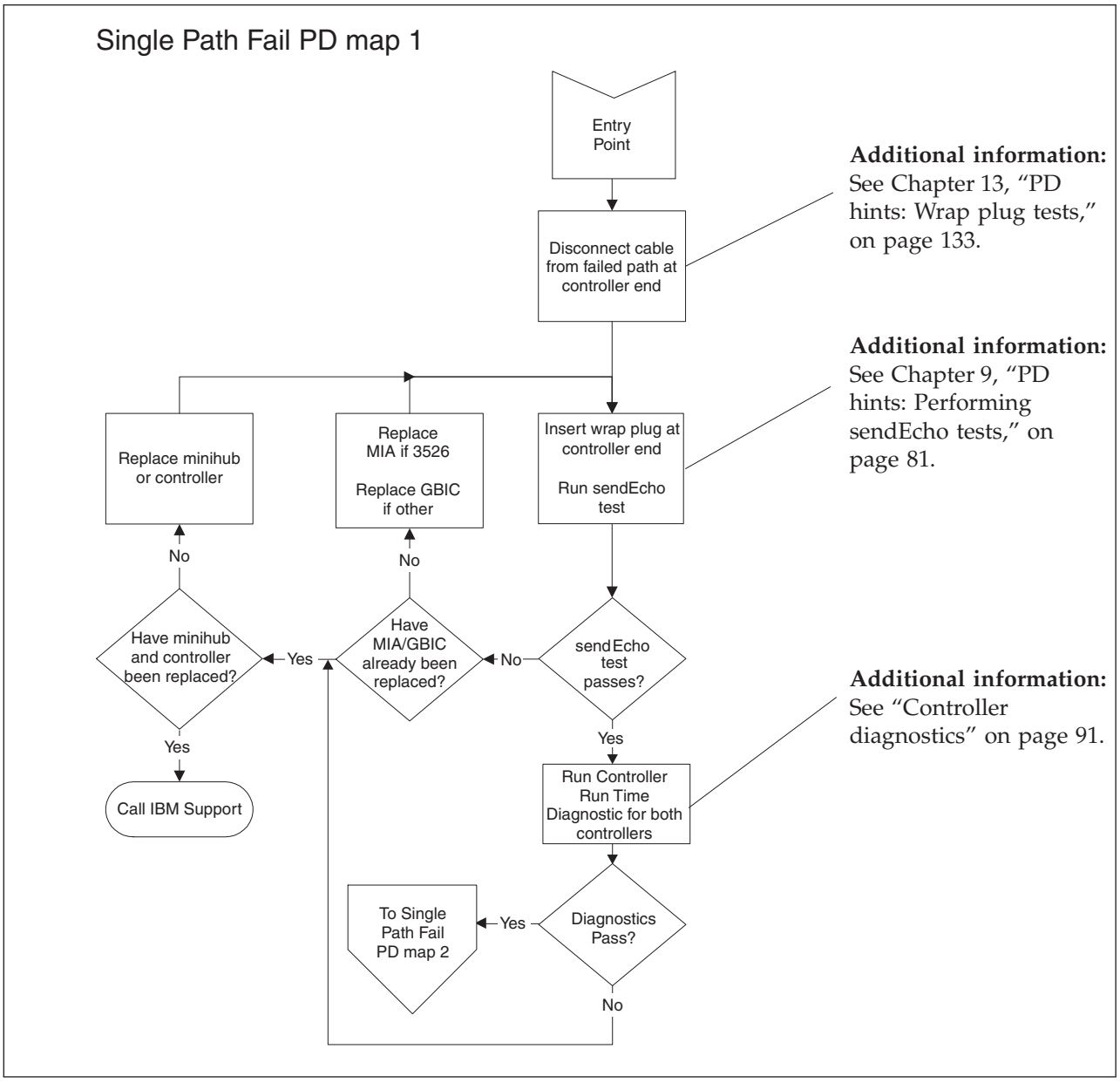


To see Single Path Fail PD map 1, go to “Single Path Fail PD map 1” on page 20.

To see Common Path PD map 1, go to “Common Path PD map 1” on page 22.

Single Path Fail PD map 1

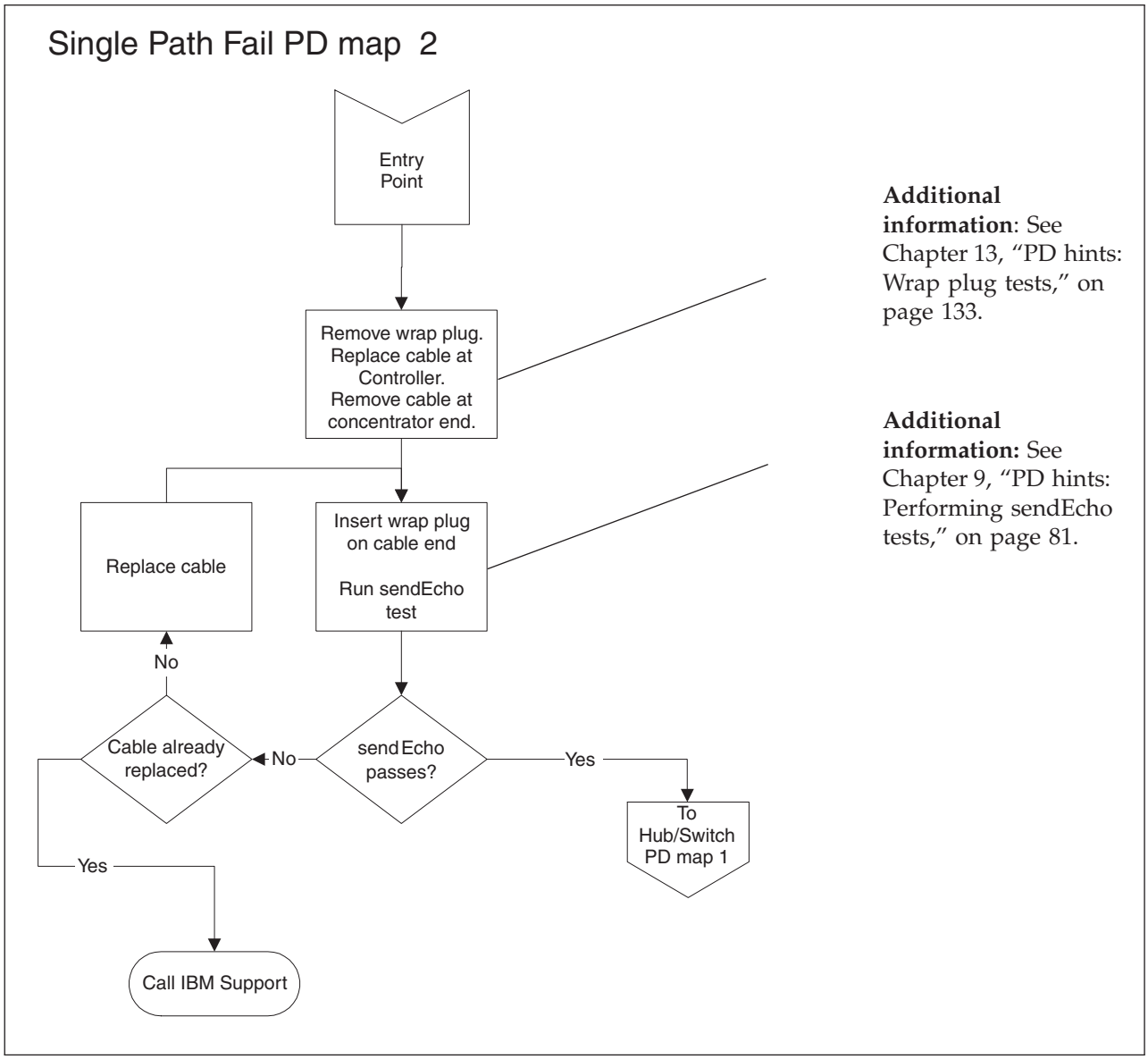
From: "Fibre Path PD map 2" on page 19.



To see Single Path Fail PD map 2, go to "Single Path Fail PD map 2" on page 21.

Single Path Fail PD map 2

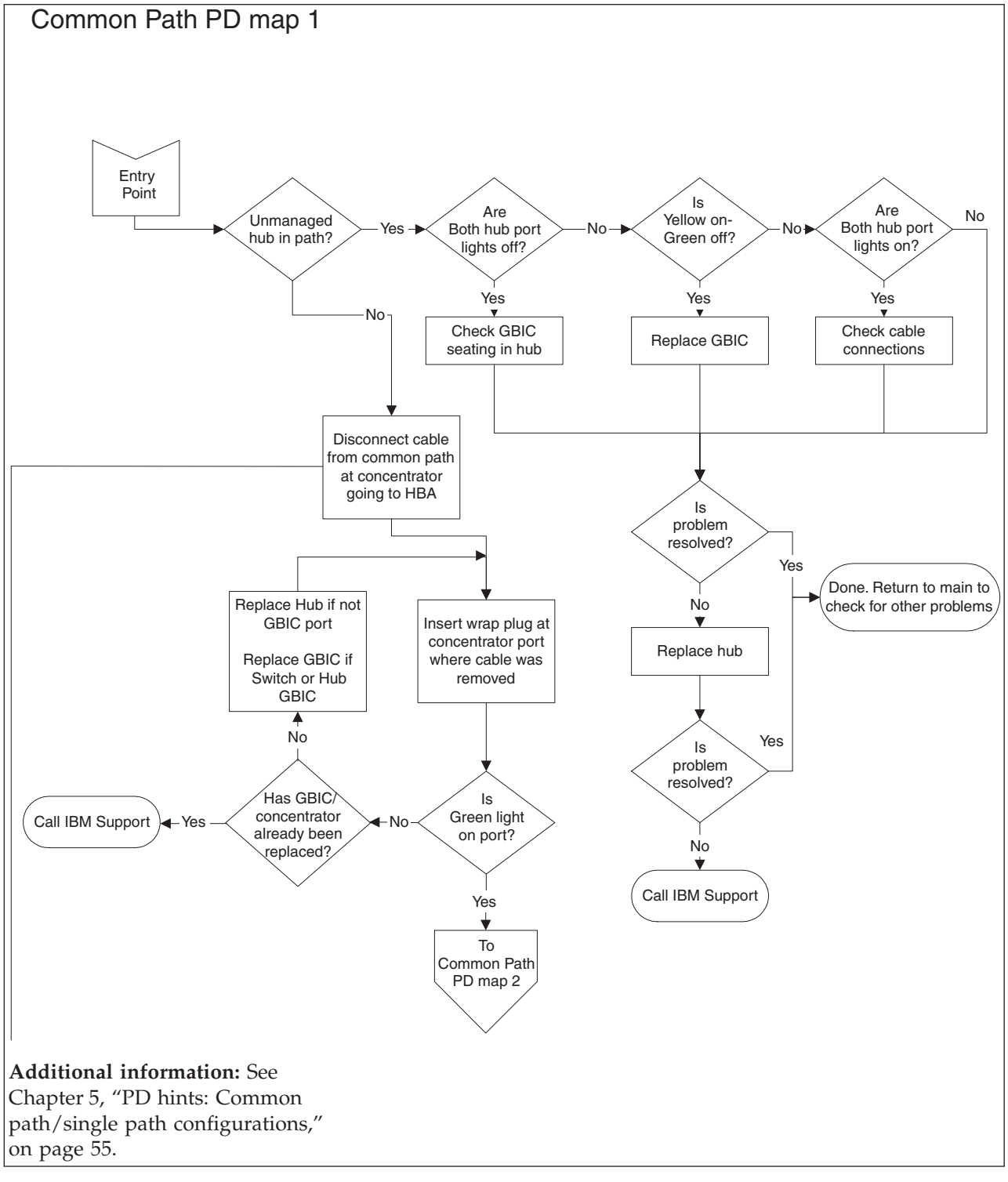
From: "Single Path Fail PD map 1" on page 20.



To see Hub/Switch PD map 1, go to "Hub/Switch PD map 1" on page 13.

Common Path PD map 1

From: "Fibre Path PD map 2" on page 19.

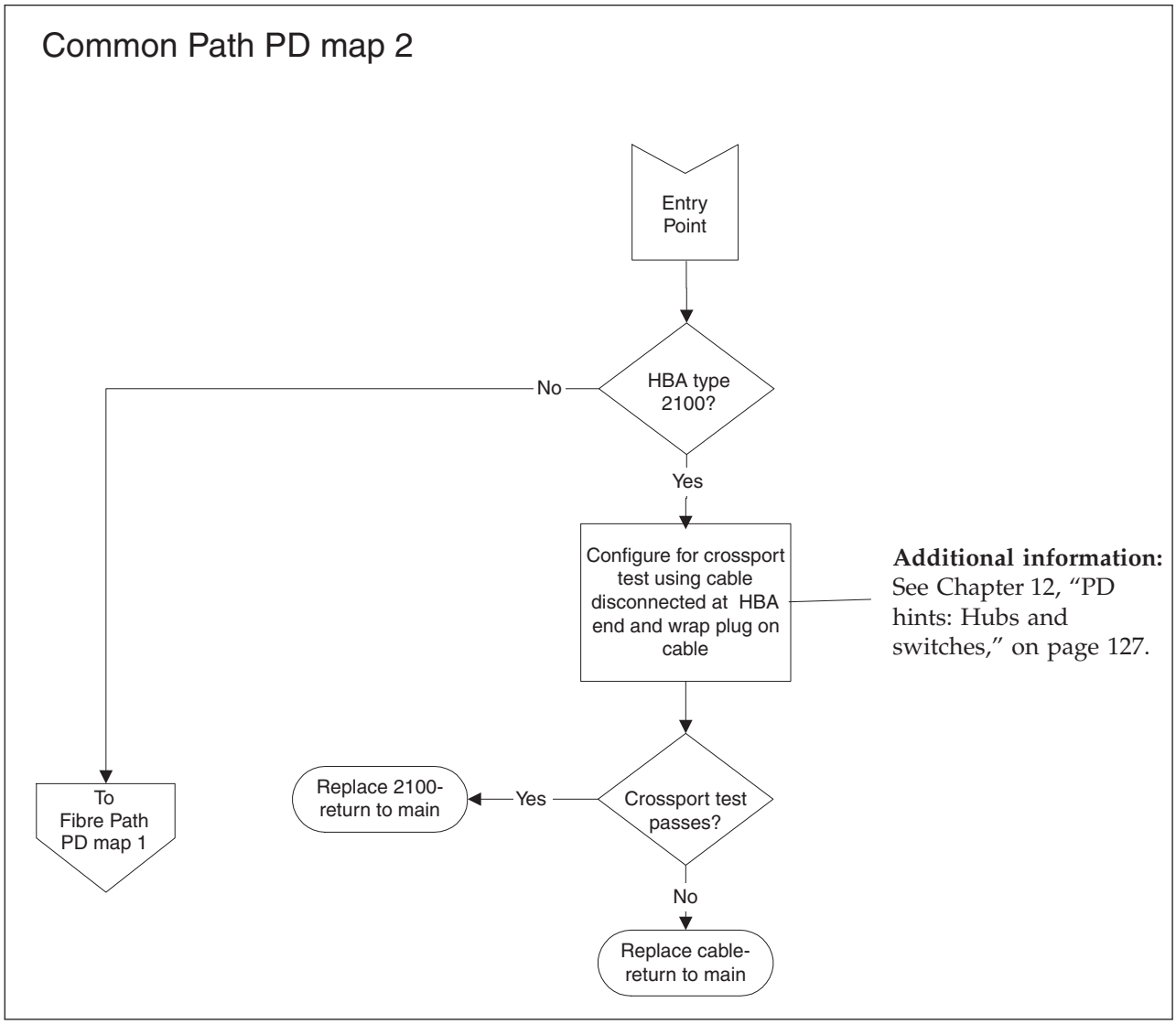


Additional information: See Chapter 5, "PD hints: Common path/single path configurations," on page 55.

To see Common Path PD map 2, go to "Common Path PD map 2" on page 23.

Common Path PD map 2

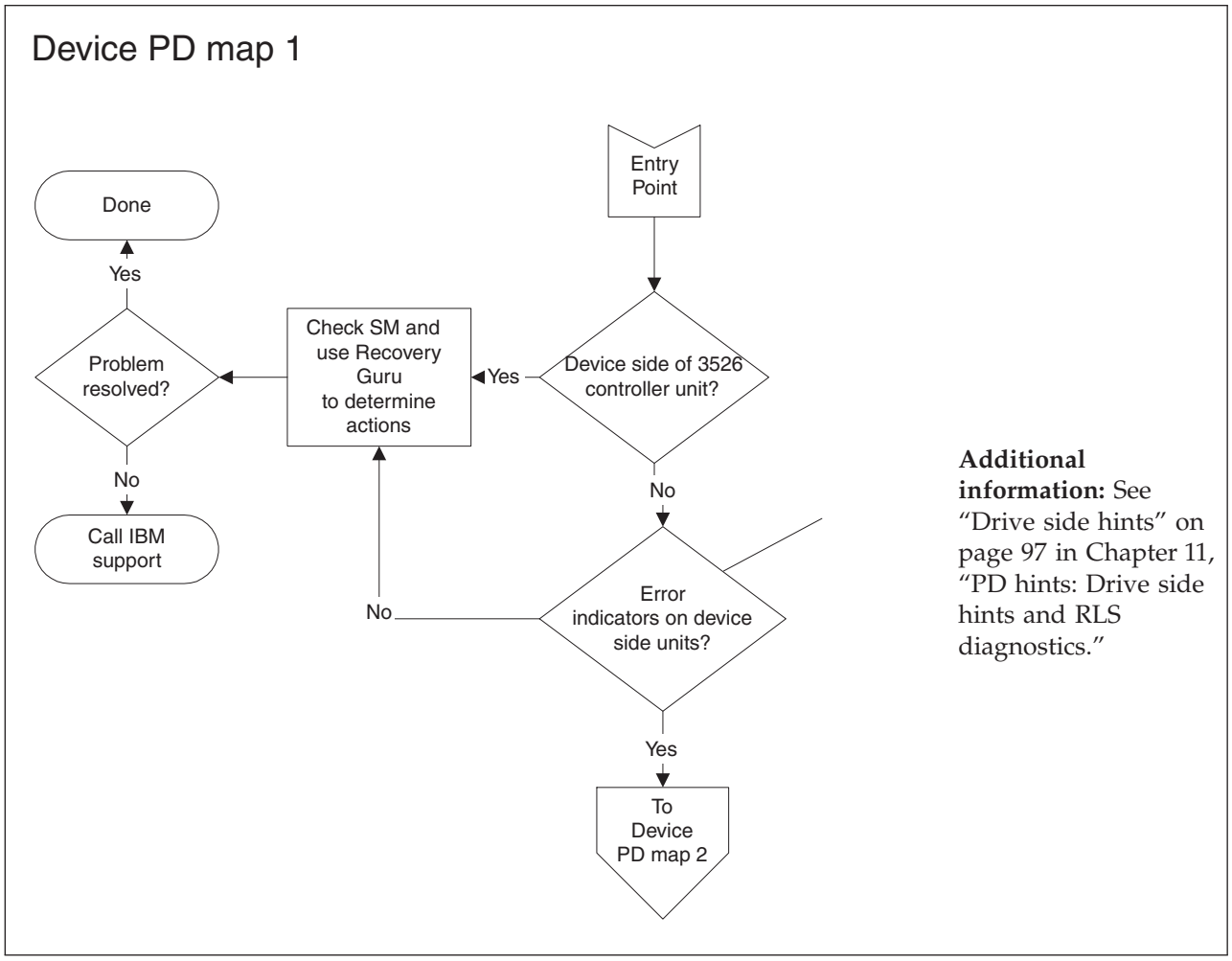
From: "Common Path PD map 1" on page 22.



To see Fibre Path PD map 1, go to "Fibre Path PD map 1" on page 18.

Device PD map 1

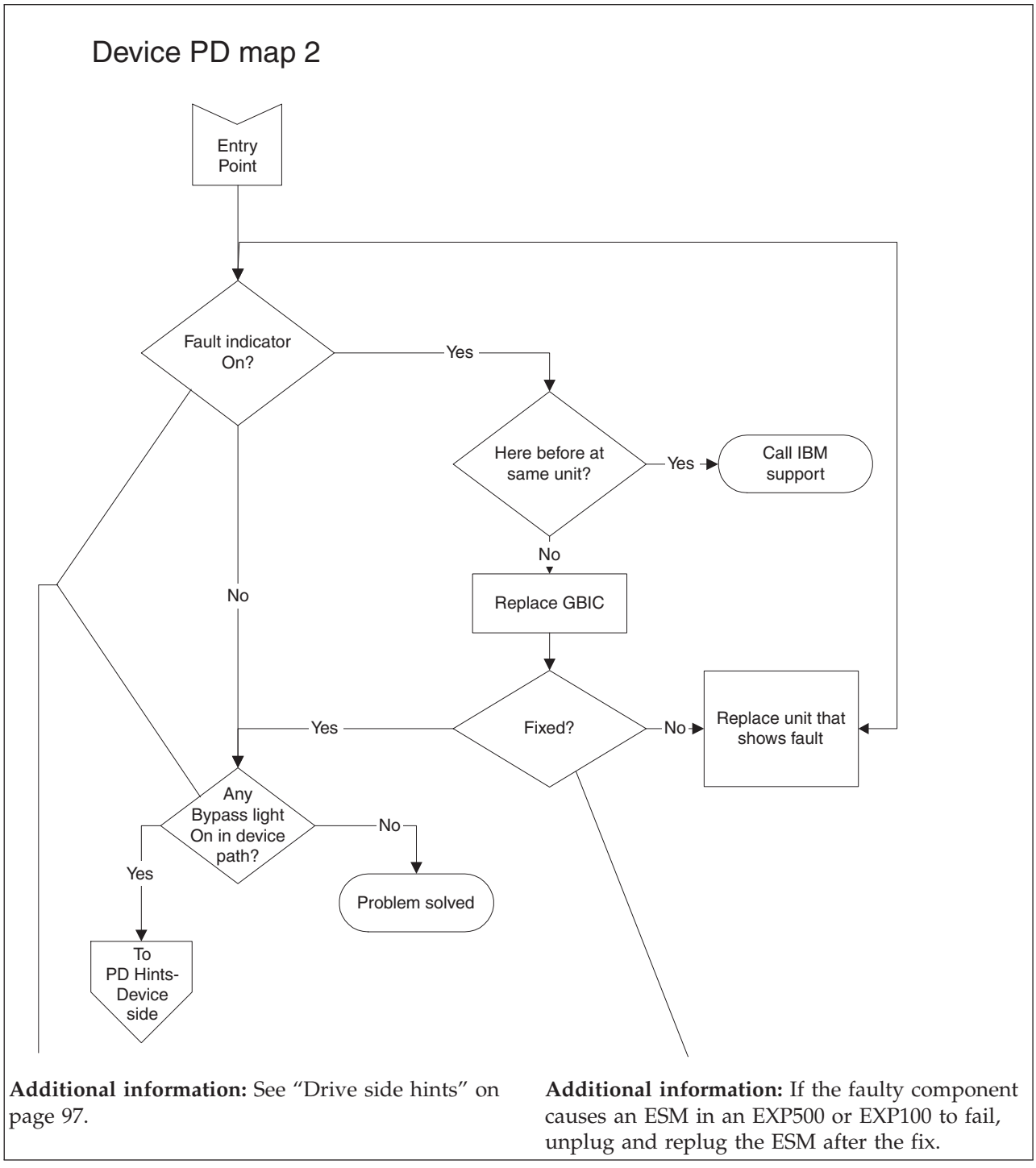
From: "PD maps and diagrams" on page 6.



To see Device PD map 2, go to "Device PD map 2" on page 25.

Device PD map 2

From: "Device PD map 1" on page 24.



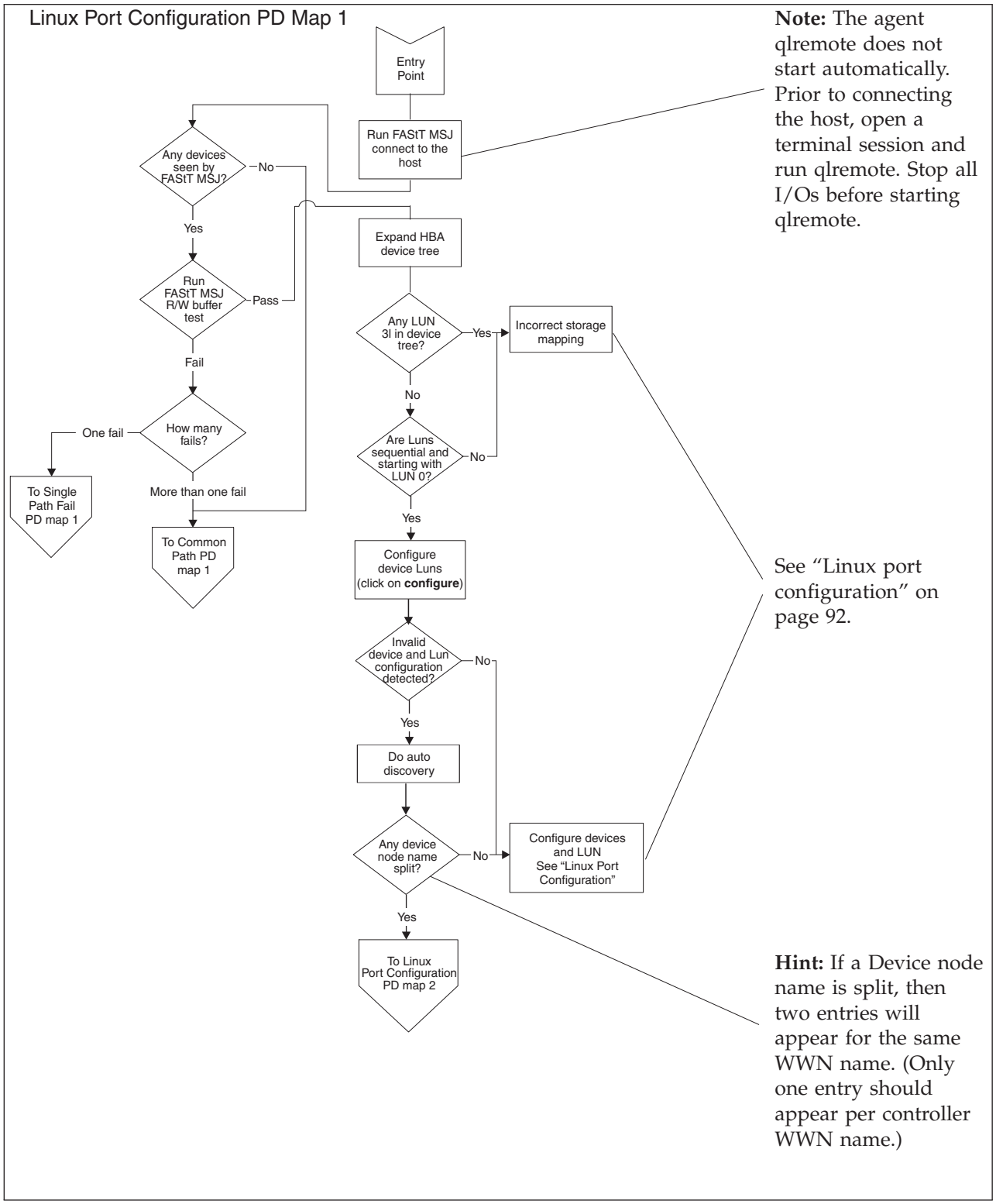
Additional information: See "Drive side hints" on page 97.

Additional information: If the faulty component causes an ESM in an EXP500 or EXP100 to fail, unplug and replug the ESM after the fix.

To see PD hints about troubleshooting the device (drive) side, go to "Drive side hints" on page 97.

Linux Port Configuration PD map 1

From: "Specific problem areas" on page 5.



To see Single Path Fail PD map 1, see "Single Path Fail PD map 1" on page 20.

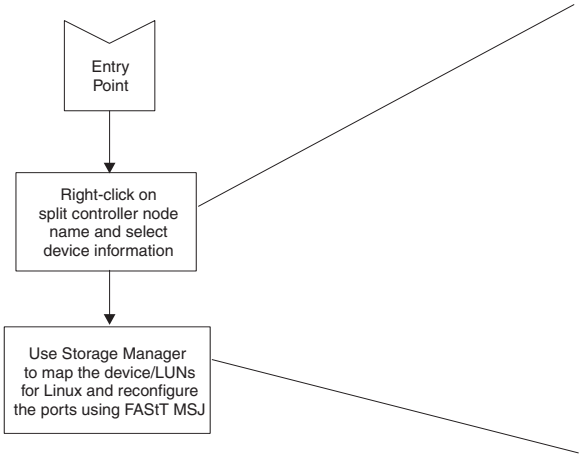
To see Common Path PD map 1, see "Common Path PD map 1" on page 22.

To see Linux Port Configuration PD map 2, see “Linux Port Configuration PD map 2” on page 28.

Linux Port Configuration PD map 2

From: "Linux Port Configuration PD map 1" on page 26

Linux Port Configuration PD Map 2



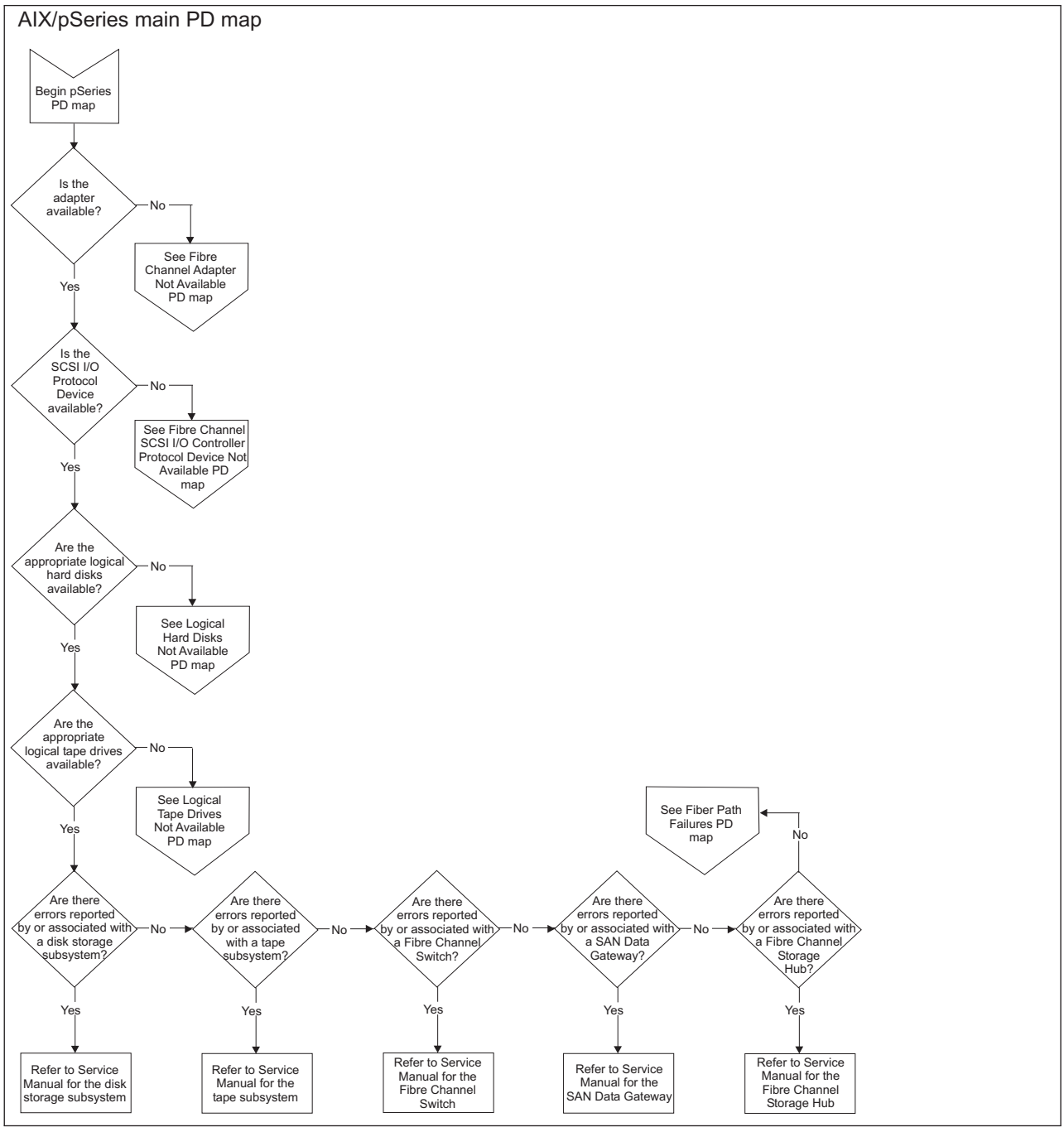
Hint: Right-click the Host icon in the HBA Tree and select **Adapter Persistent Configuration Data ...** The Adapter(s) WWNN displays. Record this information as it will be required by DS4000 Storage Manager to map your storage to the Linux OS.

Additional information: See "Linux port configuration" on page 92.

To see Single Path Fail PD map 1, see "Single Path Fail PD map 1" on page 20.

pSeries PD map

Start with this pSeries PD map if you are troubleshooting fibre channel network SANs with FC 6228 HBAs and IBM pSeries servers running AIX.



For more detailed information including sample diagnostic information, see Chapter 17, “pSeries supplemental problem determination information,” on page 157.

To see Fibre Channel Adapter Not Available PD map, see “Fibre Channel Adapter Not Available PD map” on page 31.

To see Fibre Channel SCSI I/O Controller Protocol Device Not Available PD map, see “Fibre Channel SCSI I/O Controller Protocol Device Not Available PD map” on page 32.

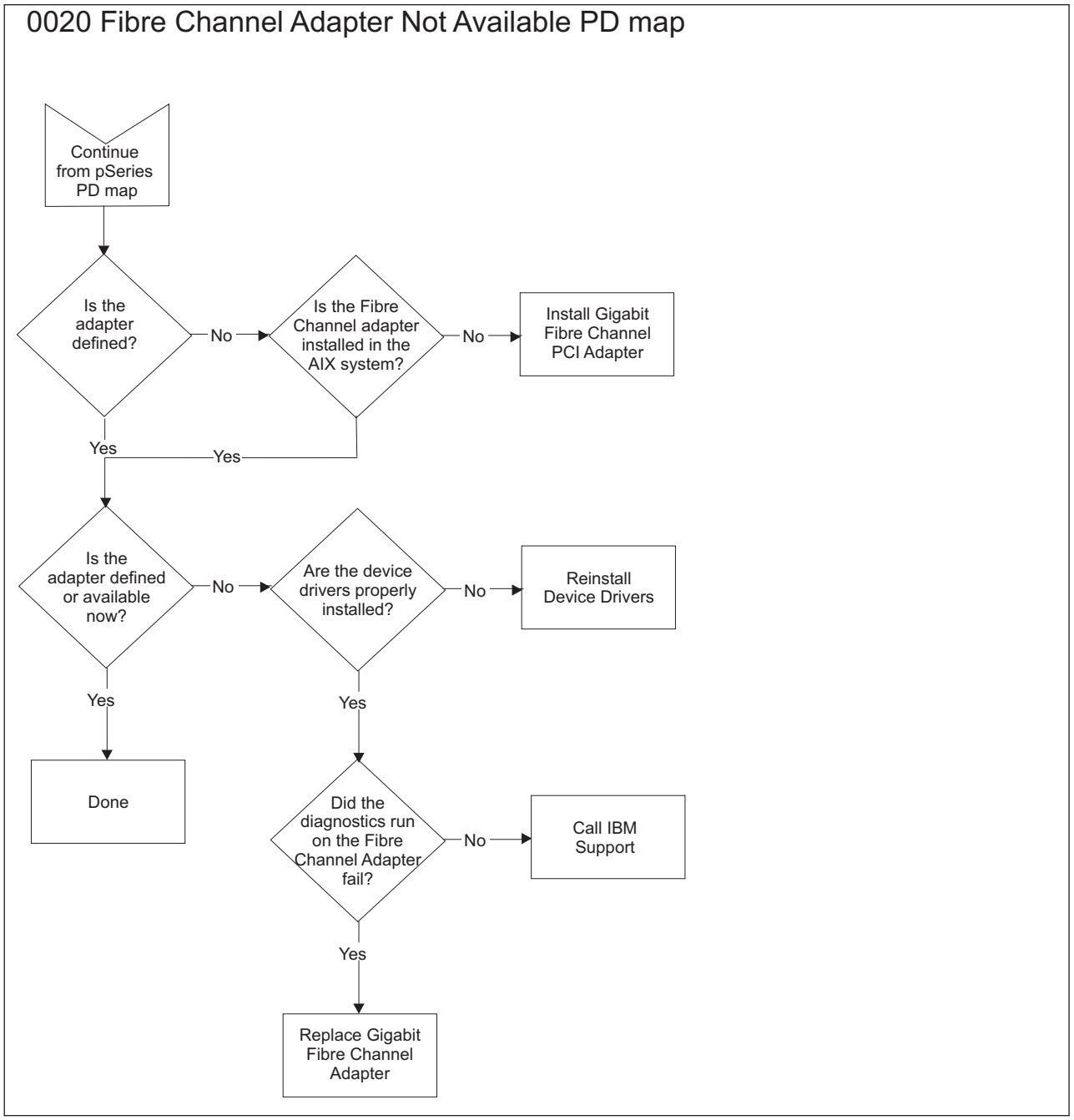
To see Logical Hard Disks Not Available PD map, see “Logical Hard Disks Not Available PD map” on page 33.

To see Logical Hard Tapes Not Available PD map, see “Logical Tape Drives Not Available PD map” on page 35.

To see Fiber Path Failures PD map, see “Fiber Path Failures PD map 1” on page 37.

Fibre Channel Adapter Not Available PD map

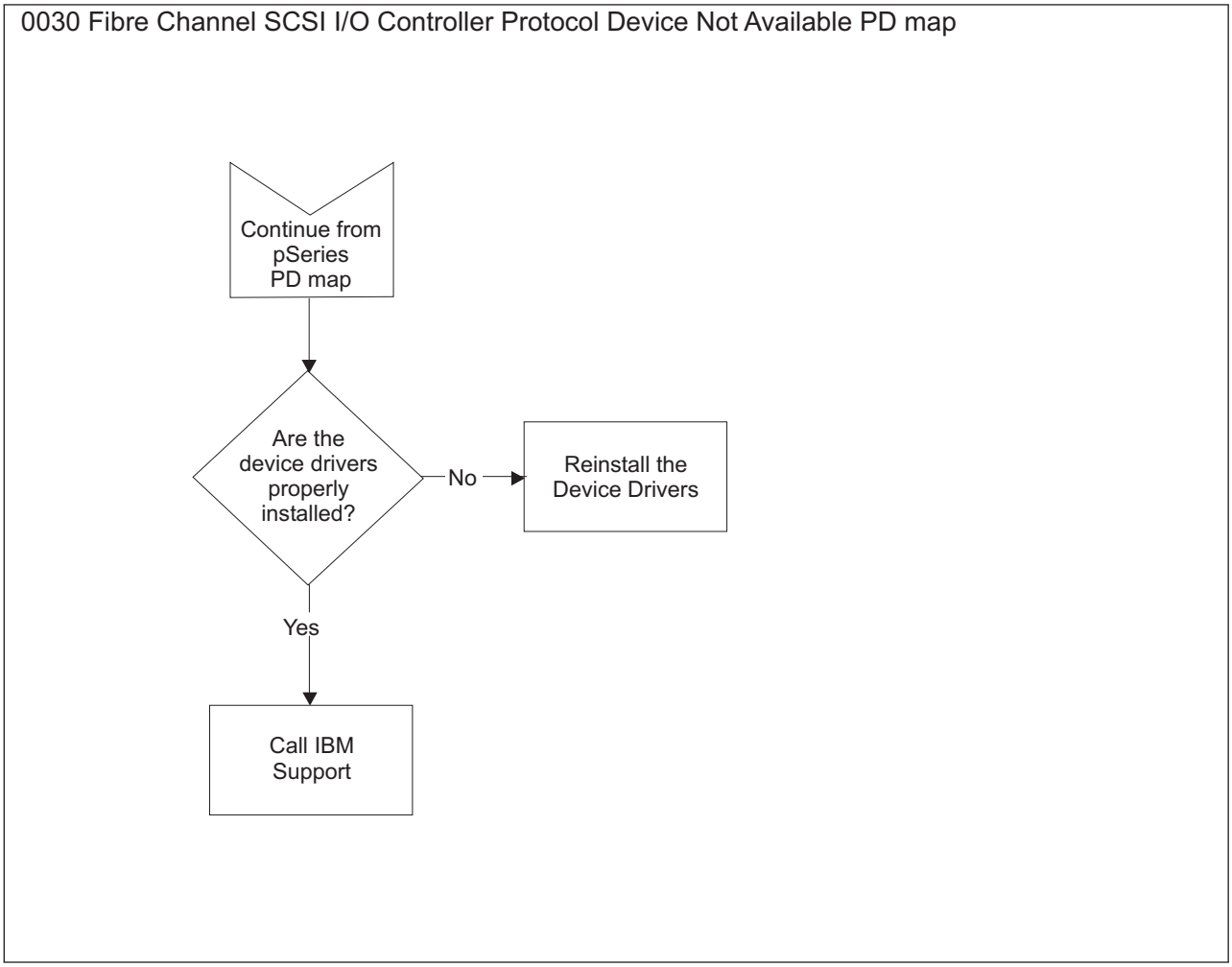
From: "pSeries PD map" on page 29



For more detailed information including sample diagnostic information, see "Start of PDP PD0020 - Fibre Channel Adapter not Available" on page 168.

Fibre Channel SCSI I/O Controller Protocol Device Not Available PD map

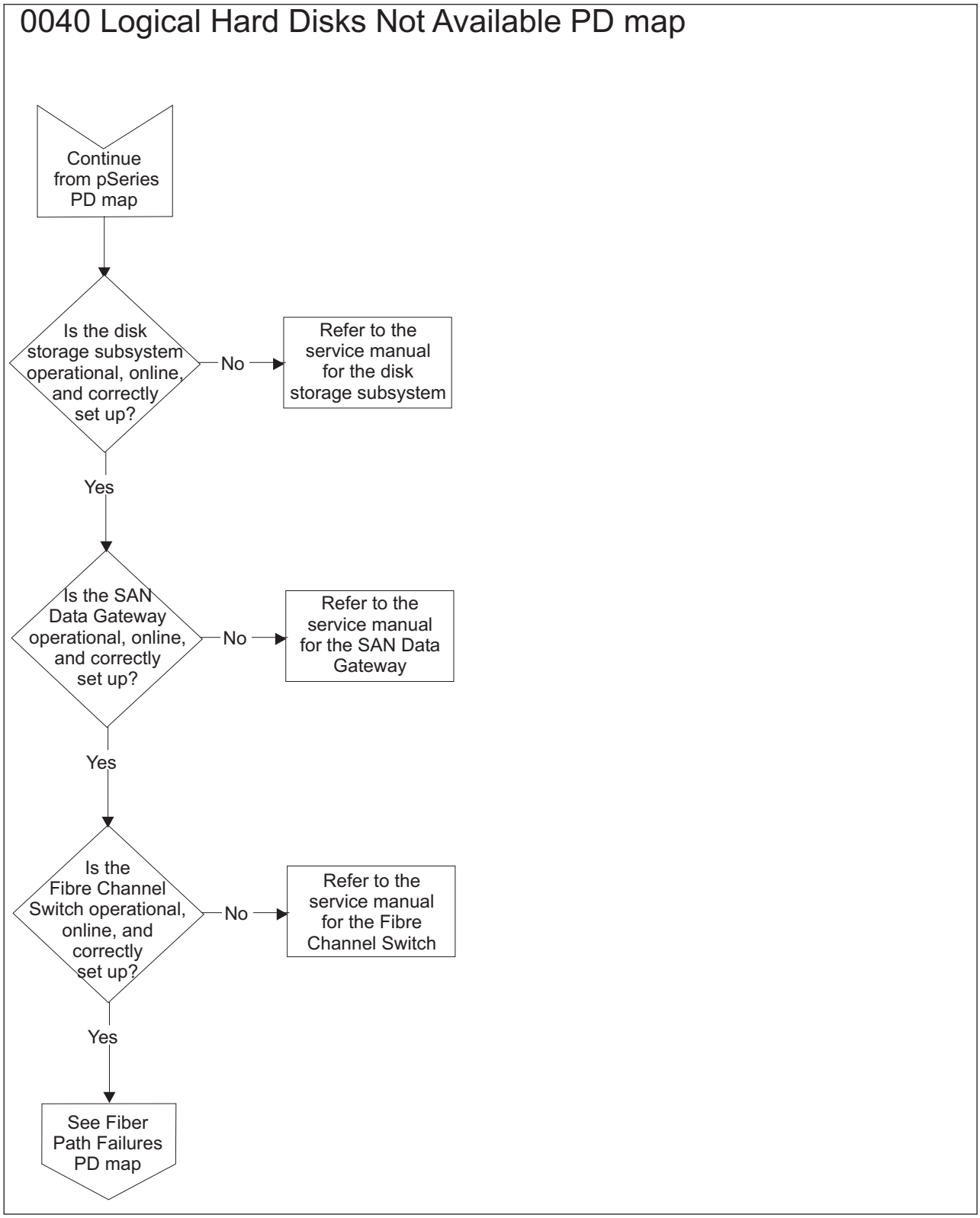
From: "pSeries PD map" on page 29



For more detailed information including sample diagnostic information, see Chapter 17, "pSeries supplemental problem determination information," on page 157.

Logical Hard Disks Not Available PD map

From: "pSeries PD map" on page 29

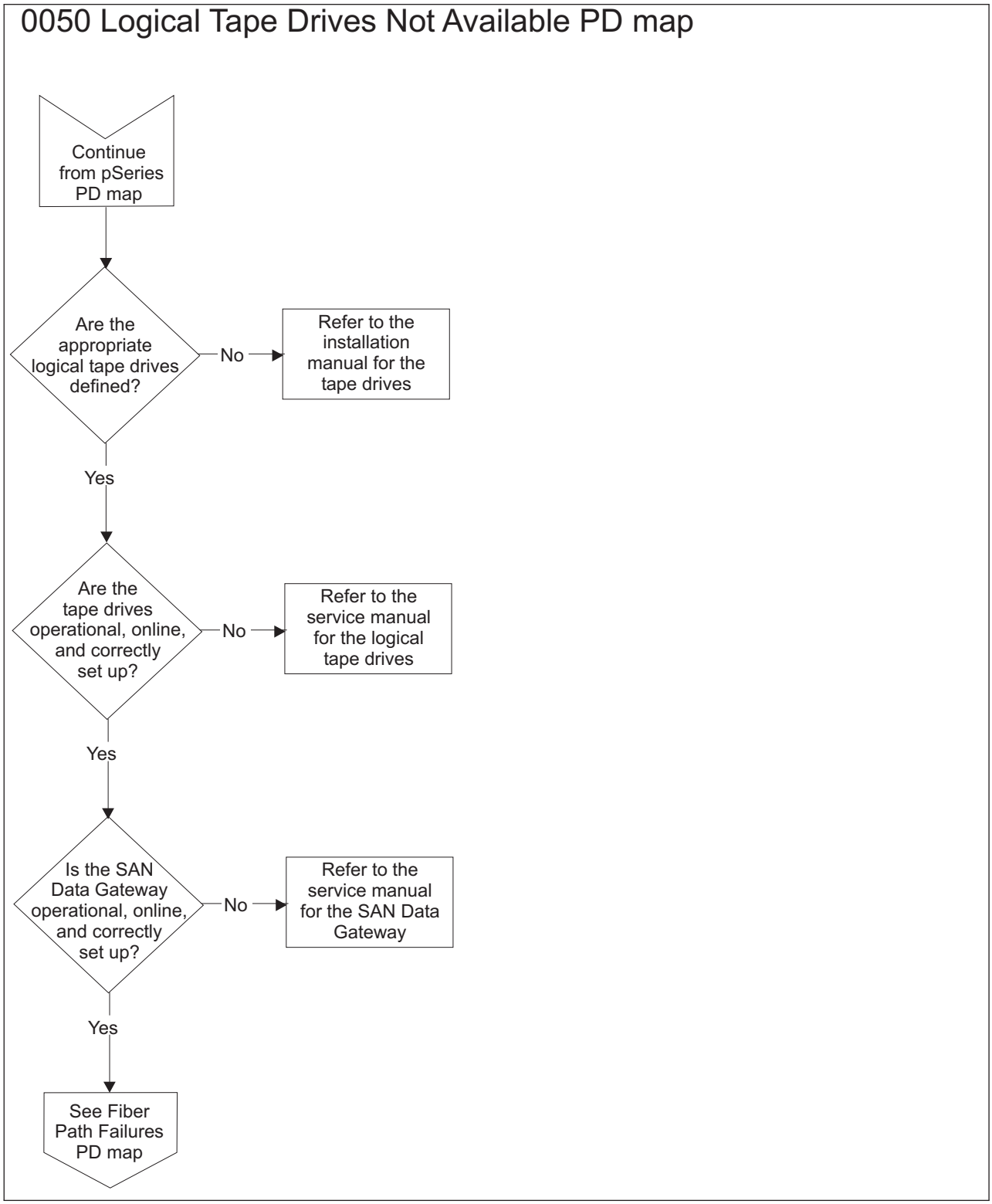


For more detailed information including sample diagnostic information, see Chapter 17, “pSeries supplemental problem determination information,” on page 157.

To see Fiber Path Failures, see “Fiber Path Failures PD map 1” on page 37.

Logical Tape Drives Not Available PD map

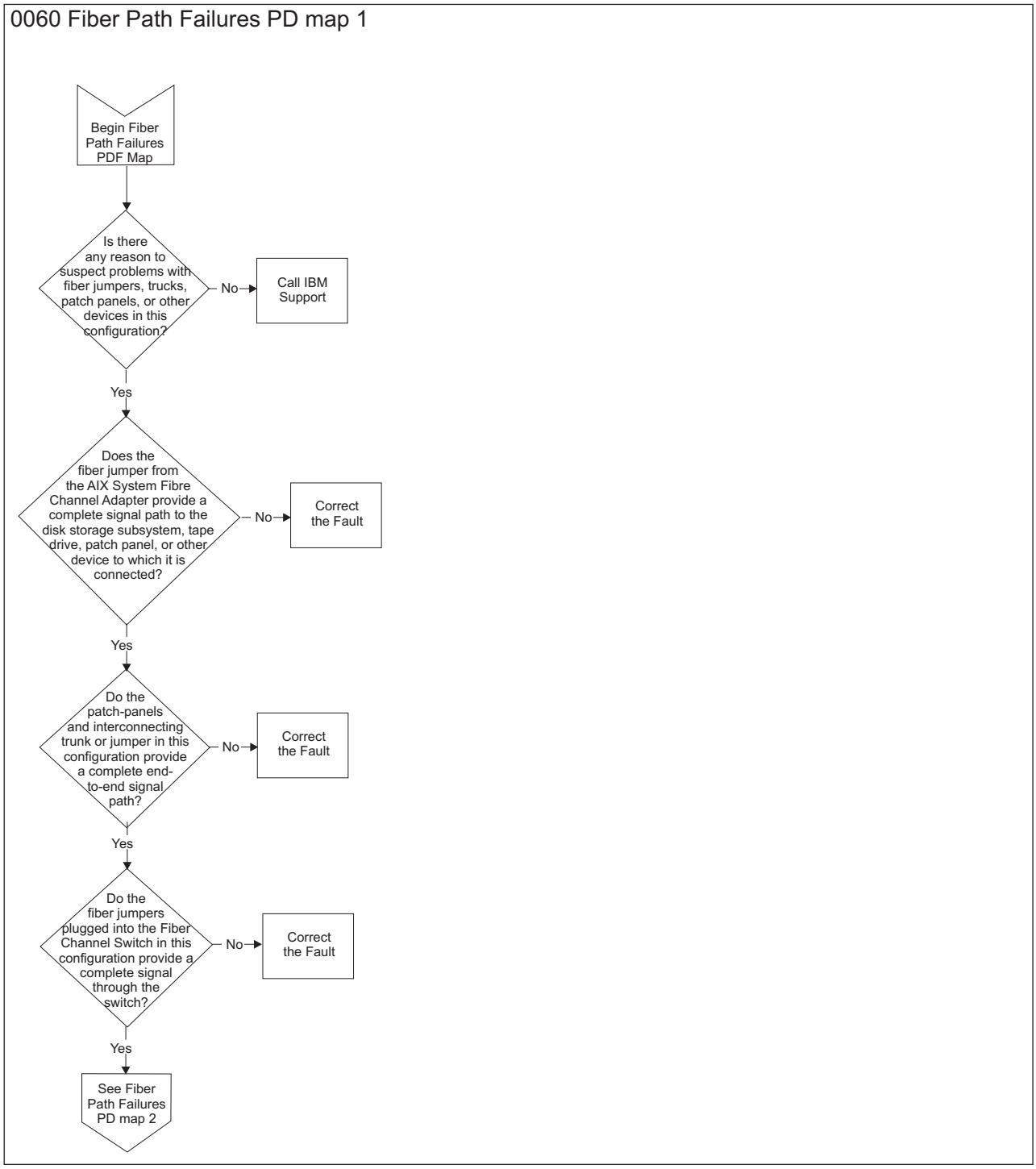
From: "pSeries PD map" on page 29



For more detailed information including sample diagnostic information, see Chapter 17, "pSeries supplemental problem determination information," on page 157.

To see Fiber Path Failures, see “Fiber Path Failures PD map 1” on page 37.

Fiber Path Failures PD map 1

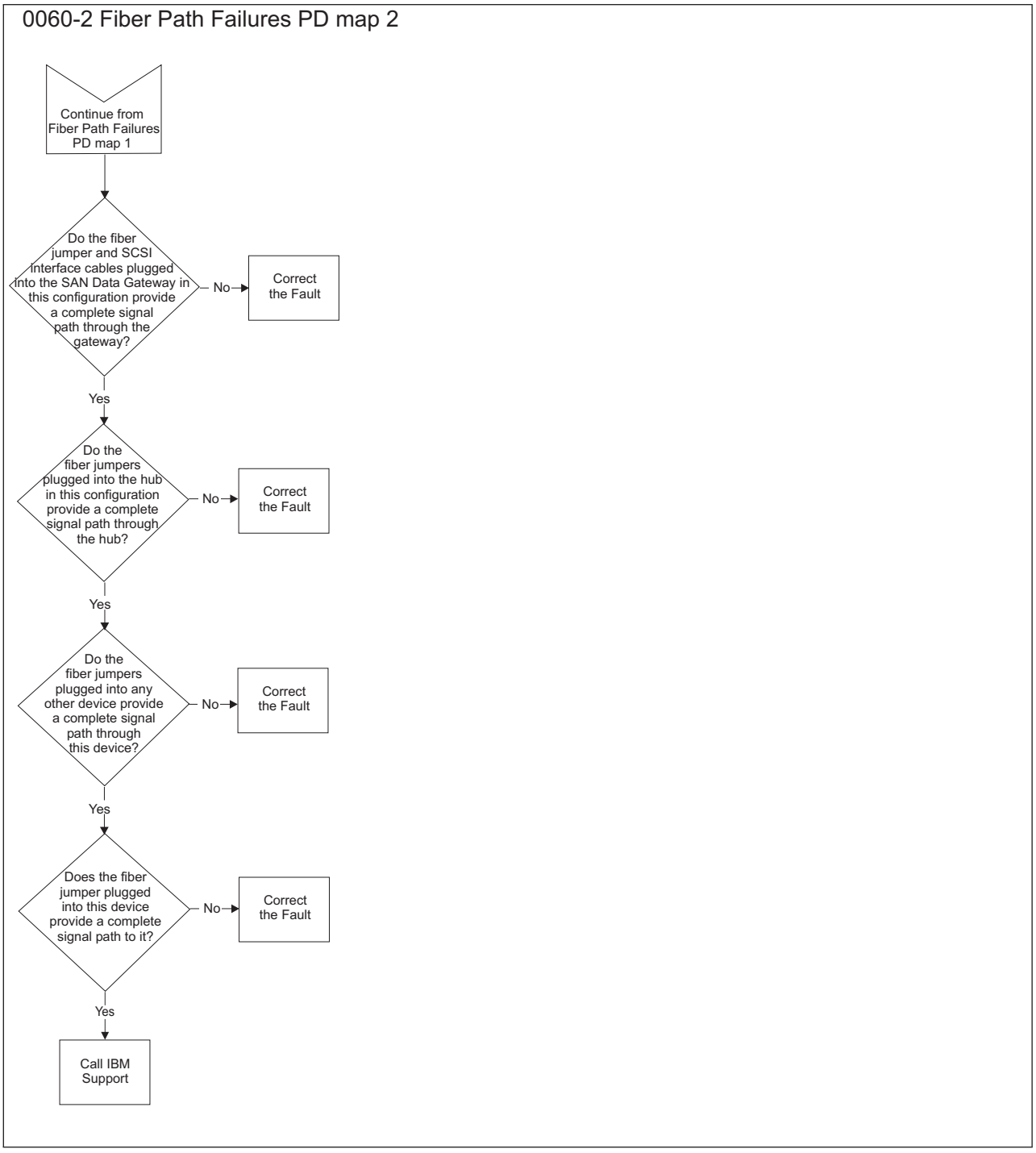


For more detailed information including sample diagnostic information, see Chapter 17, “pSeries supplemental problem determination information,” on page 157.

To see Fiber Path Failure PDF Map 2, see “Fibre Path Failures PD map 2” on page 38.

Fibre Path Failures PD map 2

From: "Fiber Path Failures PD map 1" on page 37



For more detailed information including sample diagnostic information, see Chapter 17, "pSeries supplemental problem determination information," on page 157.

Chapter 4. Introduction to FAStT MSJ

This chapter introduces IBM Management Suite Java (FAStT MSJ) and includes background information on SAN environments and an overview of the functions of FAStT MSJ.

Note: Read the readme file, located in the root directory of the installation CD, or see the IBM Web site for the latest installation and user information about FAStT MSJ at:

www.ibm.com/pc/support/

SAN environment

In a typical Storage Area Network (SAN) environment, a system might be equipped with multiple host bus adapters (HBAs) that control devices on the local loop or on the fabric.

In addition, a single device can be visible to and controlled by more than one HBA. An example of this is dual-path devices used in a primary/failover setup.

In a switched or clustering setup, more than one system can access the same device; this type of configuration enables storage sharing. Sometimes in this scenario, a system must access certain LUNs on a device while other systems control other LUNs on the same device.

Because SAN has scalable storage capacity, you can add new devices and targets dynamically. After you add these new devices and targets, you need to configure them.

A SAN can change not only through the addition of new devices, but also through the replacement of current devices on the network. For device hot-swapping, you sometimes need to remove old devices and insert new devices in the removed slots.

In such a complicated environment where there is hot-swapping of SAN components, some manual configuration is required to achieve proper installation and functionality.

Overview of FAStT MSJ

The IBM FAStT Management Suite Java (FAStT MSJ) is an application designed for the monitoring and configuration of a SAN environment. This application is specifically designed for IBM Fibre Channel in such an environment. Together with HBA components, storage devices and host systems, this application helps complete a Storage Area Network.

FAStT MSJ is a network-capable (client/server) application that can connect to and configure a remote Windows NT, Linux, or Novell Netware systems. The application uses ONC RPC for network communication and data exchange. The networking capability of the application allows for centralized management and configuration of the entire SAN.

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With FAStT MSJ, you can use the following four types of operations to configure devices in the system:

Disable (unconfigure) a device on a host bus adapter
When a device is set as unconfigured by the utility, it is not recognized by the HBA and is inaccessible to that HBA on that system.

Enable a device
This operation adds a device and makes it accessible to the HBA on that system.

Designate a path as an alternate for preferred path
When a device is accessible from more than one adapter in a system, you can assign one path as the preferred path and the other path as the alternate path. If the preferred path fails, the system switches to the alternate path to ensure that data transfer is not interrupted.

Replace a removed device with a new inserted device
In a hot-plug environment, the HBA driver does not automatically purge a device that has been physically removed. Similarly, it does not delete a device that is no longer accessible because of errors or failure. Internally, the driver keeps the device in its database and marks it as invisible.

The HBA driver adds a new device to the database, even if the device is inserted into the same slot as the removed device.

FAStT MSJ provides the function to delete the removed device's data from the driver's database and to assign the inserted device the same slot as the one that it replaces.

FAStT MSJ system requirements

The FAStT MSJ application consists of the following two components:

- FAStT MSJ client interface
- Host agent

Each component has different system requirements depending on the operating system.

FAStT MSJ client interface

FAStT MSJ, which is written in Java, should run on any platform that has a compatible Java VM installed. The minimum system requirements for FAStT MSJ to run on all platforms are as follows:

- A video adapter capable of 256 colors
- At least 128 MB of physical RAM; 256 MB is recommended. Running with less memory might cause disk swapping, which has a negative effect on performance.
- 64 MB of free disk space

Platform-specific requirements for the FAStT MSJ client interface are as follows:

- Redhat Linux IA32
  - RedHat Linux 7.0, 7.1, 7.2, 8.0, or 9.0 (recommended configuration). AS 2.1, 3.0
  - SuSe Linux SLES 8.0
  - PII 233MHz (recommended minimum)
- RedHat Linux IA64

  - RedHat Linux 7.1, 7.3. AS 3.0
  - Itanium 2
- Linux PPC 64
  - SuSe Linux SLES 8.0
  - POWER4+ at 1.2GHz or 1.45GHz.
- Microsoft Windows IA32
  - Microsoft Windows NT 4.0, W2K, XP, W2K3 (recommended configuration)
  - Pentium III processor 450 MHz or greater
- Microsoft Windows IA64
  - Microsoft W2K3 (recommended configuration)
  - Itanium 2
- Novell Netware
  - Novell Netware 5.x, or 6.x (recommended configuration)
  - Pentium III processor 450 MHz or greater

Host agent

Host agents are platform-specific applications that reside on a host with IBM HBAs attached. The minimum system requirements for an agent to run on all platforms are as follows:

- An IBM FAStT MSJ-supported device driver (see release.txt in the release package for a list of supported device driver versions for each platform)
- At least 8 MB of physical RAM
- 2 MB of free disk space

Platform-specific requirements for the FAStT MSJ host agents are as follows:

- Linux x86 – Agent runs as a daemon
- Microsoft Windows NT, Windows 2000, Windows 2003, or Windows XP – Agent runs as a Windows NT service
- Novell NetWare Installation from a Windows system
  - Novell NetWare Installation Prerequisites

    Note: You must be logged on as an administrator.

    Be sure you have the following items before installing the FAStT MSJ for NetWare.

    - On the Windows NT/2000 Client:
      - Load NetWare Client software (from Novell).
      - Log into the Netware Server from the Windows NT/2000 client.
      - Map a Windows drive letter to the root of the SYS Volume of the NetWare server. Record this drive letter for later use.
      - Add the NetWare host name and IP address to the Hosts file.
      - Network protocols: TCP/IP transport protocol (from Microsoft)
    - On the NetWare Server:
      - NetWare 5.X server with support pack 7 or NetWare 6.0 server with support pack 4 or NetWare 6.5 server with support pack 2.
      - Network protocols: TCP/IP and IPX/SPX transport protocols (from NIC vendor)
    - Agent – Runs as an AUTOEXEC.NCF started NLM

Attention: In the file AUTOEXEC.NCF, remove REM from the front of the following two lines:

```
REM RPCSTART.NCF
REM LOAD QLREMOTE.NLM
```

Limitations

The following is a list of limitations:

- **Multiple Network Interface Cards** — if multiple Network Interface Cards (NICs) are present in the system, the FAStT MSJ client will broadcast to the first IP address subnet based on the binding order. Therefore, ensure that the NIC for the local subnet is first in the binding order. If this is not done, the diagnostics might not run properly and remote connection might not occur. See the readme file in the release package for more information.
- **Host IP Addresses** — The FAStT MSJ application tries to help in not allowing the user to connect to the same host more than once (causes issues with policies and wasted system resources). This adds the requirement that all host IP addresses MUST resolve to a host name to allow connection to complete.
- **Local host file** — If DNS is not used you must edit the local host file on the systems where you are running the FAStT MSJ GUI and the QLremote agent. Add the host name to IP mapping manually. Edit the file /etc/hosts.
- **Firewalls** — Having systems with the firewall installed could cause problems with async alarms from the agent running on Linux to a remote machine. Problems could also occur if the GUI is running on a Linux Client communicating to a remote machine. To circumvent this problem, type the following command at a shell prompt:

  ```
  chkconfig --list
  ```

  Verify that ″ipchains and iptables″ in run levels 2, 3, 4, 5 are disabled. To disable at a specific run level, set the following:

  ```
  chkconfig --level 2 ipchains off
  chkconfig --level 3 ipchains off
  chkconfig --level 4 ipchains off
  chkconfig --level 5 ipchains off
  chkconfig --level 2 iptables off
  chkconfig --level 3 iptables off
  chkconfig --level 4 iptables off
  chkconfig --level 5 iptables off
  ```
- **HBA connected to a fabric** — When a DS4000 fibre channel HBA (QL2200, 2310, or 2340) is connected to the fabric (switch), Loopback test is disabled because the adapter is in a point-to-point mode. Unplugging the cable from the fabric and inserting a wrap plug at the end of the cable (or at the adapter) will enable loopback test.
- **Online Help** — The FAStT MSJ online Web help can only be viewed by Netscape Communicator (version 4.5 or greater).
- **Configuration refresh** — When an online device fails and goes offline and a subsequent configuration refresh occurs, the loop id for that device does not reflect the original ID because, in effect, the device is no longer in the loop (might show x100 or xff).
- **Restarting after failure detection** — When a failure occurs during Diagnostics (Loopback test and Read/Write Buffer test) and the test is restarted immediately,

FAStT MSJ might request whether or not you want to refresh the configuration. Select **NO** to continue the test. If **YES** is selected the host may be disconnected with the following message:

```
Unable to connect to the Host: {Host Name / IP address}. The Host is
currently in diagnostics mode, try again later.
```

To recover, you need to stop (press **<CTL - C>** in the terminal session where you started qlremote) and then restart the agent ″qlremote″.

Installing and getting started

This section contains procedures for how to install FAStT MSJ and how to use the application.

Initial installation options

FAStT MSJ supports stand-alone and network configurations. Install the software appropriate for your configuration. See Table 9 for details.

Note: The same version of FAStT MSJ must be installed on all systems.

Table 9. Configuration option installation requirements

Configuration	Software Requirements
Stand-alone system: This system monitors host bus adapters locally.	FAStT MSJ GUI Plus one of the following: • FAStT MSJ Windows NT, Windows 2000, or Windows 2003 agent • FAStT MSJ Linux agent
Networked system: This system monitors host bus adapters locally and monitors remote systems on the network. Host agents are required for remote connection (see ″Host agent system″ following).	FAStT MSJ GUI Plus one of the following: • FAStT MSJ Windows NT, Windows 2000, or Windows 2003 agent • FAStT MSJ Linux agent
Client system: This system monitors host bus adapters only on remote systems on the network.	FAStT MSJ GUI Host agents (see requirements for host agent system)
Host agent system: The host bus adapters on this system are remotely monitored only from other systems on the network.	One of the following: • FAStT MSJ NT4/2000 agent • FAStT MSJ NetWare 5.x and 6.x agent • FAStT MSJ Linux agent

You can install FAStT MSJ either from a GUI or from a Linux command line.

Installing FAStT MSJ from the GUI

The FAStT MSJ installer is a self-extracting program that installs the FAStT MSJ application and related software.

Notes:

1. If you have a previous version of FAStT MSJ installed, uninstall the previous version of FAStT MSJ before you install the current version. See “Uninstalling FAStT MSJ” on page 46.

2. You cannot install the FAStT MSJ agent directly on a NetWare server; you must install the agent on a system connected to the NetWare server. The Netware server must have a drive mapped to a system running Windows NT, Windows 2000, or Windows 2003.

Perform the following steps to install FAStT MSJ on the system or the NetWare server:

1. Access the FAStT MSJ installer by performing one of the following actions:
   - If installing FAStT MSJ from a CD, click the **IBM FAStT MSJ** folder on the CD.
   - If installing FAStT MSJ from the IBM Web site, go to the page from which you can download FAStT MSJ (this URL is listed in the readme file).
2. From the CD folder or the folder in which you saved the FAStT MSJ installer, select the appropriate install file by performing one of the following actions:
   - For Windows 2000, Windows NT, Windows 2003, and NetWare, double-click the FAStTMSJ_install.exe file.
   - For Linux, perform the following steps:
     a. Open a shell.
     b. Change to the directory that contains the FAStT MSJ installer that you downloaded in Step 1.
     c. At the prompt, type `sh ./FAStTMSJ_install.bin`, where *install* is the FAStT MSJ installer file.

        InstallAnywhere prepares to install FAStT MSJ. The Installation Introduction window displays.
3. Click **Next**. The Choose Product Features window displays. The window differs, depending on whether you are installing on a system running Windows NT, Windows 2000, Windows 2003, or Linux.
4. Perform one of the following actions to install the software appropriate to your configuration:
   - For a system running Windows NT, Windows 2000, or Windows 2003, click one of the following preconfigured installation sets, then click **Next**:
     - Click **GUI and NT Agent** if the system running Windows NT, Windows 2000, or Windows 2003 will monitor host bus adapters on this system and remote systems on the network.
     - Click **GUI** if the system will monitor host bus adapters only on remote systems on the network.
     - Click **NT Agent** if the host bus adapters on the system running Windows NT, Windows 2000, or Windows 2003 will be remotely monitored only from other systems on the network.
     - Click **NetWare 5.x and 6.x Agent** if the host bus adapters on this NetWare 5.x or 6.x system will be remotely monitored only from other systems on the network.
   - For Linux systems, click one of the following preconfigured installation sets, then click **Next**:
     - Click **GUI** if the system will monitor host bus adapters only on remote systems on the network.
     - Click **Linux Agent** if the host bus adapters on this system running Linux will be remotely monitored only from other systems on the network.
     - Click **GUI and Linux Agent** if this system running Linux will monitor host bus adapters on this system and on remote systems on the network.

- For other configuration installation sets, click **Customize** to create a customized installation set. The Choose Product Components window displays. The window differs depending on whether you are installing on a system running Windows NT, Windows 2000, Windows 2003, or Linux. Perform the following steps to create a custom installation set:
  a. In the **Feature Set** list-box, click **Custom Set**.
  b. Select from the following components:
     – For a system running Windows NT, Windows 2000, Windows 2003,:
       - **GUI**
       - **NT Agent**
       - **NetWare 5.x or 6.x Agent**
       - **Help**
     – For a system running Linux:
       - **GUI**
       - **Linux Agent**
       - **Help**
  c. Click **Next**. The Important Information window displays.

5. Read the information, then click **Next.**

   Note: Information in the readme file supplied with the installation package takes precedence over the information in the Important Information window.

   The Choose Install Folder window displays.
6. Perform one of the following actions:

   Note: For NetWare, click the drive(s) mapped to the `sys:` directory of the NetWare server.

   - To select the default destination location displayed in the window, click **Next**.

     The default location for a system running Windows NT, Windows 2000, Windows 2003 is `C:\Program Files\IBM FAStT Management Suite\`.

     The default location for a system running Linux is `/root/IBM_FAStT_MSJ`.
   - To select a location other than the default, click **Choose**, click the desired location, and click **Next**.
   - To reselect the default location after selecting a different location, click **Restore Default Folder**, and click **Next**.
7. If you are installing on a Windows platform, the Select Shortcut Profile Location window displays. Perform one of the following actions:
   - To select the all users profile to install the application program group and shortcuts, select the **All Users Profile** radio button, and click **Next**.
   - To select the current users profile to install the application program group and shortcuts, select the **Current Users Profile** radio button, and click **Next**.
8. If you are installing on a NetWare system, the Novell NetWare Disk Selection window displays. A list of the autodetected, mapped NetWare drives on the subnet displays.
   a. Click the drives on which to install the NetWare agent. Each drive must be a NetWare drive `sys:` directory mapped on the system running Windows NT, Windows 2000, Windows 2003. You can select drives by clicking one or more autodetected drives from the list or by typing the drive letter corresponding to the drive you want to use.

b. Click **Next**. The Installing Components window displays. Subsequent windows inform you that the installation is progressing. When the installation is complete, the Install Complete window displays.

9. Click **Done**.
10. Customize the FAStT MSJ application and set your security parameters. See the FAStT MSJ online help for details about security.

Installing FAStT MSJ from a Linux command line

Use the following procedure to install FAStT MSJ from the command line of a Linux system.

Note: The command line installation procedure is not currently supported with the IA-64 FAStTMSJ package.

To perform a command line installation of FAStT MSJ and the qlremote agent, perform the following steps:

1. Open a shell and change to the directory that contains the FAStT MSJ installer.
2. At the prompt, type: `sh FAStTMSJ_install.bin -i silent`
3. FAStT MSJ installs in the /opt directory. The launch script is located in the /usr directory.

To perform a command line installation of only the qlremote agent, perform the following steps:

1. Open a shell and change to the directory that contains the FAStT MSJ installer.
2. At the prompt, type:

   ```
   sh FAStTMSJ_install.bin -i silent -DCHOSEN_INSTALL_SET="QMSJ_LA"
   ```

3. FAStT MSJ installs in the /opt directory. The launch script is located in the /usr directory.

Uninstalling FAStT MSJ

You must exit the FAStT MSJ application before you uninstall FAStT MSJ. Make sure you uninstall the NetWare agent from the Windows NT, Windows 2000, or Windows 2003 drive mapped to the Novell NetWare server when installing FAStT MSJ.

Perform the following steps to uninstall FAStT MSJ:

1. Start the FAStT MSJ Uninstaller:
   - On a system running Windows NT, Windows 2000, or Windows 2003, click **Start** -> **Programs** -> **IBM FAStT MSJ** -> **FAStT MSJ Uninstaller**.
   - On a system running Linux:
     a. Change to the directory where you installed FAStT MSJ. For example, type:

        ```
        cd /usr
        ```

     b. Type the following command to run the InstallAnywhere Uninstaller:

        ```
        ./FAStT_MSJ_Uninstaller
        ```

     The InstallAnywhere Uninstaller window displays; it lists IBM FAStT Management Suite Java Vx.x.xx as the program to be uninstalled.
2. Click **Uninstall**. The InstallAnywhere Uninstaller - Component List window lists the components to be uninstalled. A message displays informing you that the uninstaller is waiting 30 seconds for the agent to shut down. Wait while the

uninstaller removes the components. The InstallAnywhere Uninstaller - Uninstall Complete window informs you that the uninstall is complete.

Note: If you are running NetWare, you must select the drive mapped to the `sys:` directory of the NetWare host.

3. Click **Quit**.
4. If any items are not successfully uninstalled, repeat the uninstallation instructions to remove them.
5. Restart the system.

Getting started

FAStT MSJ enables you to customize the GUI and agent. After you install FAStT MSJ and set your initial parameters, these components activate each time you start the application.

Starting FAStT MSJ

This section describes how to start FAStT MSJ on systems running Windows and Linux.

Windows NT, Windows 2000, or Windows 2003: On a system running Windows NT, Windows 2000, or Windows 2003, double-click the **FAStT MSJ** icon on your desktop if you selected to create the icon during installation (see Figure 2), or click **Start** -> **Programs**-> **IBM FAStT MSJ** -> **FAStT MSJ**.

Figure 2. FAStT MSJ icon

The FAStT MSJ main window opens.

Linux: On a system running Linux, perform the following steps to start the FAStT MSJ:

1. Ensure that you are in a graphical user environment.
2. Open a command terminal.
3. Change to the usr directory in which the IBM FAStT MSJ application is installed by typing `cd /usr`.
4. Type `./FAStT_MSJ`. The FAStT MSJ main window opens.

FAStT MSJ main window

The IBM Management Suite Java-HBA View window (hereafter referred to as the FAStT MSJ main window) displays after you start FAStT MSJ. See Figure 3 on page 48.

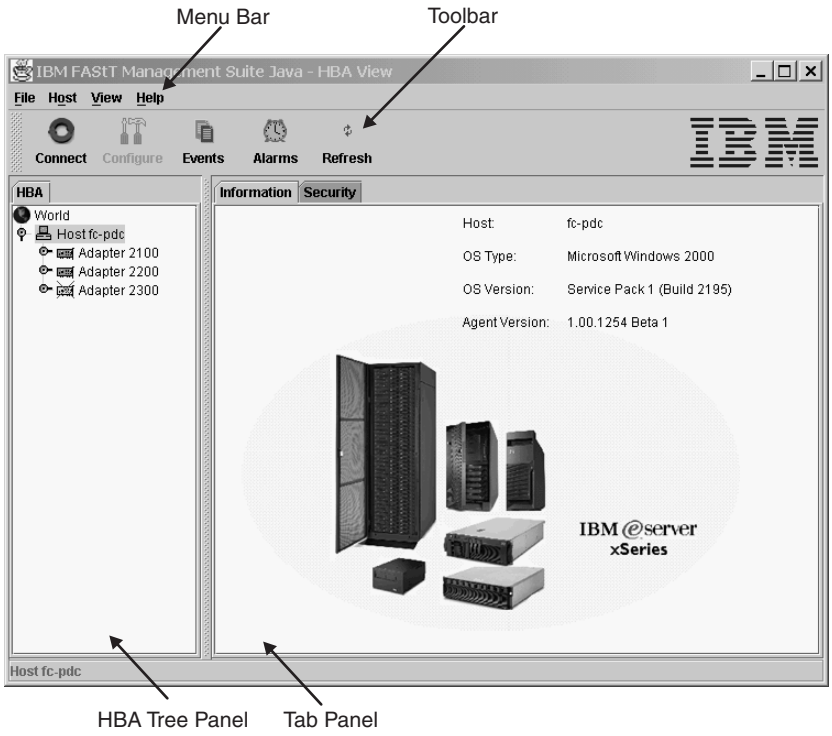

Figure 3. FAStT MSJ main window

The window consists of the following sections:

- Menu bar
- Toolbar
- HBA tree panel
- Tab panel

FAStT MSJ basic features overview

This section lists FAStT MSJ features and contains general information needed to run FAStT MSJ on any supported platform.

For additional details about FAStT MSJ functions, refer to the FAStT MSJ online help.

Features

FAStT MSJ enables you to perform the following actions:

- Set FAStT MSJ options
- Connect to hosts
- Disconnect from a host
- View extensive event and alarm log information
- Use host-to-host SAN configuration policies
- Configure port devices
- Use LUN Level configuration
- Watch real-time to see when failovers occur with the Failover Watcher

- Control host-side agent operations, including setting the host agent polling interval
- Review host adapter information, including:
  - General information
  - Statistics
  - Information on attached devices
  - Attached device link status
- Perform adapter functions, including:
  - Configure adapter NVRAM settings
  - Run fibre channel diagnostics (read/write and loopback tests)
  - Perform flash updates on an adapter
  - Perform NVRAM updates on an adapter
- Manage configurations
  - Save configurations for offline policy checks and SAN integrity
  - Load configurations from file if host is offline for policy checks and SAN integrity
- Confirm security

Options

To configure FAStT MSJ, click **View** -> **Options**. The Options window opens.

The Options window has four sections and two buttons:

- Event Log
- Alarm Log
- Warning Displays
- Configuration Change Alarm
- **OK** (save changes) and **Cancel** (discard changes) buttons

The Options window functions are described in the following sections.

Event log

The event log size can be restricted to a certain number of entries. If the log size is reached, the oldest entries are removed to allow space for the newest entries. The current log size can range from 20 to 200 event entries. If information or warning events are to be logged, click on the associated checkbox. Logged information includes: communication and file system errors. FAStT MSJ stores the event entries in a file called 'events.txt'.

Example entries follow:

```
Tue Dec 23 16:22:29 PST 2003, 4, RPC request 42 for Host 10.3.10.64
failed., 2

Tue Dec 23 16:22:29 PST 2003, 4, Retrying RPC request 42 for Host
10.3.10.64., 2

Tue Dec 23 16:22:30 PST 2003, 4, RPC request 42 for Host 10.3.10.64
failed., 2

Tue Dec 23 16:22:30 PST 2003, 4, Retrying RPC request 42 for Host
10.3.10.64., 2
```

```
Tue Dec 23 16:22:30 PST 2003, 4, RPC request 42 for Host 10.3.10.64
failed., 2
```

Alarm log

While FAStT MSJ communicates with a host, FAStT MSJ continually receives notification messages from the host indicating various changes directly or indirectly made on a host's adapter(s). The log size can be restricted to a certain number of entries. If the log size is reached, the oldest entries are removed to allow space for the newest entries. The current log size can range from 20 to 200 event entries. Logged information includes: status, configuration and NVRAM changes. FAStT MSJ stores the alarm entries in a file called 'alarms.txt'.

Example entries follow:

```
Wed Dec 24 10:27:28 PST 2003, qlogic-agc001, 1-QLA2300/2310, 0, Status
Change:  Good Status. Loop Down., 1

Wed Dec 24 10:27:28 PST 2003, qlogic-agc001, 4-QLA2350, 0, Status Change:
Good Status. Loop Down., 1

Wed Dec 24 10:27:50 PST 2003, qlogic-agc001, 1-QLA2300/2310, 0, Status
Change:  Good Status. Loop Down., 1

Wed Dec 24 10:27:50 PST 2003, qlogic-agc001, 4-QLA2350, 0, Status Change:
Good Status. Loop Down., 1
```

Warning displays

FAStT MSJ displays additional warning dialogs throughout the application. By default, the Warning Displays option is enabled. To disable the display of warning dialogs, clear the **Enable warning displays** check box in the Options window.

Configuration change alarm

FAStT MSJ tries to keep current the devices and the LUNs that the adapter displays. During cable disconnects, device hotplugs, or device removal, configuration change alarms are generated to keep the GUI current. You can control the way FAStT MSJ handles configuration change alarms with the Configuration Change Alarm option. You can choose from the following options:

- Apply Configuration Changes Automatically

  When a configuration change alarm is detected by the GUI, the application disconnects the host and reconnects to get the new configuration automatically.
- Confirm Configuration Change Applies (default setting)

  When a configuration change alarm is detected by the GUI, the application displays a window that the user clicks **Yes** or **No** to refresh the configuration for the specified host.
- Ignore Configuration Changes

  With this setting, a configuration change alarm detected by the GUI is ignored. For the configuration to be updated, you must perform a manual disconnect and connect of the host must be performed.

Note: You can refresh the configuration by selecting the desired host and clicking the **Refresh** button on the toolbar or by right-clicking the desired host and clicking **Refresh** on the pop-up menu.

Connecting to hosts

There are three ways to connect to hosts in a network:

- Manually
- Automatically with the Broadcast function
- Host files

For multi-homed or multiple IP hosts, FAStT MSJ tries to ensure that a specified host is not loaded twice into the recognized host tree. If a particular host has multiple interfaces (NICs), each with its own IP address, and proper name-resolution-services are prepared, the host will not be loaded twice into the tree. Problems can occur when one or more IPs are not registered with a host.

A blinking heart indicator (blue pulsating heart icon) indicates that the connection between the client and remote agent is active for this test.

Manual connection

Perform the following steps to manually connect to a host:

1. From the FAStT MSJ main window, click the **Connect** button or click **Connect** from the **Host** menu.

   The Connect to Host window displays.
2. Type in the host name, or select the host you want to connect to from the drop-down list. You can use the computer IP address or its host name. If the computer you want to connect to is the computer on which FAStT MSJ is running, select **localhost** from the drop-down list. To delete all user-entered host names from the drop-down list, click **Clear**.
3. After you have selected or typed the host name, click **Connect** to initiate the connection.

   If the connection attempt fails, an error message displays that indicates the failure and potential causes. If the connection is successfully established, the host's name and its adapters are shown on the HBA tree.

   Click **Cancel** to stop the connection process and return to the main window.

Broadcast connections

FAStT MSJ can auto-connect to all hosts running an agent in a network. For auto-connect to function properly, ensure that the **Broadcast** setting is enabled. To enable auto-connect, select the **Auto Connect** check box from the **Settings** menu. To disable auto-connect, clear the **Auto Connect** check box.

Note: If multiple NICs are present in the system, the FAStT MSJ client will broadcast to the first IP address subnet based on the binding order. Therefore, ensure that the NIC for the local subnet is first in the binding order. If this is not done, the diagnostics might not run properly and remote connection might not occur. See the readme file in the release package for more information.

Host files

The final way that FAStT MSJ provides to connect to specified agent(s) is by using a host file to connect to all specified hosts (that are present in the file). The feature can be useful if you the system administrator have to manage a number of fibre channel attached hosts that are in the same SAN or not and doesn't want to connect to each of the host(s) individually.

Creating a Host File: Perform the following steps to save the group of hosts that display in the HBA tree to a host file.

1. Do one of the following:
   - On the FAStT MSJ main window Host menu, click **Save Group**.
   - Right-click on the HBA tree. From the pop-up menu, click **Save Group**.
2. The Save dialog box displays. Save the host file (.hst) in an appropriate directory. Click **Save**.

Note: You can also create a host file (.hst) from the command line. The format of the file is one host name per line, for example:

```
adsw2ksys2
nt4ssys1
  nw51sys7
```

Using a Host File to Connect to Hosts: Perform the following steps to connect to a group of hosts using a previously created host file.

1. Do one of the following:
   - On the FAStT MSJ main window Host menu, click **Open Group**.
   - Right-click on the HBA tree. From the pop-up menu, click **Open Group**.
2. The Open dialog box displays. Save the host file (.hst) that contains the hosts to which you want to connect. Click **Open**. The hosts display in the FAStT MSJ main window HBA tree.

Disconnecting from a host

Perform the following steps to disconnect from a host:

1. From the FAStT MSJ main window HBA tree, click the host that you want to disconnect from.
2. Click **Host -> Disconnect**.

   When a host is disconnected, its entry in the HBA tree is removed.

Polling interval

You can set polling intervals on a per-host basis to retrieve information. The polling interval setting can be in the range from 1 second to 3600 seconds (one hour). Perform the following steps to set the polling interval:

1. Click the host in the HBA tree in the FAStT MSJ main window.
2. Click **Host -> Polling**. The Polling Settings - target window displays.
3. Type the new polling interval and click **OK**.

Security

FAStT MSJ protects everything written to the adapter or adapter configuration with an agent-side password. You can set the host agent password from any host that can run the FAStT MSJ GUI and connect to the host agent.

When a configuration change is requested, the Security Check window displays to validate the application-access password. Type the application-access password for confirmation.

To change the host agent password, select a host by clicking it in the HBA tree. The Information/Security tab panels display. Click the Security tab to display the Security panel.

The security panel is divided into two sections: Host Access and Application Access.

Host access

The Host Access section verifies that the host user login and password has administrator or root privileges before an application access is attempted. The login and password values are the same as those used to access the computer.

Login A host user account with administrator or root-level rights.

Password
The password for the host user account.

Application access

The Application Access section enables you to change the FAStT MSJ host agent password. To change the password, type the following information into the following fields:

Old password
The current application-access password for the host. The original default password is **config**. Change it immediately to a new password.

New password
The new application-access password for the host.

Verify Password
The new application-access password for host verification.

The Help menu

From the FAStT MSJ **Help** menu, you can specify the location of the browser to launch when help is requested by a user. You can also view FAStT MSJ version information.

The **Help** menu contains the following items:

- **Set Browser Location**

  Click this item to display the Browser Location window. Type the file path of the browser that FAStT MSJ will launch when a user requests help, or click **Browse** to find the file location.
- **Browse Contents**

  Click this item to access FAStT MSJ help.
- **About**

  Click this item to view information about FAStT MSJ, including the current FAStT MSJ version number.

Chapter 5. PD hints: Common path/single path configurations

You should be referred to this chapter from a PD map or indication. If this is not the case, see Chapter 2, “Problem determination starting points,” on page 3.

After you read the relevant information in this chapter, return to “Common Path PD map 1” on page 22.

In Figure 4, the HBA, HBA-to-concentrator cable, and the port that this cable uses are on the common path to all storage. The other cables and ports to the controllers are on their own paths so that a failure on them does not affect the others. This configuration is referred to a common orsingle path.

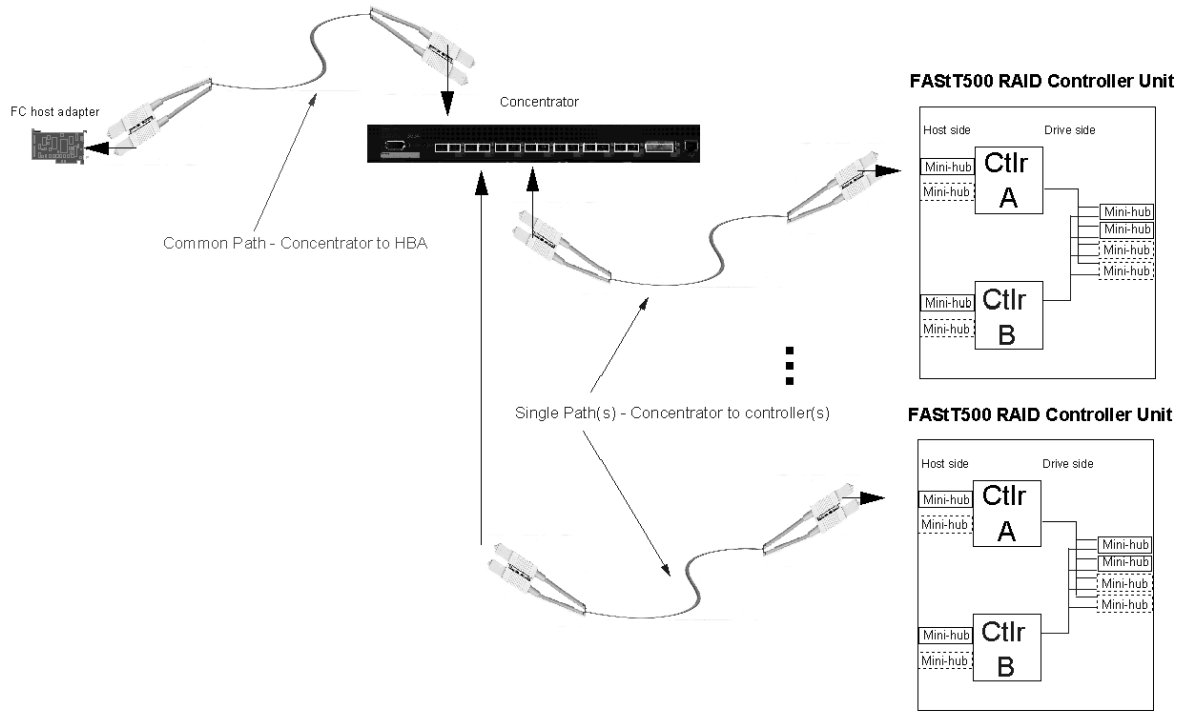

Figure 4. Common path configuration

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Chapter 6. PD hints: RAID controller errors in the Windows 2000, Windows 2003, or Windows NT event log

You should be referred to this chapter from a PD map or indication. If this is not the case, see Chapter 2, "Problem determination starting points," on page 3.

After you read the relevant information in this chapter, return to "RAID Controller Passive PD map" on page 9.

This chapter presents general guidelines that explain the errors that can appear in an event log and what actions to perform when these errors occur.

Note: If you have a system running on Windows NT 4.0, the driver is listed as SYMarray. If you have a system running on Windows 2000, the driver is listed as RDACFLTR.

Common error conditions

- **Getting a series of SYMarray event ID 11s in the Windows event log**

  Open and review the event log. A series of event ID 11s generally indicates a number of bus resets and might be caused by a bad host bus adapter or a bad cable.
- **Getting a series of SYMarray event ID 11s and 18s in the Windows event log**

  Open and review the event log. A series of event ID 11s generally indicates LIPs (Loop resets). This generally indicates a bad fibre path. It could be an indication of a problem with a GBIC, an MIA, or an adapter.

  Event ID 18s indicate that RDAC failed a controller path. The fault will most likely be a component in the fibre path, rather than the controller.
- **Getting a series of SYMarray event ID 15s in the Windows event log**

  This error is undocumented. A series of event ID 15s indicates that the link is down. The problem is generally within the Fibre path.

Event log details

In addition to reviewing the SYMplicity Storage Manager log, you can choose to review the Windows event log, which is viewed in a GUI environment (see Figure 5). To open the event log, click **Start -> Programs -> Administrative Tools -> Event Viewer**.

Date	Time	Source	Category	Event	User
2/22/99	4:35:25 AM	symarray	None	11	N/A
2/21/99	11:34:35 PM	symarray	None	11	N/A
2/18/99	12:47:45 AM	SNMP	None	1001	N/A

Figure 5. Event log

Table 10 on page 58 lists the most common, but not necessarily the only, event IDs encountered in a SYMarray (RDAC) event.

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Table 10. Common SYMarray (RDAC) event IDs

Event	Microsoft Label Identifier	Description
9	IO_ERR_TIMEOUT	The device %s did not respond within timeout period.
11	IO_ERR_CONTROLLER_ERROR	Driver detected controller failure.
16	ERR_INVALID_REQUEST	The request is incorrectly formatted for %1.
18	IO_LAYERED_FAILURE	Driver beneath this layer failed.
389	STATUS_IO_DEVICE_ERROR	The I/O device reported an I/O error.

Event ID 18 is a special case. SYMarray uses event ID 18 to designate a failed controller path. (The controller on the physical path is the failed controller.) All LEDs on the controller are usually lit when a failure occurs. This does not necessarily mean that the controller is defective, but rather that a component along the path to the controller is generating errors. Possible problem components include the host adapter, fibre cable, GBIC, hub, and so on.

In a multi-node cluster with multiple event ID 18s, the earliest log entry most likely initiated the original controller failure. Event ID 18s on other nodes were most likely responses to the original failure and typically contain an SRB status of (0x0a - SCSI Selection Timeout). Check the system date and time stamp for synchronization to validate which entry occurred first. To review an entry in the Event Viewer, perform the following steps:

1. Double-click the entry you want to review.
2. Select the **Words** radio button to convert the bottom text from bytes to words. See Figure 6.

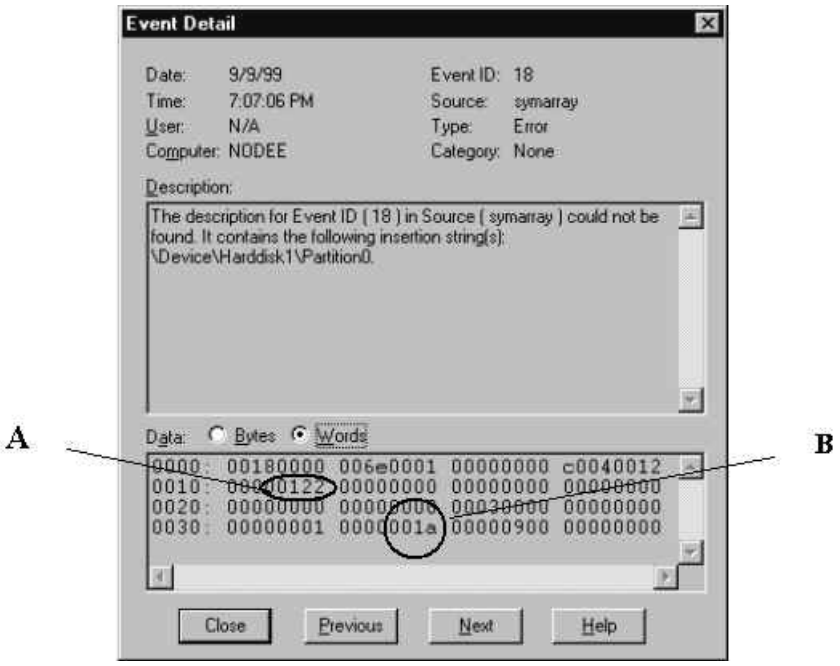

Figure 6. Event detail

A. The last 4 digits (2 bytes) in this field indicate the unique error value. In this example, the error value shown indicates a Controller Failover Event.

B. For Event ID 18, this offset represents the SCSI operation that was attempted when the failover event took place.

Table 11. Unique error value - Offset 0x0010

Unique Error Value - Offset 0x0010			
Value	**Meaning**	**Value**	**Meaning**
100	Media Error (check condition)	110	Device Not Ready (check condition)
101	Hardware Error (check condition)	111	No Sense (check condition)
102	Recovered Error (check condition)	112	Unrecognized Sense Key
103	Default - Controller Error	113	Error being returned to system that would otherwise not be logged
105	Command Aborted or Timed Out	114	SCSI Release Configuration Error, Multiple paths to the same controller
106	Phase Sequence Error	115	SCSI Reserve Configuration Error, Multiple paths to the same controller
107	Request Flushed	116	The driver has discovered more paths to a controller than are supported (four are supported)
108	Parity Error or Unexpected Bus Free	117	The driver has discovered devices with the same WWN but different LUN numbers
109	SCSI Bus Error Status (busy, queue full, and so on)	122	Controller Failover Event (alternate controller/path failed)
10a	Bus Reset	123	A path to a multipath controller failed
10e	Aborted Command (check condition)	124	A controller failover failed
10f	Illegal Request (check condition)	125	A Read/Write error has been returned to the system

The example shown in Figure 7 is a recovered drive timeout error on drive 2, 1.

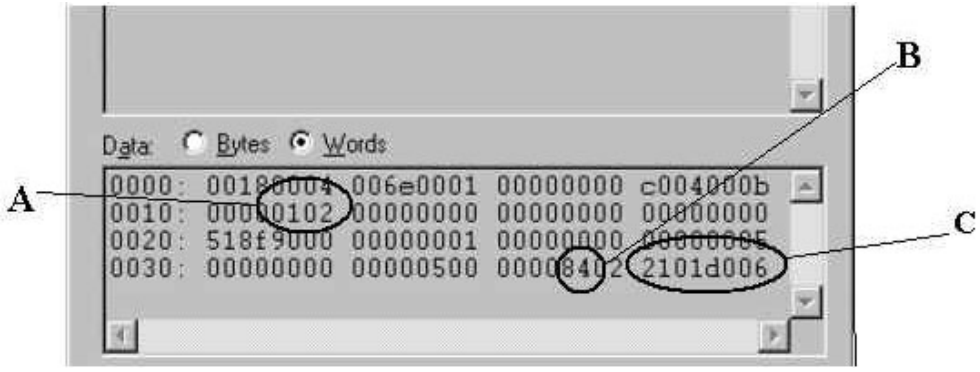

Figure 7. Unique error value example

A. This error indicates (according to the error codes listed in Table 11) a recovered error.

B. This bit indicates validity of the following word. A number 8 means field C is a valid sense key. A number other than 8 means that field C is not valid and should be disregarded.

C. This word represents the FRU code, SCSI sense key, ASC and ASCQ.

ffkkaaqq –			
ff = FRU code	kk = SCSI sense key	aa = ASC	qq = ASCQ

Sense Key table

Table 12 lists Sense Key values and descriptions.

Table 12. Sense Key table

SENSE KEY	DESCRIPTION
0x00	No Sense
0x01	Recovered Error
0x02	Not Ready
0x03	Medium Error
0x04	Hardware Error
0x05	Illegal Request
0x06	Unit Attention
0x07	Data Protect (Not Used)
0x08	Blank Check (Not used)
0x09	Vendor Specific (Not used)
0x0A	Copy Aborted (Not used)
0x0B	Aborted Command
0x0C	Equal (Not used)
0x0D	Volume Overflow (Not used)
0x0E	Miscompare
0x0F	Reserved (Not used)

ASC/ASCQ table

This section lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifier (ASCQ) values returned by the array controller in the sense data. SCSI-2 defined codes are used when possible. Array-specific error codes are used when necessary, and are assigned SCSI-2 vendor-unique codes 80 through FFH. More detailed sense key information can be obtained from the array controller command descriptions or the SCSI-2 standard.

Codes defined by SCSI-2 and the array vendor-specific codes are shown in Table 13. The sense keys most likely to be returned for each error are also listed in the table.

Table 13. ASC/ASCQ values

ASC	ASCQ	Sense Key	Description
00	00	0	No Additional Sense Information The controller has no sense data available for the requesting host and addressed logical unit combination.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
04	01	2	Logical Unit is in the Process of Becoming Ready The controller is running its initialization functions on the addressed logical unit. This includes drive spinup and validation of the drive and logical unit configuration information.
04	02	2	Logical Unit Not Ready, Initializing Command Required The controller is configured to wait for a Start Stop Unit command before spinning up the drives, but the command has not yet been received.
04	04	2	Logical Unit Not Ready, Format In Progress The controller previously received a Format Unit command from an initiator, and is in the process of running that command.
04	81	2	Storage Module Firmware Incompatible - Manual Code Synchronization Required
04	A1	2	Quiescence Is In Progress or Has Been Achieved
0C	00	4	Unrecovered Write Error Data could not be written to media due to an unrecoverable RAM, battery, or drive error.
0C	00	6	Caching Disabled Data caching has been disabled due to loss of mirroring capability or low battery capacity.
0C	01	1	Write Error Recovered with Auto Reallocation The controller recovered a write operation to a drive and no further action is required by the host. Auto reallocation might not have been used, but this is the only standard ASC/ASCQ that tells the initiator that no further actions are required by the driver.
0C	80	4, (6)	Unrecovered Write Error Due to Non-Volatile Cache Failure The subsystem Non-Volatile cache memory recovery mechanisms failed after a power cycle or reset. This is possibly due to some combination of battery failure, alternate controller failure, or a foreign controller. User data might have been lost.
0C	81	4, (6)	Deferred Unrecoverable Error Due to Memory Failure Recovery from a Data Cache error was unsuccessful. User data might have been lost.
11	00	3	Unrecovered Read Error An unrecovered read operation to a drive occurred and the controller has no redundancy to recover the error (RAID 0, degraded RAID 1, degraded mode RAID 3, or degraded RAID 5).
11	8A	6	Miscorrected Data Error - Due to Failed Drive Read A media error has occurred on a read operation during a reconfiguration operation. User data for the LBA indicated has been lost.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
18	02	1	Recovered Data - Data Auto Reallocated The controller recovered a read operation to a drive and no further action is required by the host. Auto reallocation might not have been used, but this is the only standard ASC/ASCQ that tells the initiator that no further actions are required by the driver.
1A	00	5	Parameter List Length Error A command was received by the controller that contained a parameter list and the list length in the CDB was less than the length necessary to transfer the data for the command.
20	00	5	Invalid Command Operation Code The controller received a command from the initiator that it does not support.
21	00	5	Logical Block Address Out of Range The controller received a command that requested an operation at a logical block address beyond the capacity of the logical unit. This error could be in response to a request with an illegal starting address or a request that started at a valid logical block address and the number of blocks requested extended beyond the logical unit capacity.
24	00	5	Invalid Field in CDB The controller received a command from the initiator with an unsupported value in one of the fields in the command block.
25	00	5	Logical Unit Not Supported The addressed logical unit is currently unconfigured. An Add LUN operation in the Logical Array Mode Page must be run to define the logical unit before it is accessible.
26	00	5	Invalid Field in Parameter List The controller received a command with a parameter list that contained an error. Typical errors that return this code are unsupported mode pages, attempts to change an unchangeable mode parameter, or attempts to set a changeable mode parameter to an unsupported value.
28	00	6	Not Ready to Ready Transition The controller has completed its initialization operations on the logical unit and it is now ready for access.
29	00	6	Power On, Reset, or Bus Device Reset Occurred The controller has detected one of the above conditions.
29	04	6	Device Internal Reset The controller has reset itself due to an internal error condition.
29	81	(6)	Default Configuration has been Created The controller has completed the process of creating a default logical unit. There is now an accessible logical unit that did not exist previously. The host should run its device scan to find the new logical unit.
29	82	6	Controller Firmware Changed Through Auto Code Synchronization The controller firmware has been changed through the Auto Code Synchronization (ACS) process.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
2A	01	6	Mode Parameters Changed The controller received a request from another initiator to change the mode parameters for the addressed logical unit. This error notifies the current initiator that the change occurred. This error might also be reported in the event that Mode Select parameters changed as a result of a cache synchronization error during the processing of the most recent Mode Select request.
2A	02	6	Log Parameters Changed The controller received a request from another initiator to change the log parameters for the addressed logical unit. This error notifies the current initiator that the change occurred. This error is returned when a Log Select command is issued to clear the AEN log entries.
2F	00	6	Commands Cleared by Another Initiator The controller received a Clear Queue message from another initiator. This error is to notify the current initiator that the controller cleared the current initiators commands if it had any outstanding.
31	01	1, 4	Format Command Failed A Format Unit command issued to a drive returned an unrecoverable error.
32	00	4	Out of Alternates A Re-assign Blocks command to a drive failed.
3F	01	(6)	Drive micro-code changed
3F	0E	6	Reported LUNs data has changed Previous LUN data reported using a Report LUNs command has changed (due to LUN creation or deletion or controller hot-swap).

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
3F	8N	(6)	Drive No Longer Usable The controller has set a drive to a state that prohibits use of the drive. The value of N in the ASCQ indicates the reason why the drive cannot be used. 0 - The controller set the drive state to ″Failed - Write failure″ 1 - Not used 2 - The controller set the drive state to ″Failed″ because it was unable to make the drive usable after replacement. A format or reconstruction error occurred. 3 - Not used 4 - Not used 5 - The controller set the drive state to ″Failed - No response″ 6 - The controller set the drive state to ″Failed - Format failure″ 7 - The controller set the drive state to ″User failed via Mode Select″ 8 - Not used 9 - The controller set the drive state to ″Wrong drive removed/replaced″ A - Not used B - The controller set the drive state to ″Drive capacity < minimum″ C - The controller set the drive state to ″Drive has wrong block size″ D - The controller set the drive state to ″Failed - Controller storage failure″ E - Drive failed due to reconstruction failure at Start of Day (SOD)
3F	98	(6)	Drive Marked Offline Due to Internal Recovery Procedure An error has occurred during interrupted write processing causing the LUN to transition to the Dead state. Drives in the drive group that did not experience the read error will transition to the Offline state (0x0B) and log this error.
3F	BD	(6)	The controller has detected a drive with Mode Select parameters that are not recommended or which could not be changed. Currently this indicates the QErr bit is set incorrectly on the drive specified in the FRU field of the Request Sense data.
3F	C3	(6)	The controller had detected a failed drive side channel specified in the FRU Qualifier field.
3F	C7	(6)	Non-media Component Failure The controller has detected the failure of a subsystem component other than a disk or controller. The FRU codes and qualifiers indicate the faulty component.
3F	C8	(6)	AC Power Fail The Uninterruptible Power Source has indicated that ac power is no longer present and the UPS has switched to standby power.
3F	C9	(6)	Standby Power Depletion Imminent The UPS has indicated that its standby power source is nearing depletion. The host should take actions to stop IO activity to the controller.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
3F	CA	(6)	Standby Power Source Not at Full Capability The UPS has indicated that its standby power source is not at full capacity.
3F	CB	(6)	AC Power Has Been Restored The UPS has indicated that ac power is now being used to supply power to the controller.
3F	D0	(6)	Write Back Cache Battery Has Been Discharged The controllers battery management has indicated that the cache battery has been discharged.
3F	D1	(6)	Write Back Cache Battery Charge Has Completed The controllers battery management has indicated that the cache battery is operational.
3F	D8	(6)	Cache Battery Life Expiration The cache battery has reached the specified expiration age.
3F	D9	(6)	Cache Battery Life Expiration Warning The cache battery is within the specified number of weeks of failing.
3F	E0	(6)	Logical Unit Failure The controller has placed the logical unit in a Dead state. User data, parity, or both can no longer be maintained to ensure availability. The most likely cause is the failure of a single drive in non-redundant configurations or a second drive in a configuration protected by one drive. The data on the logical unit is no longer accessible.
3F	EB	(6)	LUN marked Dead due to Media Error Failure during SOD An error has occurred during interrupted write processing causing the LUN to transition to the Dead state.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
40	NN	4, (6)	Diagnostic Failure on Component NN (0x80 - 0xFF) The controller has detected the failure of an internal controller component. This failure might have been detected during operation as well as during an on-board diagnostic routine. The values of NN supported in this release of the software are as follows: 80 - Processor RAM 81 - RAID Buffer 82 - NVSRAM 83 - RAID Parity Assist (RPA) chip or cache holdup battery 84 - Battery Backed NVSRAM or Clock Failure 91 - Diagnostic Self Test failed non-data transfer components test 92 - Diagnostic Self Test failed data transfer components test 93 - Diagnostic Self Test failed drive Read/Write Buffer data turnaround test 94 - Diagnostic Self Test failed drive Inquiry access test 95 - Diagnostic Self Test failed drive Read/Write data turnaround test 96 - Diagnostic Self Test failed drive Self Test
43	00	4	Message Error The controller attempted to send a message to the host, but the host responded with a Reject message.
44	00	4, B	Internal Target Failure The controller has detected a hardware or software condition that does not allow the requested command to be completed. If the sense key is 0x04, indicating a hardware failure, the controller has detected what it believes is a fatal hardware or software failure and it is unlikely that a retry would be successful. If the sense key is 0x0B, indicating an aborted command, the controller has detected what it believes is a temporary software failure that is likely to be recovered if retried.
45	00	1, 4	Selection Time-out on a Destination Bus A drive did not respond to selection within a selection time-out period.
47	00	1, B	SCSI Parity Error The controller detected a parity error on the host SCSI bus or one of the drive SCSI buses.
48	00	1, B	Initiator Detected Error Message Received The controller received an Initiator Detected Error Message from the host during the operation.
49	00	B	Invalid Message Error The controller received a message from the host that is not supported or was out of context when received.
49	80	B	Drive Reported Reservation Conflict A drive returned a status of reservation conflict.

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
4B	00	1, 4	Data Phase Error The controller encountered an error while transferring data to or from the initiator or to or from one of the drives.
4E	00	B	Overlapped Commands Attempted The controller received a tagged command while it had an untagged command pending from the same initiator or it received an untagged command while it had one or more tagged commands pending from the same initiator.
5D	80	6	Drive Reported PFA (Predicted Failure Analysis) Condition
80	02	1, 4	Bad ASC code detected by Error/Event Logger
80	03	4	Error occurred during data transfer from SRM host.
84	00	4, 5	Operation Not Allowed With the Logical Unit in its Current State The requested command or Mode Select operation is not allowed with the logical unit in the state indicated in byte 76 of the sense data. Examples would be an attempt to read or write a dead logical unit or an attempt to verify or repair parity on a degraded logical unit.
84	06	4	LUN Awaiting Format A mode select has been done to create a LUN but the LUN has not been formatted.
85	01	4	Drive IO Request Aborted IO Issued to Failed or Missing drive due to recently failed removed drive. This error can occur as a result of IOs in progress at the time of a failed or removed drive.
87	00	4	Microcode Download Error The controller detected an error while downloading microcode and storing it in non-volatile memory.
87	08	4	Incompatible Board Type For The Code Downloaded
87	0C	6	Download failed due to UTM LUN number conflict
87	0E	6	Controller Configuration Definition Inconsistent with Alternate Controller
88	0A	(6)	Subsystem Monitor NVSRAM values configured incorrectly
8A	00	5	Illegal Command for Drive Access The initiator attempted to pass a command through to a drive that is not allowed. The command could have been sent in pass-thru mode or by attempting to download drive microcode.
8A	01	5	Illegal Command for the Current RAID Level The controller received a command that cannot be run on the logical unit due to its RAID level configuration. Examples are parity verify or repair operations on a RAID 0 logical unit.
8A	10	5	Illegal Request- Controller Unable to Perform Reconfiguration as Requested The user requested a legal reconfiguration but the controller is unable to run the request due to resource limitations.
8B	02	B, (6)	Quiescence Is In Progress or Has Been Achieved
8B	03	B	Quiescence Could Not Be Achieved Within the Quiescence Timeout Period
8B	04	5	Quiescence Is Not Allowed

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
8E	01	E, (6)	A Parity/Data Mismatch was Detected The controller detected inconsistent parity/data during a parity verification.
91	00	5	General Mode Select Error An error was encountered while processing a Mode Select command.
91	03	5	Illegal Operation for Current Drive State A drive operation was requested through a Mode Select that cannot be run due to the state of the drive. An example would be a Delete Drive when the drive is part of a LUN.
91	09	5	Illegal Operation with Multiple SubLUNs Defined An operation was requested that cannot be run when multiple SubLUNs are defined on the drive.
91	33	5	Illegal Operation for Controller State The requested Mode Select operation could not be completed due to the current state of the controller.
91	36	5	Command Lock Violation The controller received a Write Buffer Download Microcode, Send Diagnostic, or Mode Select command, but only one such command is allowed at a time and there was another such command active.
91	3B	6	Improper LUN Definition for Auto-Volume Transfer mode - AVT is disabled. Controller will operate in normal redundant controller mode without performing Auto-Volume transfers.
91	50	5	Illegal Operation For Drive Group State An operation was requested that cannot be run due to the current state of the Drive Group.
91	51	5	Illegal Reconfiguration Request - Legacy Constraint Command could not be completed due to Legacy configuration or definition constraints.
91	53	5	Illegal Reconfiguration Request - System Resource Constraint Command could not be completed due to resource limitations of the controller.
94	01	5	Invalid Request Due to Current Logical Unit Ownership
95	01	4	Extended Drive Insertion/Removal Signal The controller has detected the drive insertion/removal signal permanently active.
95	02	(6)	Controller Removal/Replacement Detected or Alternate Controller Released from Reset The controller detected the activation of the signal or signals used to indicate that the alternate controller has been removed or replaced.
98	01	(6)	The controller has determined that there are multiple sub-enclosures with the same ID value selected.
98	02	(6)	Sub-enclosure with redundant ESMs specifying different Tray IDs
98	03	(6)	Sub-enclosure ESMs have different firmware levels

Table 13. ASC/ASCQ values (continued)

ASC	ASCQ	Sense Key	Description
A0	00	(6)	Write Back Caching Could Not Be Enabled The controller could not perform write-back caching due to a battery failure or discharge, Two Minute Warning signal from the UPS, or an ICON failure.
A1	00	(6)	Write Back Caching Could Not Be Enabled - RDAC Cache Size Mismatch The controller could not perform write back caching due to the cache sizes of the two controllers in the RDAC pair not matching.
A4	00	(6)	Global Hot Spare Size Insufficient for All Drives in Subsystem. A defined Global Hot Spare is not large enough to cover all of the drives present in the subsystem. Failure of a drive larger than the Global Hot Spare will not be covered by the Global Hot Spare drive.
A6	00	(6)	Recovered processor memory failure The controller has detected and corrected a recoverable error in processor memory.
A7	00	(6)	Recovered data buffer memory error The controller has detected and corrected a recoverable error in the data buffer memory. Sense bytes 34-36 will contain the count of errors encountered and recovered.
C0	00	4, (6)	The Inter-controller Communications Have Failed The controller has detected the failure of the communications link between redundant controllers.
D0	06	4	Drive IO Time-out The controller destination IO timer expired while waiting for a drive command to complete.
D1	0A	4	Drive Reported Busy Status A drive returned a busy status in response to a command.
E0	XX	4	Destination Channel Error XX = 00 through 07 indicates the Sense Key returned by the drive after a check condition status XX = 10 indicates that a bus level error occurred
E0	XX	6	Fibre Channel Destination Channel Error XX = 20 indicates redundant path is not available to devices XX = 21 indicates destination drive channels are connected to each other Sense Byte 26 will contain the Tray ID. Sense Byte 27 will contain the Channel ID.

FRU code table

A nonzero value in the FRU code byte identifies a FRU that failed or a group of field-replaceable modules that includes one or more failed devices. For some Additional Sense Codes, the FRU code must be used to determine where the error occurred. For example, the Additional Sense Code for SCSI bus parity error is returned for a parity error detected on either the host bus or one of the drive buses. In this case, the FRU field must be evaluated to determine whether the error occurred on the host channel or a drive channel.

Because of the large number of replaceable units possible in an array, a single byte is not sufficient to report a unique identifier for each individual FRU. To provide meaningful information that will decrease field troubleshooting and problem resolution time, FRUs have been grouped. The defined FRU groups and their descriptions are listed in Table 14.

Table 14. FRU codes

FRU code	Title	Description
0x01	Host Channel Group	A FRU group consisting of the host SCSI bus, its SCSI interface chip, and all initiators and other targets connected to the bus
0x02	Controller Drive Interface Group	A FRU group consisting of the SCSI interface chips on the controller that connect to the drive buses
0x03	Controller Buffer Group	A FRU group consisting of the controller logic used to implement the on-board data buffer.
0x04	Controller Array ASIC Group	A FRU group consisting of the ASICs on the controller associated with the array functions.
0x05	Controller Other Group	A FRU group consisting of all controller-related hardware not associated with another group
0x06	Subsystem Group	A FRU group consisting of subsystem components that are monitored by the array controller, such as power supplies, fans, thermal sensors, and ac power monitors. Additional information about the specific failure within this FRU group can be obtained from the additional FRU bytes field of the array sense.
0x07	Subsystem Configuration Group	A FRU group consisting of subsystem components that are configurable by the user, on which the array controller will display information (such as faults)
0x08	Sub-enclosure Group	A FRU group consisting of the attached enclosure devices. This group includes the power supplies, environmental monitor, and other subsystem components in the sub-enclosure.
0x09-0x0F	Reserved	
0x10-0xFF	Drive Groups	A FRU group consisting of a drive (embedded controller, drive electronics, and Head Disk Assembly), its power supply, and the SCSI cable that connects it to the controller; or supporting sub-enclosure environmental electronics The FRU code designates the channel ID in the most significant nibble and the SCSI ID of the drive in the least significant nibble. **Note:** Channel ID 0 is not used because a failure of drive ID 0 on this channel would cause a FRU code of 0x00, which the SCSI-2 standard defines as no specific unit has been identified to have failed or that the data is not available.

Chapter 7. PD hints: Configuration types

You should be referred to this chapter from a PD map or indication. If this is not the case, see Chapter 2, "Problem determination starting points," on page 3.

After you read the relevant information in this chapter, return to the "Configuration Type PD map" on page 8.

To simplify a complicated configuration so that it can be debugged readily, reduce the configuration to subsets that you can use to build the larger configuration. This process yields two basic configurations. (The type of RAID controller is not material; FAStT500 is shown in the following examples.) The following two sections discuss these two basic configurations.

Type 1 configuration

The identifying features of a type 1 configuration (as shown in Figure 8) are:

- Host adapters are connected directly to mini-hubs of Controller A and B, with one or more host adapters per system.
- Multiple servers can be connected, but without system-to-system failover (no MSCS).
- Uses some type of isolation mechanism (such as partitions) between server resources.

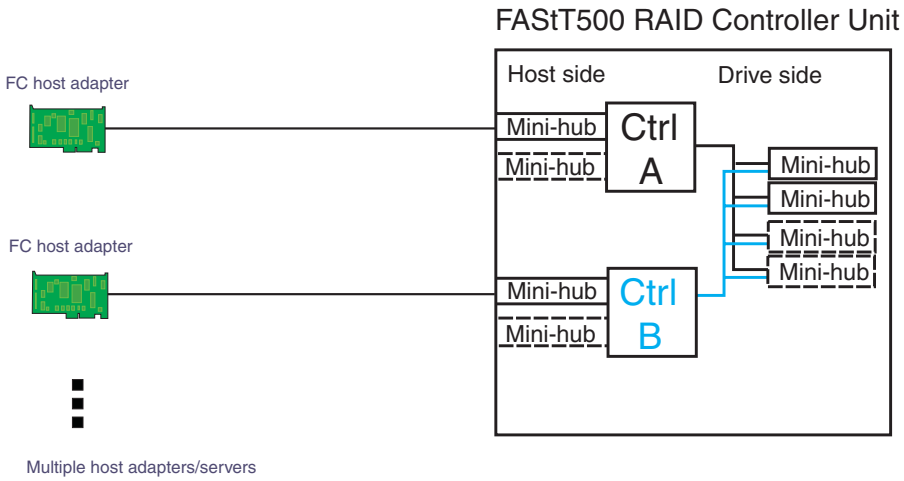

Figure 8. Type 1 configuration

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Type 2 configuration

The type 2 configuration can occur with or without hubs and switches, as shown in Figure 9 and Figure 10.

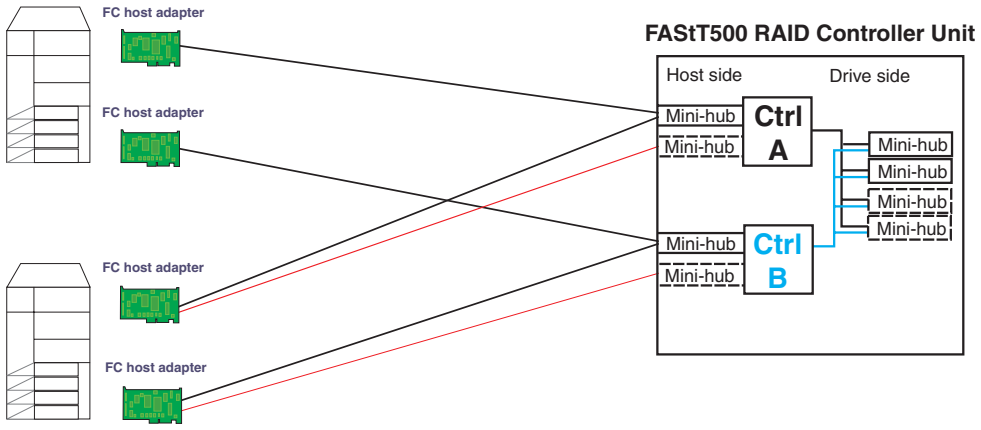

Figure 9. Type 2 configuration - With hubs

The identifying features of a type 2 configuration are:

- Multiple host adapters are connected for full redundancy across systems having failover support such as MSCS.
- Host adapters are connected either directly to mini-hubs or through managed hubs or switches (2 GBIC ports per mini-hub are possible).
- A redundant path to mini-hubs can be separated using optional mini-hubs, as shown in the following figure in red (vs. the green path).

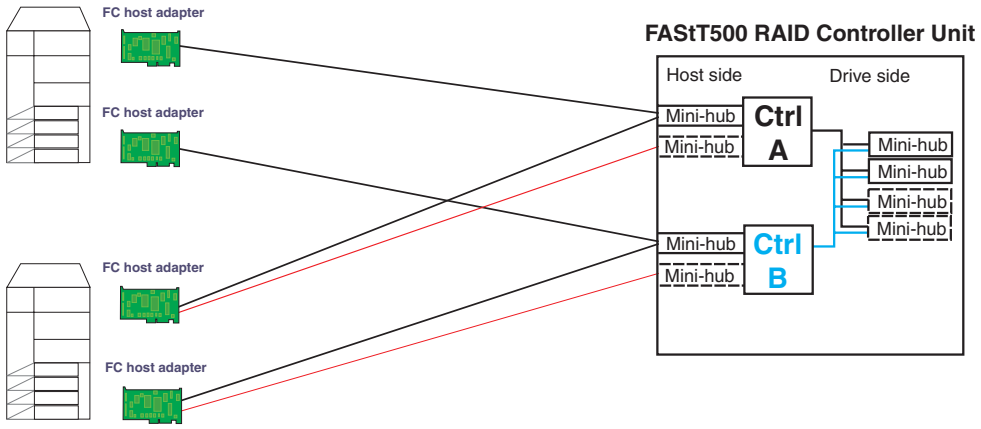

Figure 10. Type 2 configuration - Without hubs

Diagnostics and examples

In a type 1 configuration there are no externally managed hubs or switches to aid in debugging. The diagnostic tools available are FAStT MSJ (from the host adapter end) and the `sendEcho` command (from the RAID controller end). If you intend to diagnose a failed path while using the alternate path for production, be sure that you are familiar with the tools and the loop connections so that the correct portion is being exercised and you do not unplug anything in the active path.

For a type 2 configuration, use the features of the switches and managed hubs and the capability of MSCS to isolate resources from the bad or marginal path before beginning debug activities. Switches and managed hubs allow a view of log information that shows what problems have been occurring, as well as diagnostics that can be initiated from these managed elements. Also, a type 2 configuration has the capability to have more than one RAID controller unit behind a switch or managed hub. In the diagnostic maps, the switches and managed hubs are referred to generically as *concentrators*. Figure 11 shows a type 2 configuration with multiple controller units.

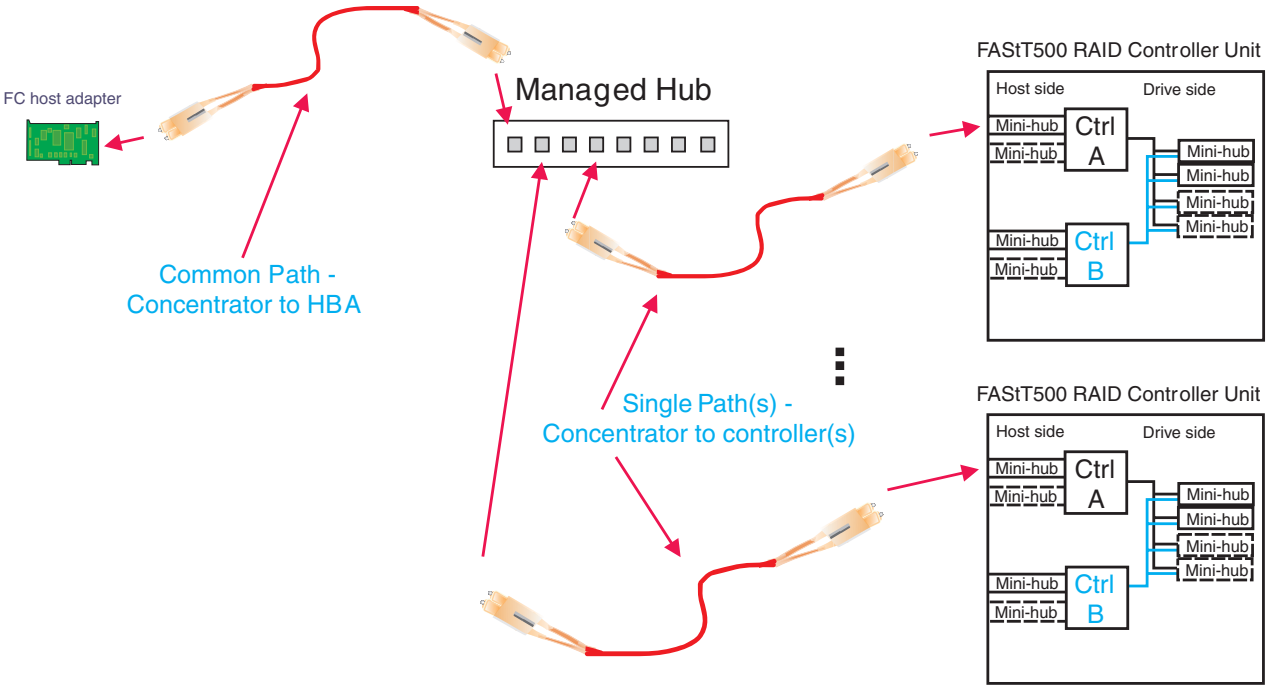

Figure 11. Type 2 configuration with multiple controller units

Debugging example sequence

An example sequence for debugging a type 2 MSCS configuration is shown in the following sequence of figures.

You can attach multiple server pairs to the switches by using zoning or partitioning for pair isolation or combinations of type 1 and type 2 configurations. Break the larger configuration into its smaller subelements and work with each piece separately. In this way you can remove the good path and leave only the bad path, as shown in the following sequence.

1. One controller is passive. In the example shown in Figure 12 on page 74, controller B is passive.

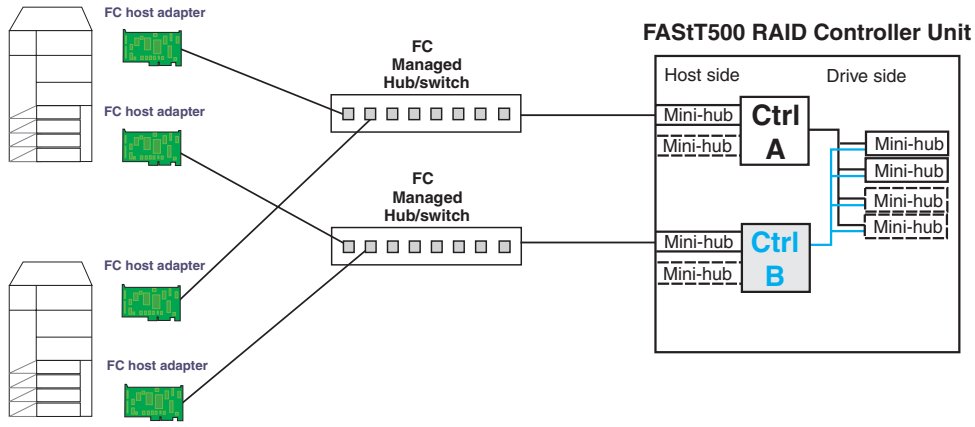

Figure 12. Passive controller B

2. All I/O is flowing through controller A. This yields the diagram shown in Figure 13 for debugging.

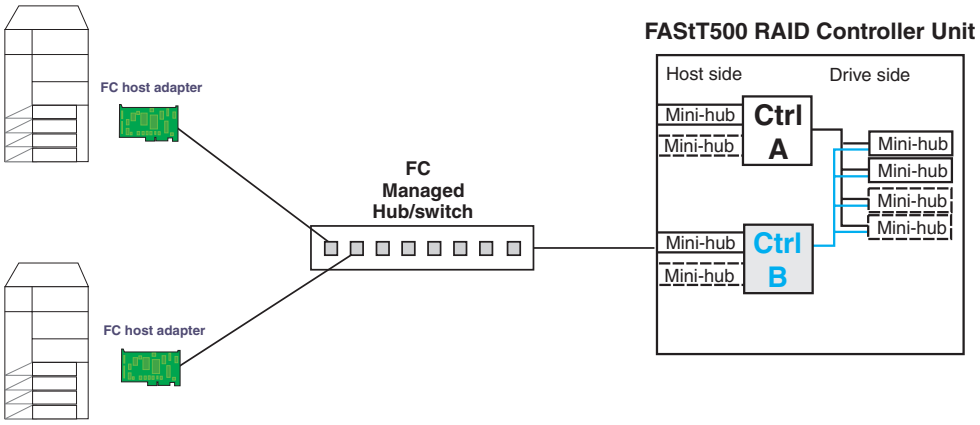

Figure 13. All I/O flowing through controller A

3. To see more clearly what is involved, redraw the configuration showing the path elements in the loop, as shown in Figure 14 on page 75.

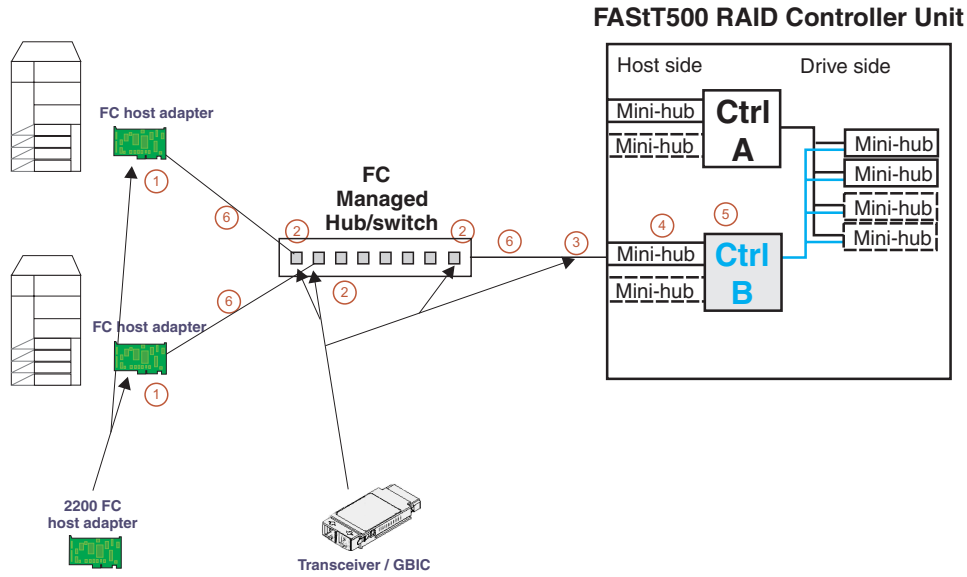

Figure 14. Path elements loop

The elements of the paths shown in Figure 14 are as follows:

1. Host adapter with optical transceiver
2. Optical transceiver in managed hub or GBIC in switch
3. GBIC in controller mini-hub
4. Mini-hub
5. RAID controller
6. Optical cables

Chapter 8. PD hints: Passive RAID controller

You should be referred to this chapter from a PD map or indication. If this is not the case, see Chapter 2, “Problem determination starting points,” on page 3.

After you read the relevant information in this chapter, return to “RAID Controller Passive PD map” on page 9.

Use the DS4000 Storage Manager client to view the controller properties of the passive controller, which appears as a dimmed icon.

As shown in Figure 15, right-click the dimmed controller icon and click **Properties**.

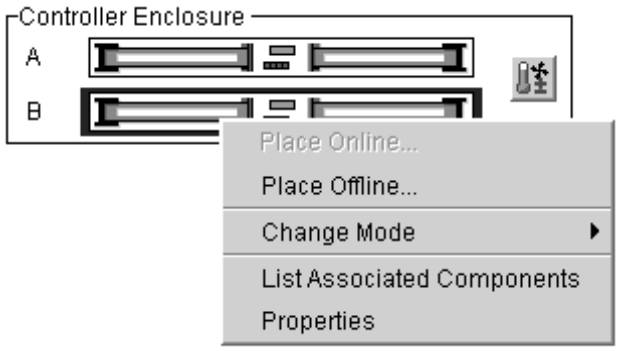

Figure 15. Controller right-click menu

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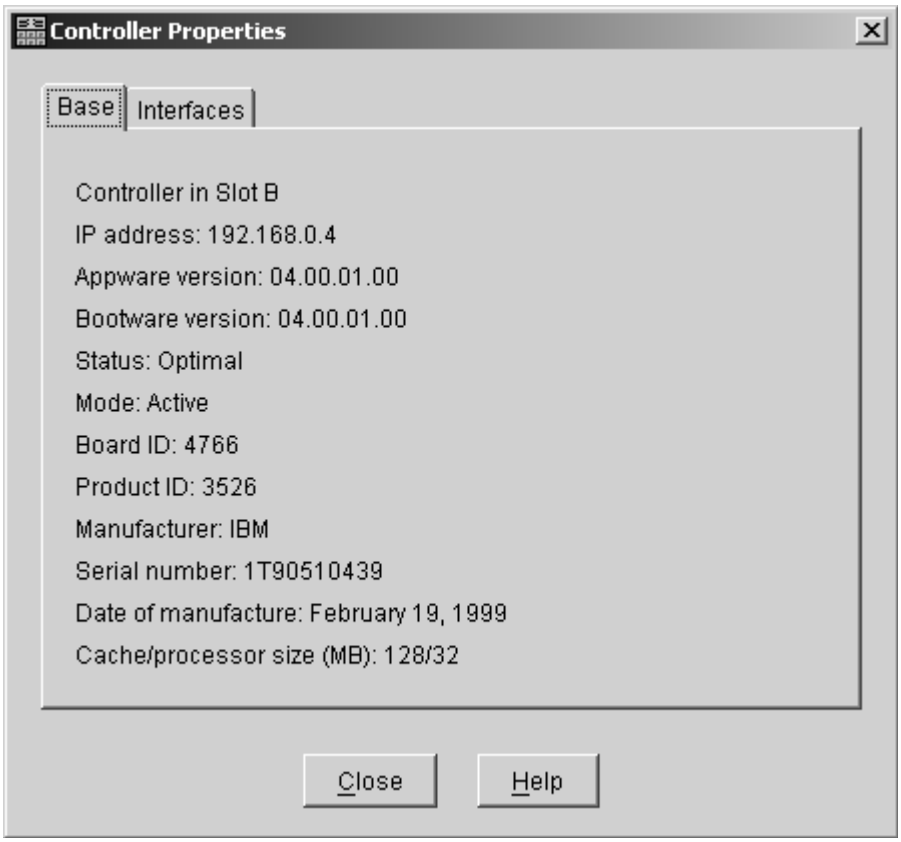

Figure 16. Controller Properties window

If the Controller Properties view (shown in Figure 16) of the dimmed controller icon does not include a message about it being cached, then the controller is passive. Return to the PD map at the page that referred you here ("RAID Controller Passive PD map" on page 9) and continue.

If the Controller Properties information cannot be retrieved, then call IBM Support.

Perform the following steps when you encounter a passive controller and want to understand the cause:

1. Check the controller LEDs to verify that a controller is passive and to see which controller is passive.
2. Look on the system event viewer of the server to find the SYMarray event ID 18. When you find it, write down the date, time, and SRB status. (The SRB status is found in offset x3A in the Windows NT event log. For an example of offset x3A, see the fourth row, third column of the figure on page 58.)
3. If multiple servers are involved, repeat step 2 for each server.
4. Look for the first event ID 18 found in step 2. The SRB status provides information as to why the failure occurred but is valid only if the high order bit is on (8x, 9x, Ax).
5. Check the history of the event log looking for QL2200/QL2100 events. These entries will give further clues as to whether the fibre loop was stable or not.
   - SRB statuses of 0x0d, 0x0e, and 0x0f point to an unstable loop. (To find the value, discard the high order "valid" bit. For example, 8d yields an SRB status of 0d.)
   - QL2200/2100 events of 80110000, 80120000 indicate an unstable loop.

6. If an unstable loop is suspected, diagnose the loop using the fibre path PD aids (see “Fibre Path PD map 1” on page 18).
7. If the diagnosis in step 6 does not reveal the problem, then the adapter and the controller might be the cause. If you determine that the adapter and controller caused the problem, then reset all fibre components on the path and retest.
8. If fibre cabling can be rearranged, swap the adapter cabling so that the adapter communicating to controller A is now connected to controller B (and vice-versa).

   Note: *Do not* do this in a system that is still being used for business. It is useful for bring-up debug.
9. When the problem is resolved, set the controller back to active and rebalance the logical drives.
10. If the problem occurred as the result of an I/O condition, then rerun and determine whether the failure reoccurs.

Note: If the failure still occurs, then you need to perform further analysis, including the use of the serial port to look at loop statuses. The previous steps do not include consideration of switches or managed hubs. If these are included, then see “Hub/Switch PD map 1” on page 13 for helpful tools.

Chapter 9. PD hints: Performing sendEcho tests

You should arrive at this chapter from a PD map or indication. If this is not the case, see Chapter 2, “Problem determination starting points,” on page 3.

After you read the relevant information in this chapter, return to “Single Path Fail PD map 1” on page 20.

The 3526 RAID controllers use MIA copper-to-optical converters, while the FAStT200, FAStT500, DS4400, DS4500, DS4300, and DS4100 controllers use GBICs or SFPs. There are times when these devices, and their corresponding cable mediums, need to be tested to insure that they are functioning properly.

Note: Running the loopback test for a short period of time might not catch intermittent problems. It might be necessary to run the test in a continuous loop for at least several minutes to track down intermittent problems.

Setting up for a loopback test

This section describes how to set up for a loopback test.

Loopback test for MIA or mini-hub testing

Perform the following steps to set up a loopback test:

1. Remove the fiber-optic cable from the controller MIA or mini-hub.
2. Depending on whether you are working with a 3526 RAID controller or with a FAStT500, DS4400, DS4500, DS4300, or DS4100 RAID controller, perform one of the following actions to set up a loopback test:
   a. For a Type 3526 RAID controller, install a wrap plug to the MIA on controller A. See Figure 17.

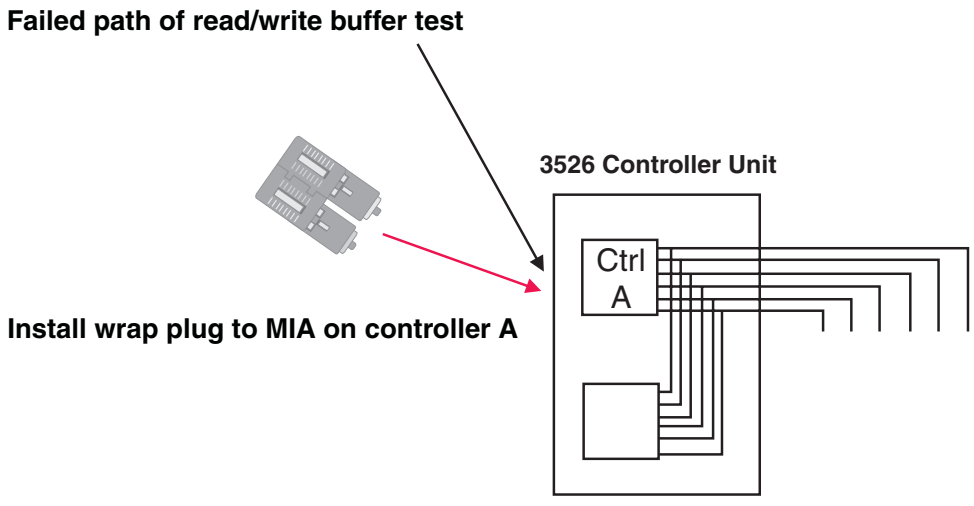

Figure 17. Install wrap plug to MIA on controller A

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b. For a FAStT500, DS4400, DS4500, DS4300, or DS4100 RAID controller, install a wrap plug to the GBIC or SFP in the mini-hub on controller A. See Figure 18.

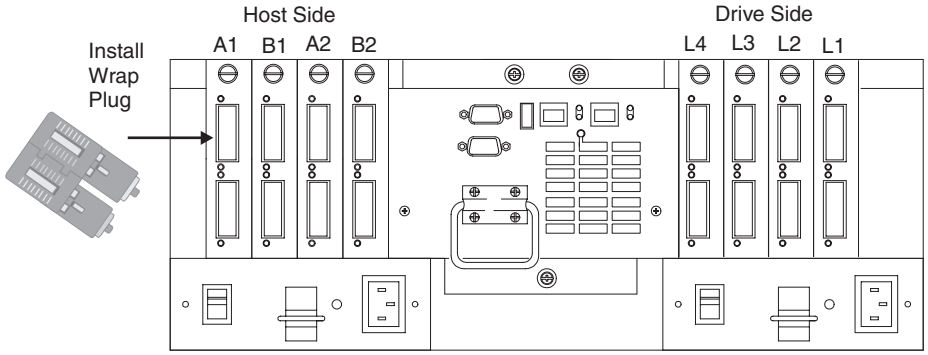

Figure 18. Install wrap plug to GBIC or SFP in mini-hub on controller A

3. Go to the appropriate Loopback Test section (either "Running the loopback test on a 3526 RAID controller" on page 83 or "Running the loopback test on a FAStT200, FAStT500, DS4400, DS4300, DS4100, or DS4800 RAID controller" on page 83).

Loopback test for optical cable testing

Perform the following steps for optical cable testing:

1. Detach the remote end of the optical cable from its destination.
2. Plug the female-to-female converter connector from your kit onto the remote end of the optical cable.
3. Insert the wrap plug from your kit into the female-to-female converter. See Figure 19.

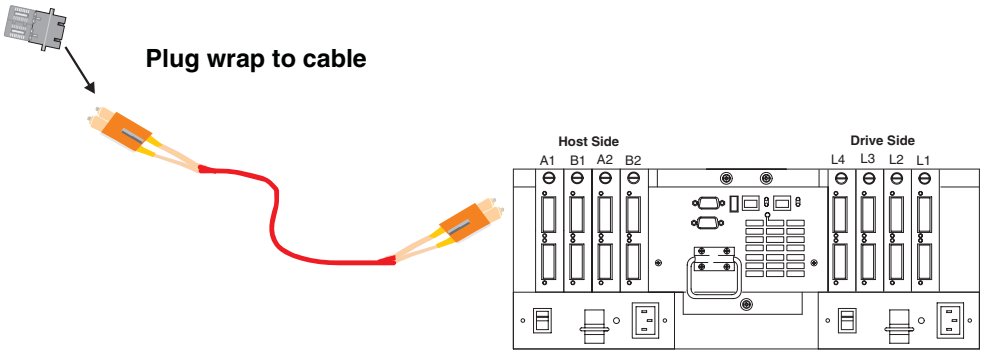

Figure 19. Install wrap plug

4. Go to the appropriate loopback test section (either "Running the loopback test on a 3526 RAID controller" on page 83 or "Running the loopback test on a FAStT200, FAStT500, DS4400, DS4300, DS4100, or DS4800 RAID controller" on page 83).

Running the loopback test on a 3526 RAID controller

Perform the following steps for a loopback test on a 3526 RAID controller:

1. In the controller shell, type the following command: `fc 5`
2. From the output, write down the AL_PA (Port_ID) for this controller.
3. Type the command

   `isp sendEcho,<AL_PA>,<# of iterations>`

   It is recommended that you use **50 000** for `# of iterations`. A value of **-1** will run for an infinite number of iterations. Message output to the controller shell is generated for every 10 000 frames sent.
4. Type the command `stopEcho` when tests are complete.

Running the loopback test on a FAStT200, FAStT500, DS4400, DS4300, DS4100, or DS4800 RAID controller

Perform the following steps for a loopback test on a FAStT200, FAStT500, DS4400, DS4300, DS4100, or DS4800 RAID controller:

1. In the controller shell, type the following command: `fcAll`
2. From the output, write down the AL_PA (Port_ID) for the channel to be tested.
3. Type the command `fcChip=X` where X=the chip number for the loop to be tested.
4. Type the command

   `isp sendEcho,<AL_PA>,<# of iterations>`

   It is recommended that you use **50 000** for `# of iterations`. A value of **-1** will run for an infinite number of iterations. Message output to the controller shell is generated for every 10 000 frames sent.
5. Type the command `stopEcho` when tests are complete.

If the test is successful, you will receive the following message:

```
Echo accept (count n)
```

If you receive the following message:

```
Echo timeout interrupt: interrupt ... end echo test
```

or if you receive nonzero values after entering the command `isp sendEcho`, then there is still a problem. Continue with the "Single Path Fail PD map 1" on page 20.

Chapter 10. PD hints: Tool hints

You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, “Problem determination starting points,” on page 3.

This chapter contains the following tool hints:

Determining the configuration

Use FAStT MSJ to determine what host adapters are present and where they are in the systems, as well as what RAID controllers are attached and whether they are on Fabric (switches) or loops. Alternately, you can click **Control Panel -> SCSI adapters** in Windows NT or **Control Panel -> System -> Hardware -> Device Manager -> SCSI and RAID Controllers** in Windows 2000.

Figure 20 shows the FAStT MSJ window for a configuration with two 2200 host adapters. When only the last byte of the Port ID displays, this indicates that the connection is an arbitrated loop.

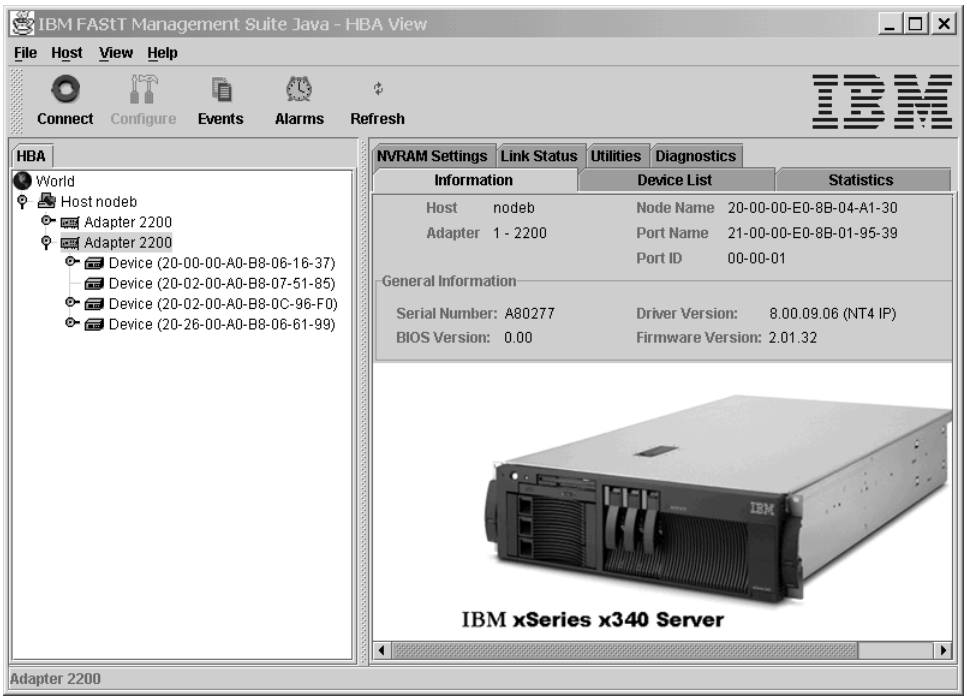

Figure 20. FAStT MSJ window - Two 2200 host adapters

A different configuration is shown in Figure 21 on page 86, which shows a 2200 adapter. Its World Wide Name is 20-00-00-E0-8B-04-A1-30 and it has five devices

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attached to it. When the first two bytes of the Port ID display (and they are other than 00), the configuration is Fabric (switch).

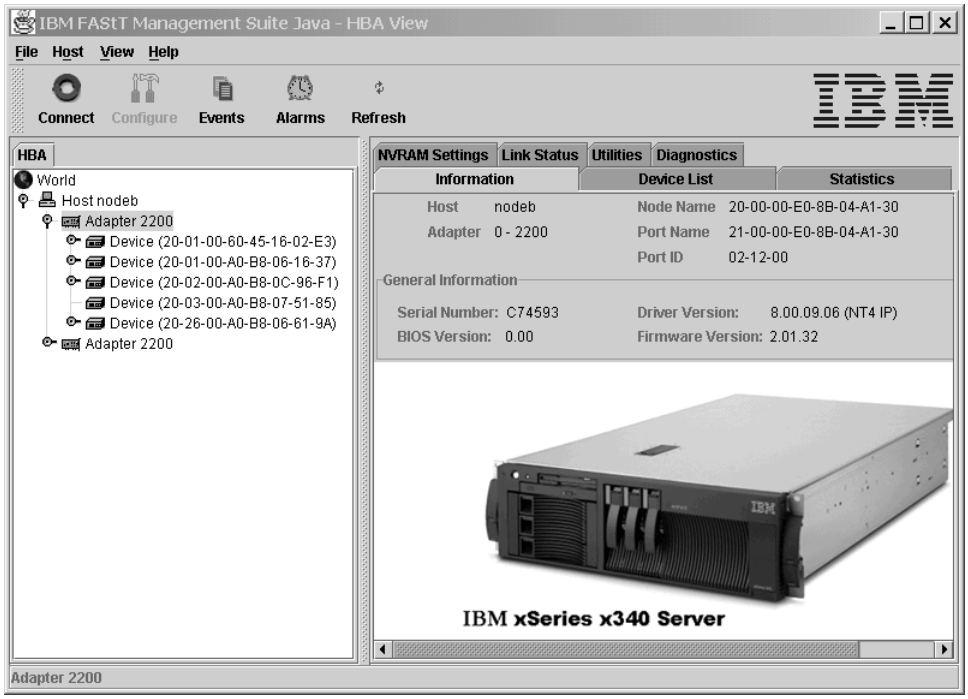

Figure 21. FAStT MSJ window - One 2200 host adapter

As shown in Figure 22, if you select one of the devices beneath a host adapter, you find that it is a controller in a 3526 RAID controller unit.

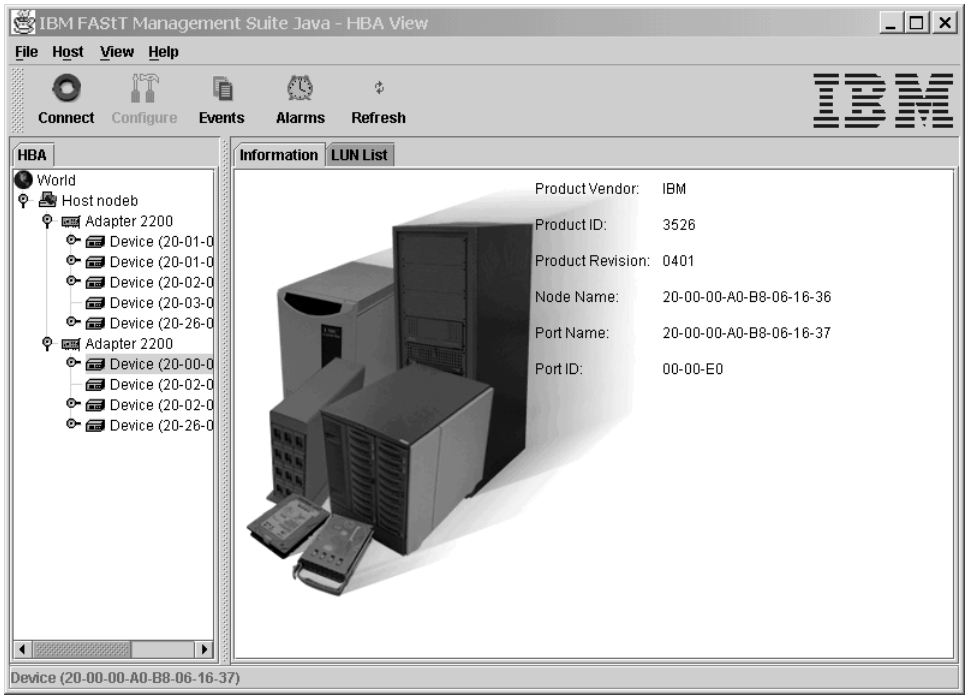

Figure 22. 3526 controller information

Boot-up delay

In Windows operating systems, an extended start-up delay indicates that Windows is not finding the expected configuration that is in its registry. In Linux operating systems, the delay might also be caused by an incorrectly configured storage subsystem (see "Linux port configuration" on page 92 for hints on troubleshooting this problem.)

The delay in the Windows operating system can be caused by several things, but the following example shows what typically happens when a fibre channel cable connecting a host adapter to the storage fails (a failed cable is broken so that no light makes it through the cable).

Note: The following Bluescreen example describes boot-up delay symptoms in a Windows NT operating system. In the Windows 2000 operating system, the Windows 2000 Starting Up progress bar would be frozen. To retrieve the SCSI information in Windows 2000, use the Computer Management dialog box (right-click **My Computer** and select **Manage**.)

1. Windows NT comes up to the blue screen and reports the first two lines (version, number of processors, and amount of memory). Windows NT takes a long time to start. The SCSI Adapters applet in the Control Panel displays the window shown in Figure 23 for the 2100.

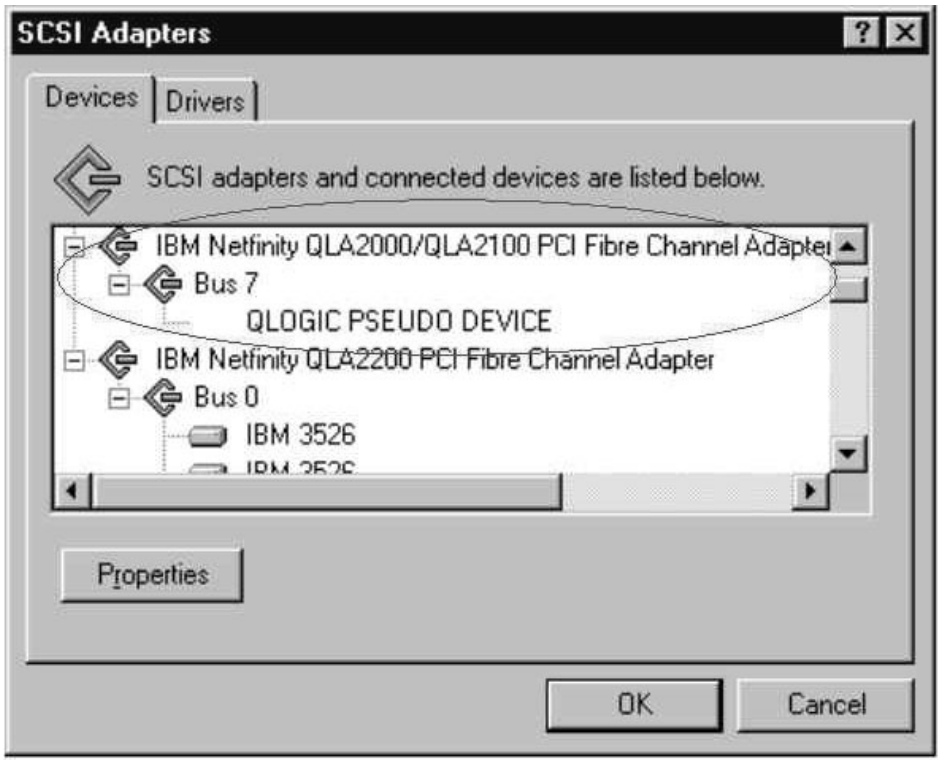

Figure 23. SCSI adapters

There are no other devices; there should have been a Bus 0 with 21 of the IBM 3526s and one IBM Universal Xport. The 2100 DD shows up as started in the Drivers tab here and in the Control Panel Devices applet.

2. WINDISK is started. It takes longer than normal to start (and there is a particularly long pause at the 100% mark) and then reports the message shown in Figure 24.

Figure 24. Disk Administrator information dialog box

3. Because disks were balanced across the two RAID controllers before the error occurred, every other disk shows in the Disk Administrator as offline, and the partition information section is grayed out, giving the following message:

   ```
   Configuration information not available
   ```

   The drive letters do not change for the drives (they are sticky, even though they are set only for boot drive). Because the cable to RAID controller A is the failed cable, it was Disk 0, Disk 2, and so on, that are missing. See Figure 25.

Figure 25. Disk Administrator

4. **If Done:** Return to "Boot-up Delay PD map" on page 11.

Controller units and drive enclosures

In Figure 26 (an EXP500 fibre channel drive enclosure), there are two loops in the box. The ESM on the left controls one loop path and the ESM on the right controls another loop path to the drives. This enclosure can be used with the FAStT500, FAStT200, DS4400, or DS4500.

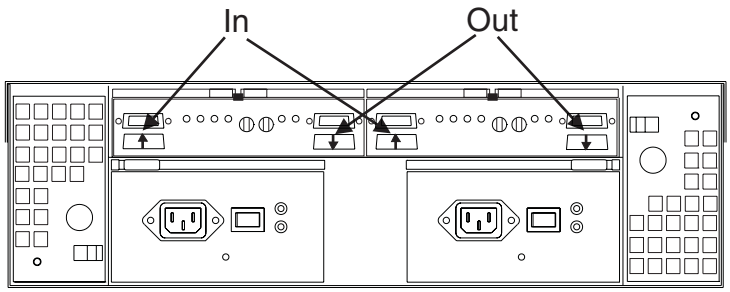

Figure 26. EXP500 fibre channel drive enclosure

Note: In the previous figure, the connections for the GBICs or SFPs are labeled as In and Out. This designation of the connections is for cabling routing purposes only, as all fibre cables have both a transmit fiber and receive fiber in them. Any connection can function as either output or input (transmitter or receiver).

Figure 27 shows the locations of the controller connections in a FAStT500 or DS4400 fibre channel controller unit.

Note: In Figure 27, a FAStT500 controller unit is shown.

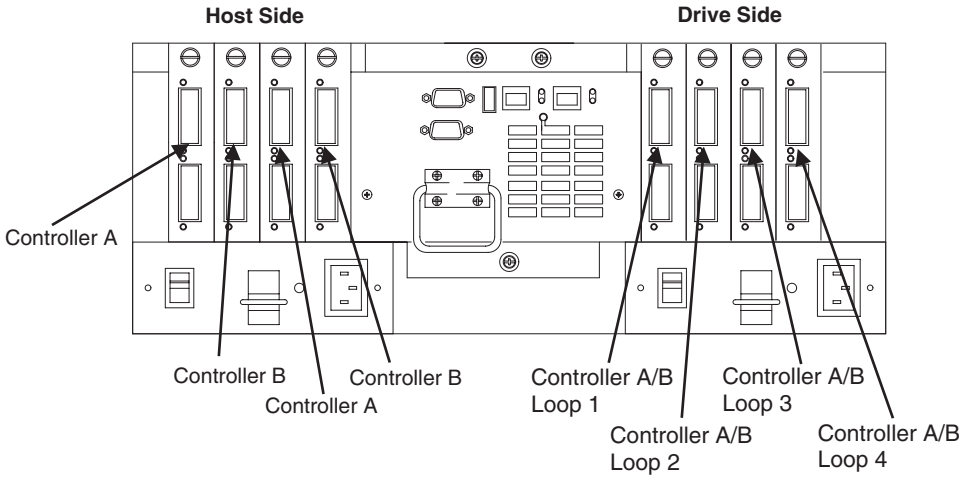

Figure 27. FAStT500 controller connection locations

Figure 28 on page 90 shows the locations of the controller units in a FAStT200 fibre channel controller and drive enclosure unit.

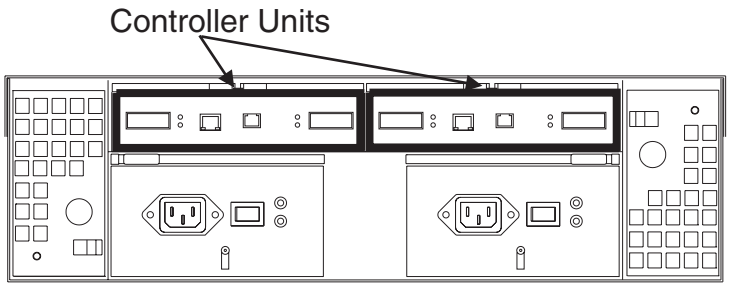

Figure 28. FAStT200 fibre channel controller unit locations

Figure 29 shows a FAStT200 configuration containing both controllers. It uses GBICs for the connection but does not have the mini-hub feature of the FAStT500. There is a place for a single host to attach to each controller without using an external concentrator. The other connection on each is used to attach more drives using EXP500 enclosures.

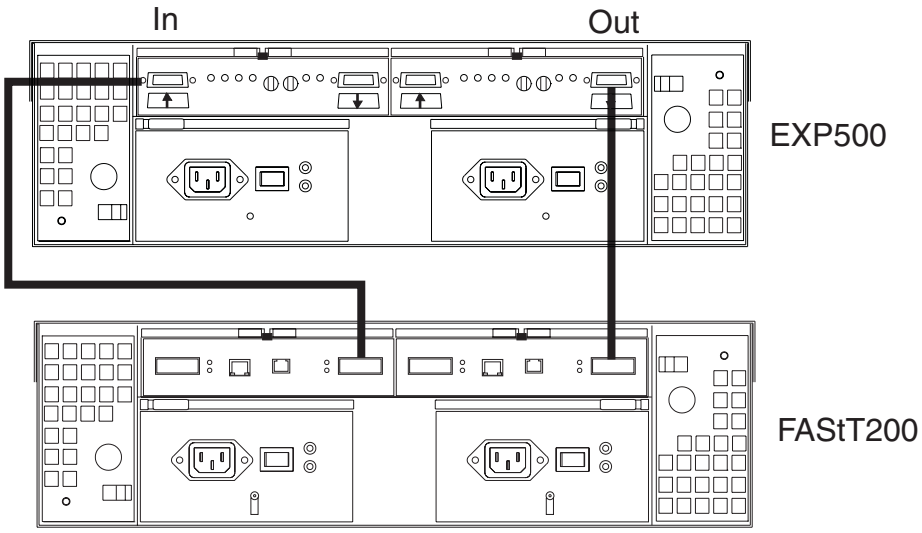

Figure 29. EXP500 and FAStT200 configuration

Controller diagnostics

The DS4000 Storage Manager Diagnostics option enables a user to verify that a controller is functioning properly, using various internal tests. One controller is designated as the Controller Initiating the Test (CIT). The other controller is the Controller Under Test (CUT).

The diagnostics use a combination of three different tests: Read Test, Write Test, and Data Loopback Test. You should run all three tests at initial installation and any time there are changes to the storage subsystem or components that are connected to the storage subsystem (such as hubs, switches, and host adapters).

Note: During the diagnostics, the controller on which the tests are run (CUT) will NOT be available for I/O.

- **Read Test**

  The Read Test initiates a read command as it would be sent over an I/O data path. It compares data with a known, specific data pattern, checking for data integrity and redundancy errors. If the read command is unsuccessful or the data compared is not correct, the controller is considered to be in error and is failed.

- **Write Test**

  A Write Test initiates a write command as it would be sent over an I/O data path (to the Diagnostics region on a specified drive). This Diagnostics region is then read and compared to a specific data pattern. If the write fails or the data compared is not correct, the controller is considered to be in error and is failed and placed offline. (Use the Recovery Guru to replace the controller.)

- **Data Loopback Test**

  Important: The Data Loopback Test does not run on controllers that have SCSI connections between the RAID controllers and drive (model 3526).

  The Data Loopback Test is run only on controllers that have fibre channel connections between the controller and the drives. The test passes data through each controller's drive-side channel, mini-hub, out onto the loop and then back again. Enough data is transferred to determine error conditions on the channel. If the test fails on any channel, then this status is saved so that it can be returned if all other tests pass.

All test results display in the Diagnostics dialog box status area.

Events are written to the DS4000 Storage Manager Event Log when diagnostics is started, and when it is has completed testing. These events will help you to evaluate whether diagnostics testing was successful or failed, and the reason for the failure. To view the Event Log, click **View -> Event Log** from the Subsystem Management Window.

Running controller diagnostics

Important: If diagnostics are run while a host is using the logical drives owned by the selected controller, the I/O directed to this controller path is rejected.

Perform the following steps to run various internal tests to verify that a controller is functioning properly.

1. From the Subsystem Management Window, highlight a controller. Then, either click **Controller -> Run Diagnostics** from the main menu or right-click the controller and click **Run Diagnostics** from the pop-up menu. The Diagnostics dialog box displays.
2. Select the check boxes for the diagnostic tests to be run. Choose from the following list:
   - Read Test
   - Write Test
   - Data Loopback Test
3. To run the Data Loopback Test on a single channel, select a channel from the drop-down list.
4. Select a Data Pattern file for the Data Loopback Test. Select **Use Default Data Pattern** to use the default Data Pattern or **Use Custom Data Pattern file** to specify another file.

   Note: A custom Data Pattern file called diagnosticsDataPattern.dpf is provided on the root directory of the Storage Manager folder. This file can be modified, but the file must have the following properties to work correctly for the test:
   - The file values must be entered in hexadecimal format (00 to FF) with one space ONLY between the values.
   - The file must be no larger than 64 bytes in size. (Smaller files will work but larger files will cause an error.)
5. Click the **Run** button. The Run Diagnostics confirmation dialog box displays.
6. Type yes in the text box, and then click **OK**.

   The selected diagnostic tests begin. When the tests are complete, the Status text box is updated with test results. The test results contain a generic, overall status message, and a set of specific test results. Each test result contains the following information:
   - Test (Read/Write/Data Loopback)
   - Port (Read/Write)
   - Level (Internal/External)
   - Status (Pass/Fail)
7. Click **Close** to exit the dialog box.

   Important: When diagnostics are completed, the controller should automatically allow data to be transferred to it. However, if there is a situation where data transfer is not re-enabled, highlight the controller and click **Data Transfer -> Enable**.

Linux port configuration

Linux operating systems do not use the IBM DS4000 Storage Manager to configure their associated Storage Subsystems. Instead, use FAStT MSJ to perform Device and LUN configuration on Linux operating systems. However, the DS4000 Storage Manager is used to map the DS4000 Storage Servers' logical drives to the appropriate operating system (in this case, Linux). The following sections provide you with hints on how to correctly configure your storage for Linux.

DS4000 Storage Manager hints

Use the DS4000 Storage Manager to map the desired logical drives to Linux storage. See the *Storage Manager User's Guide* for instructions. Note the following:

- Host ports for the Linux host are defined as Linux. See Chapter 14, “Heterogeneous configurations,” on page 137 for more information.
- The Access LUN (LUN 31, also called the UTM LUN) is not present. FAStT MSJ will typically display the following messages when attempting to configure the storage and LUN 31 is detected:
  - `An invalid device and LUN configuration has been detected`
  - `Non-SPIFFI compliant device(s) have been separated (by port names)`

  Note: The Device node name (DS4000 Storage Server World Wide Node name) should appear once in the FAStT MSJ Fibre Channel Port Configuration dialog (see the figure following Step 5 on page 94) for both device ports. The Device port names reflect the DS4000 Storage Server controller Port World Wide Node names. If the Device node name is split (that is, if the Device node name is shown once for each Port name), then an invalid configuration is present. Check the storage mapping once more by using the DS4000 Storage Manager.
- LUNs are sequential and start with LUN 0.
- Prior to configuration, all LUNs are assigned to the controller that is attached to the first HBA.
- Both storage controllers must be active. Failover is only supported in an ACTIVE/ACTIVE mode.

Linux system hints

After you have properly mapped the storage, you will also need to configure the Linux host. See the HBA driver readme file for instructions on how to configure the driver to allow for Failover support.

Make sure the HBAs that are installed in your systems are of the same type and are listed in the modules.conf file in the /etc/ directory. Add the following options string to allow more than 1 LUN to be reported by the driver:

```
options scsi_mod max_scsi_luns=32
```

You might see the following example in the modules.conf file:

```
alias eth1 eepro100
alias scsi_hostadapter aic7xxx
alias scsi_hostadapter1 qla2200
alias scsi_hostadapter2 qla2200
options scsi_mod max_scsi_luns=32
```

FAStT MSJ

Use FAStT MSJ to configure the driver for failover. See Chapter 4, “Introduction to FAStT MSJ,” on page 39 for installation instructions and to familiarize yourself with this application.

Configuring the driver with FAStT MSJ

To configure the driver, launch FAStT MSJ and perform the following steps:

1. Open a new command window and type `qlremote`; then press Enter. This will run qlremote agent in this command window.
2. Open a new command window and run /usr./FAStT_MSJ.
3. Select CONNECT.
4. Enter the IP address of the server or select LOCALHOST.

5. Select CONFIGURE. You will then be presented with the Fibre Channel Port Configuration dialog box (see Figure 30).

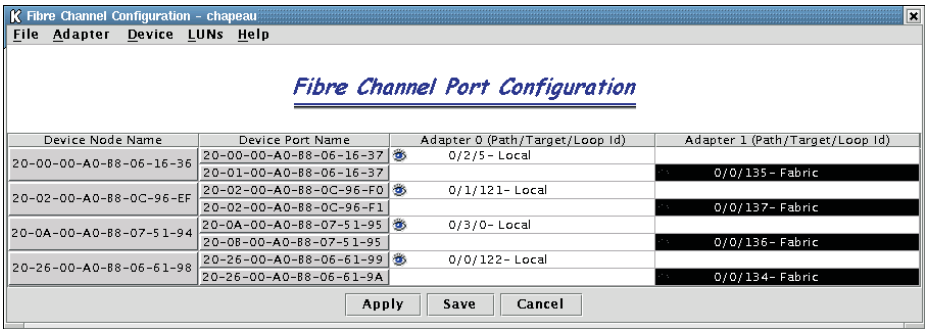

Figure 30. Fibre Channel Port Configuration window

6. Right-click the Device node name.
7. Click **Configure LUNs**. The LUN Configuration window opens (see Figure 31).

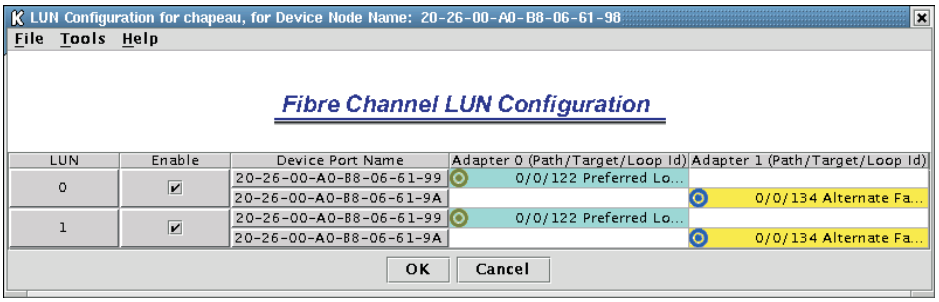

Figure 31. Fibre Channel LUN Configuration window

8. Click **Tools -> Automatic Configuration**.
9. Click **Tools -> Load Balance**.

   Your configuration should then look similar to Figure 32, which shows the preferred and alternate paths alternating between the adapters.

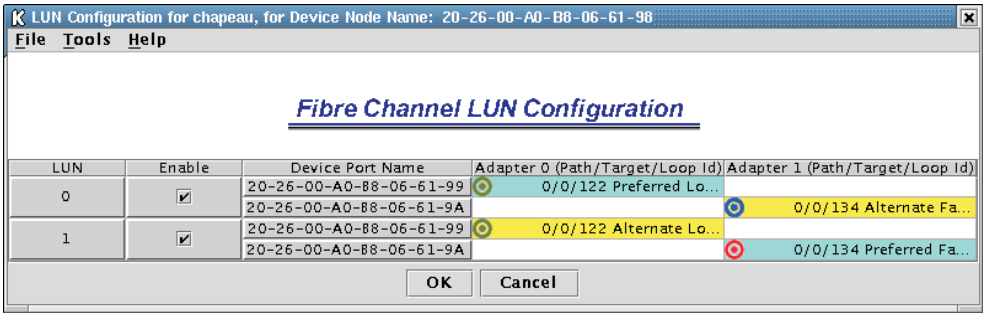

Figure 32. Preferred and alternate paths between adapters

10. Click **OK**.
11. Click **Apply** or **Save**.
12. This will save the configuration into the etc/modules.conf file. Verify that the option string reflecting the new configuration was written to that file. The

string should look like the following example:

```
options qla2300 ConfigRequired=1 ql2xopts=scsi-qla00-adapter
port=210000e08b05e875\;scsi-qla00-tgt-000-di-00-node=202600a0b8066198\;scsi-
qla00-tgt-000-di-00-port=202600a0b8066199\;scsi-qla00-tgt-000-di-00-
preferred=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffd\;scsi
-qla00-tgt-000-di-00-control=00\;scsi-qla00-tgt-001-di-00-
node=200200a0b80c96ef\;scsi-qla00-tgt-001-di-00-port=200200a0b80c96f0\;scsi-
qla00-tgt-001-di-00-
preferred=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;scsi
-qla00-tgt-001-di-00-control=00\;scsi-qla00-tgt-002-di-00-
node=200000a0b8061636\;scsi-qla00-tgt-002-di-00-port=200000a0b8061637\;scsi-
qla00-tgt-002-di-00-
preferred=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;scsi
-qla00-tgt-002-di-00-control=00\;scsi-qla00-tgt-003-di-00-
node=200a00a0b8075194\;scsi-qla00-tgt-003-di-00-port=200a00a0b8075195\;scsi-
qla00-tgt-003-di-00-
preferred=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;scsi
-qla00-tgt-003-di-00-control=00\;scsi-qla01-adapter-port=210000e08b058275\;scsi-
qla01-tgt-001-di-01-node=200200a0b80c96ef\;scsi-qla01-tgt-001-di-01-
port=200200a0b80c96f1\;scsi-qla01-tgt-001-di-01-control=80\;scsi-qla01-tgt-003-
di-01-node=200a00a0b8075194\;scsi-qla01-tgt-003-di-01-
port=200b00a0b8075195\;scsi-qla01-tgt-003-di-01-control=80\;scsi-qla01-tgt-002-
di-01-node=200000a0b8061636\;scsi-qla01-tgt-002-di-01-
port=200100a0b8061637\;scsi-qla01-tgt-002-di-01-control=80\;scsi-qla01-tgt-000-
di-01-node=202600a0b8066198\;scsi-qla01-tgt-000-di-01-
port=202600a0b806619a\;scsi-qla01-tgt-000-di-01-
preferred=0000000000000000000000000000000000000000000000000000000000000002\;scsi
-qla01-tgt-000-di-01-control=80\;
```

FAStT MSJ Hints

The following hints are for using FAStT MSJ to configure Linux ports:

- FAStT MSJ does not automatically launch the agent qlremote. If you are unable to connect the host or hosts, make sure that you have started qlremote.
- Any time a change is made to your storage (for example, if LUNs are added or removed), you must kill qlremote (Ctrl + C), unload your HBA driver, and then re-load it.
  - To unload: modprobe -r qla2x00
  - To load: modprobe qla2x00
  - To restart: qlremote

  You will then need to run FAStT MSJ to perform failover configuration.
- Do not mix HBA types. For example, qla2200 must be matched with another qla2200.
- If you replace an HBA, make sure you change the mapping in the DS4000 Storage Manager to point to the WWN name for the new adapter. You will then need to reconfigure your storage.

Chapter 11. PD hints: Drive side hints and RLS diagnostics

You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, "Problem determination starting points," on page 3.

This chapter contains hints in the following PD areas:

- "Drive side hints"
- "Read Link Status (RLS) Diagnostics" on page 121

Drive side hints

When there is a drive side (device side) issue, looking at DS4000 Storage Manager often helps to isolate the problem. Figure 33 shows the status of drive enclosures attached to the RAID controller unit. Notice that the windows show that enclosure path redundancy is lost. This is an indication that a path problem exists between the controllers and one or more drive enclosures.

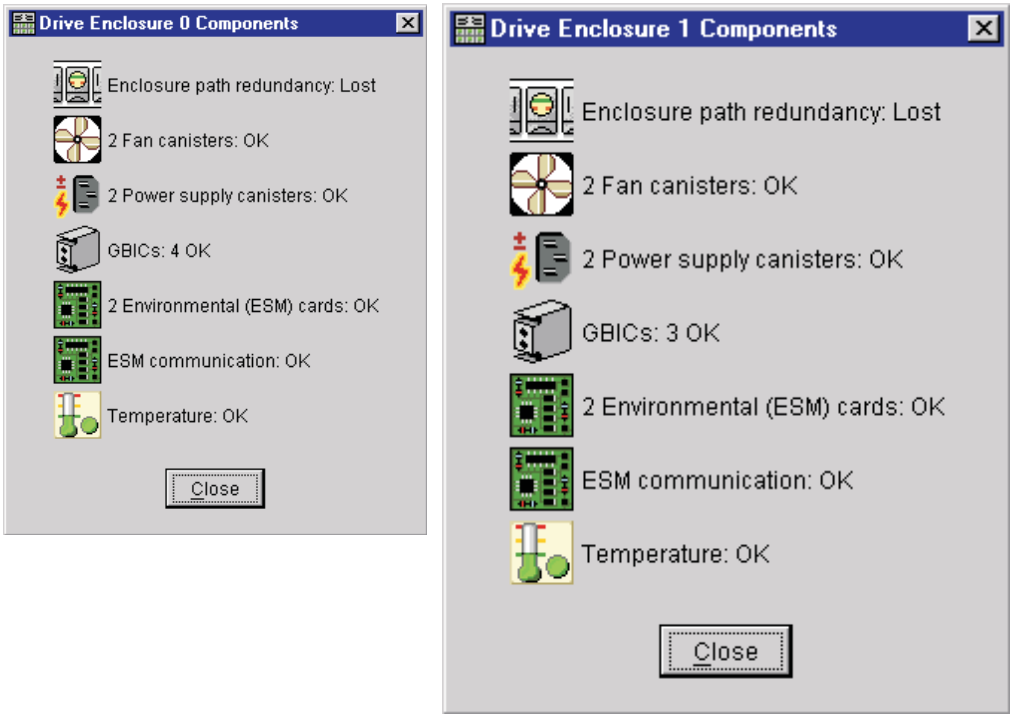

Figure 34 on page 98 shows that an ESM failed.

Figure 33. Drive enclosure components

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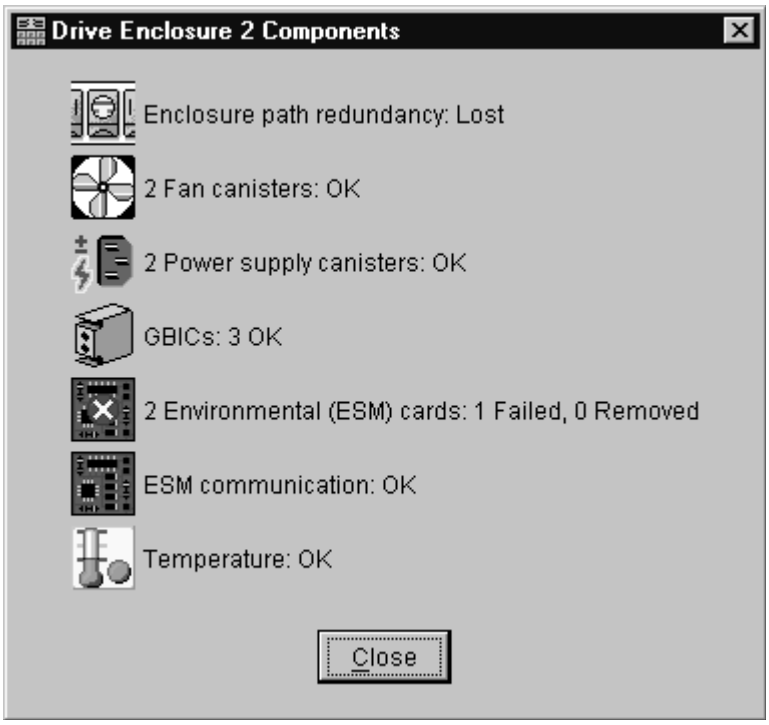

Figure 34. Drive enclosure components - ESM failure

When an ESM fails, go to the Recovery Guru for suggestions on resolving the problem. See Figure 35 on page 99.

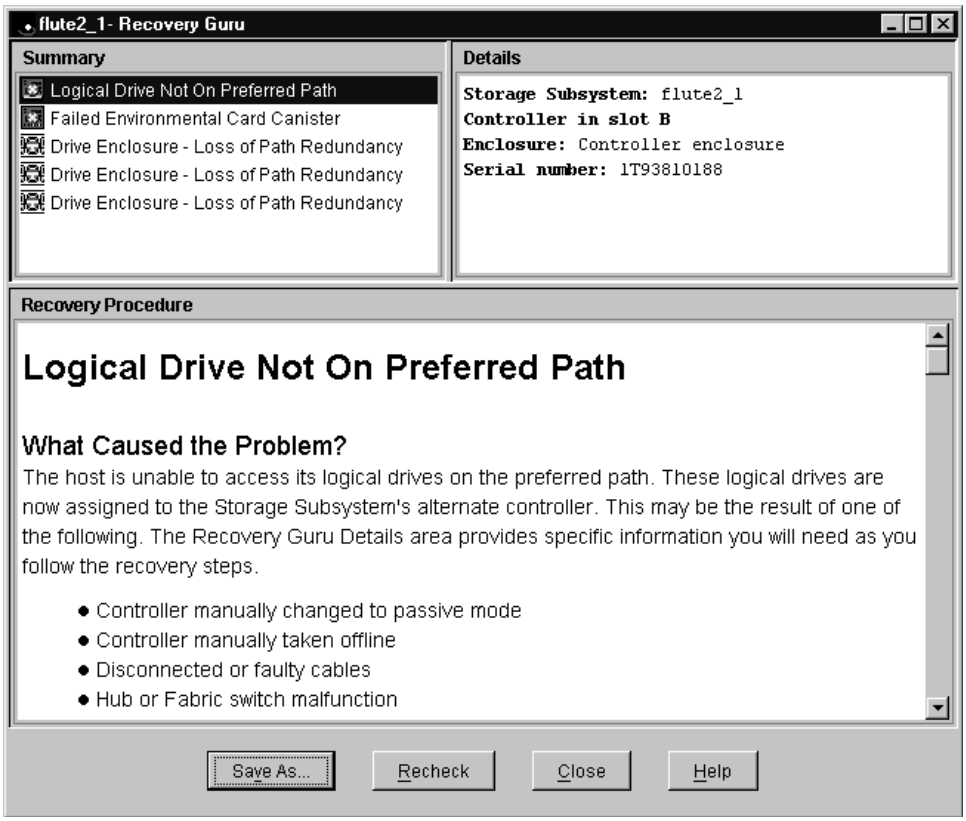

Figure 35. Recovery Guru window

Note: In the Recovery Guru window, the message `Logical drive not on preferred path` does not necessarily pertain to the current problem. The drive could have been moved to the other controller and not moved back. The loss of redundancy and the failed ESM are what is important.

Figure 36 on page 100 also shows the message `Failed or Removed Power Supply Cannister`. However, this message is not significant here because the power supply was removed for purposes of illustration.

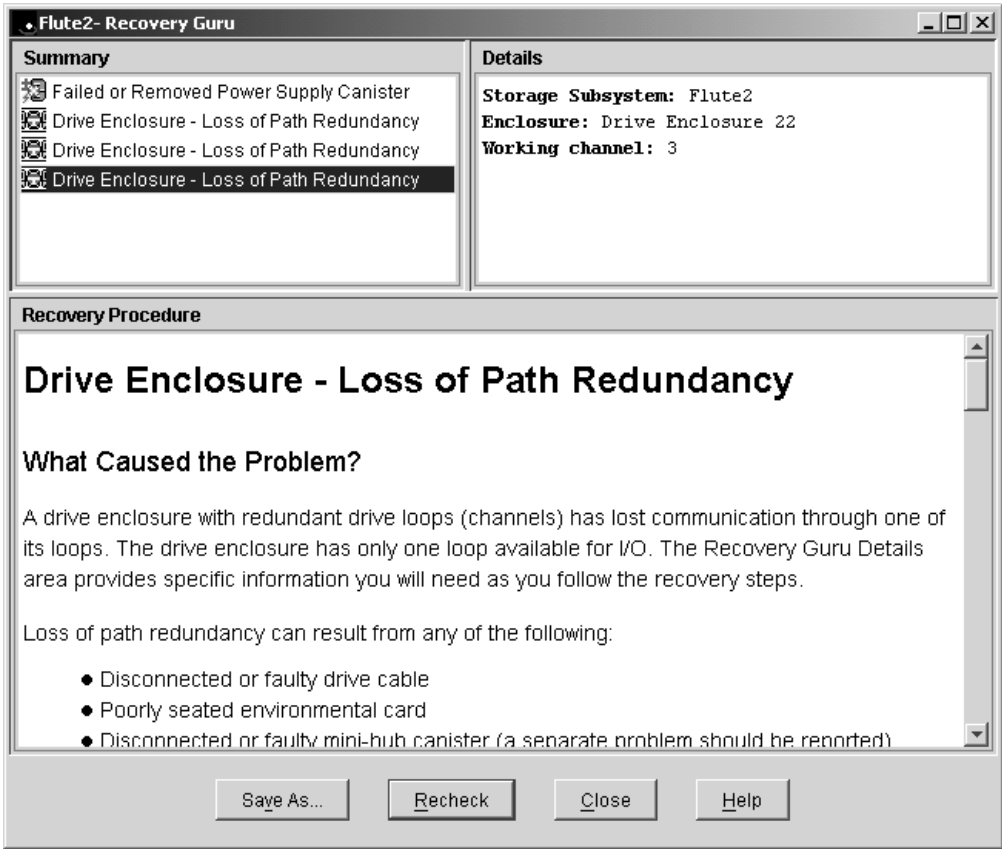

Figure 36. Recovery Guru - Loss of path redundancy

"Indicator lights and problem indications" identifies the indicators for drive side problems for DS400 series products.

Indicator lights and problem indications

The following sections show the indicator lights for each unit on the device side (for the mini-hub, the host side is also shown). In each section, the table following each figure shows the normal and problem indications.

FAStT200 RAID controller

Figure 37 on page 101 shows the controller indicator lights for a FAStT200 controller.

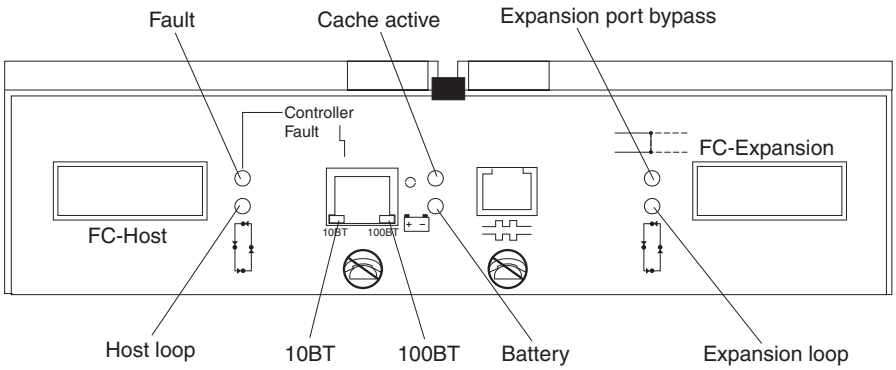

Figure 37. FAStT200 controller indicator lights

Table 15. FAStT200 controller indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	The RAID controller failed
	Host Loop	Green	On	Off	• The host loop is down, not turned on, or not connected • GBIC failed, is loose, or not occupied • The RAID controller circuitry failed or the RAID controller has no power.
	Expansion Loop	Green	On	Off	The RAID controller circuitry failed or the RAID controller has no power.
	Expansion Port Bypass	Amber	Off	On	• Expansion port not occupied • FC cable not attached to an expansion unit • Attached expansion unit not turned on • GBIC failed, FC cable or GBIC failed in attached expansion unit

FAStT500 RAID controller

Figure 38 on page 102 shows the mini-hub indicator lights for the FAStT500 RAID controller.

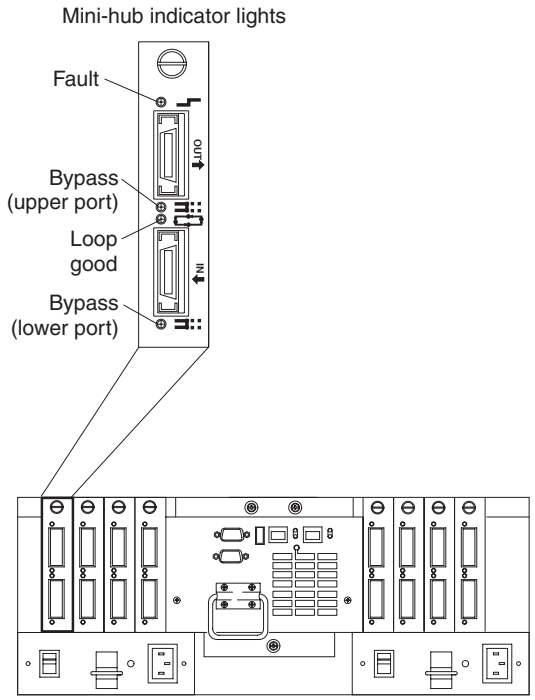

Figure 38. FAStT500 RAID controller mini-hub indicator lights

Table 16. FAStT500 mini-hub indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	Mini-hub or GBIC failed. **Note:** If a host-side mini-hub is not connected to a controller, this fault light is always on.
	Bypass (upper port)	Amber	Off	On	• Upper mini-hub port is bypassed • Mini-hub or GBIC failed, is loose, or is missing • Fiber-optic cables are damaged **Note:** If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	• The loop is not operational • Mini-hub failed or a faulty device might be connected to the mini-hub • Controller failed **Note:** If a host-side mini-hub is not connected to a controller, the green light is always off and the fault light is always on.
	Bypass (lower port)	Amber	Off	On	• Lower mini-hub port is bypassed • Mini-hub or GBIC failed, is loose, or is missing • Fiber-optic cables are damaged **Note:** If the port is unoccupied, the light is on.

DS4400 RAID controller

Figure 39 shows the host-side indicator lights on the DS4400 Storage Server.

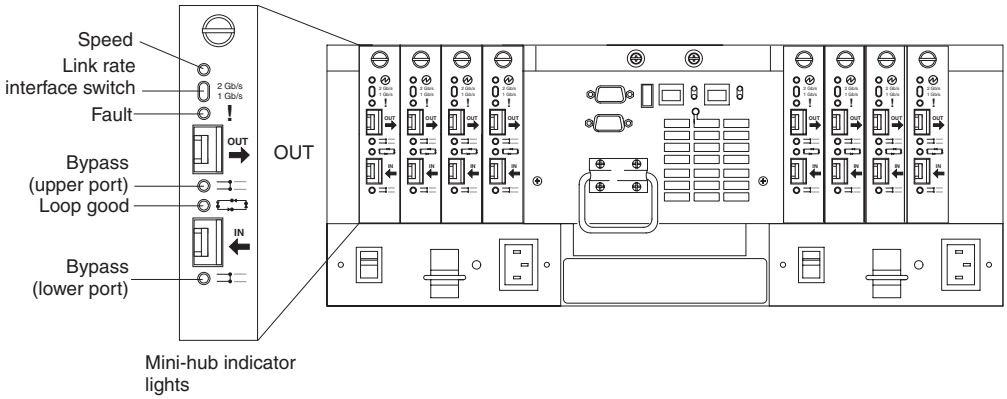

Figure 39. Type 1742 DS4400 Storage Server mini-hub indicator lights

Table 17. Type 1742 DS4400 Storage Server host-side and drive-side mini-hub indicator lights

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Speed	Green	On for 2 Gb Off for 1 Gb		Light on indicates data transfer rate of 2 Gb per second. Light off indicates data transfer rate of 1 Gb per second.
!	Fault	Amber	Off	On	Mini-hub or SFP module failed **Note:** If a host-side mini-hub is not connected to a controller, this fault light is always lit.
⊣⊢	Bypass (upper port)	Amber	Off	On	• Upper mini-hub port is bypassed • Mini-hub or SFP module failed, is loose, or is missing • Fiber-optic cables are damaged **Note:** When there are two functioning SFP modules installed into the mini-hub ports and there are no fibre channel cables connected to them, the bypass indicator is lit. If there is only one functioning SFP module installed in a host-side mini-hub port and there are no fibre channel cables connected to it, the indicator light will not be lit. However, the drive-side mini-hub bypass indicator light will be lit when there is one SFP module installed in the mini-hub and the mini-hub has no fibre channel connection.

Table 17. Type 1742 DS4400 Storage Server host-side and drive-side mini-hub indicator lights (continued)

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Loop good	Green	On	Off	• The loop is not operational, no devices are connected • Mini-hub failed or a faulty device is connected to the mini-hub • If there is no SFP module installed, the indicator will be lit • If one functioning SFP module is installed in the host-side mini-hub port and there is no fibre channel cable connected to it, the loop good indicator light will not be lit. If one functioning SFP module is installed in the drive-side mini-hub port and there is no fibre channel cable connected to it, the loop good indicator light will be lit. • Drive enclosure failed (drive-side mini-hub only)
	Bypass (lower port)	Amber	Off	On	• Lower mini-hub port is bypassed; there are no devices connected • Mini-hub or SFP module failed or is loose • Fiber-optic cables are damaged **Note:** When there are two functioning SFP modules installed into the mini-hub port and there are no fibre channel cables connected to them, the bypass indicator light is lit. If there is only one functioning SFP module installed in a host-side mini-hub and there are no fibre channel cables connected to it, the indicator light is not lit. However, the drive-side mini-hub bypass indicator light will be lit when there is one functioning SFP module installed in the mini-hub port and the mini-hub has no fibre channel cables connected to it.

DS4500 RAID controller

Figure 40 on page 105 shows the host-side indicator lights.

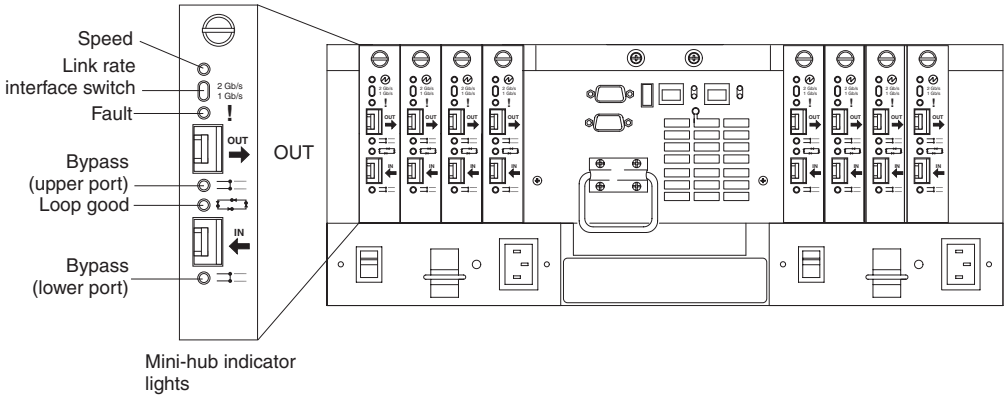

Figure 40. Type 1742 DS4500 Storage Server mini-hub indicator lights

Table 18 describes the indicator light status when there are fibre channel connections between host-side and drive-side mini-hubs.

Table 18. Type 1742 DS4500 Storage Server host-side and drive-side mini-hub indicator lights

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Speed	Green	On for 2 Gb Off for 1 Gb		Light on indicates data transfer rate of 2 Gb per second. Light off indicates data transfer rate of 1 Gb per second.
!	Fault	Amber	Off	On	Mini-hub or SFP module failed **Note:** If a host-side mini-hub is not connected to a controller, this fault light is always lit.
	Bypass (upper port)	Amber	Off	On	• Upper mini-hub port is bypassed • Mini-hub or SFP module failed, is loose, or is missing • Fiber-optic cables are damaged **Note:** When there are two functioning SFP modules installed into the mini-hub ports and there are no fibre channel cables connected to them, the bypass indicator is lit. If there is only one functioning SFP module installed in a host-side mini-hub port and there are no fibre channel cables connected to it, the indicator light will not be lit. However, the drive-side mini-hub bypass indicator light will be lit when there is one SFP module installed in the mini-hub and the mini-hub has no fibre channel connection.

Table 18. Type 1742 DS4500 Storage Server host-side and drive-side mini-hub indicator lights (continued)

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Loop good	Green	On	Off	• The loop is not operational, no devices are connected • Mini-hub failed or a faulty device is connected to the mini-hub • If there is no SFP module installed, the indicator will be lit • If one functioning SFP module is installed in the host-side mini-hub port and there is no fibre channel cable connected to it, the loop good indicator light will not be lit. If one functioning SFP module is installed in the drive-side mini-hub port and there is no fibre channel cable connected to it, the loop good indicator light will be lit. • Drive enclosure failed (drive-side mini-hub only)
	Bypass (lower port)	Amber	Off	On	• Lower mini-hub port is bypassed; there are no devices connected • Mini-hub or SFP module failed or is loose • Fiber-optic cables are damaged **Note:** When there are two functioning SFP modules installed into the mini-hub port and there are no fibre channel cables connected to them, the bypass indicator light is lit. If there is only one functioning SFP module installed in a host-side mini-hub and there are no fibre channel cables connected to it, the indicator light is not lit. However, the drive-side mini-hub bypass indicator light will be lit when there is one functioning SFP module installed in the mini-hub port and the mini-hub has no fibre channel cables connected to it.

DS4300 and DS4100 RAID controllers

Figure 41 shows the RAID controller indicator lights for the DS4300 and DS4100 Storage Servers.

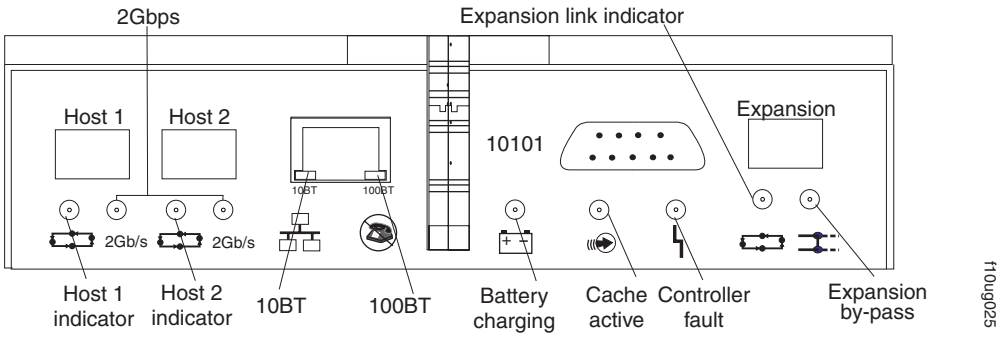

Figure 41. DS4300 and DS4100 RAID controller LEDs

Table 19. DS4300 and DS4100 RAID controller LEDs

Icon	LED	Color	Operating states[1]
	Fault	Amber	• **Off** - Normal operation. • **On** - One of the following situations has occurred: – The RAID controller has failed. – The RAID controller was placed offline – The controller battery had failed (in conjunction with the battery LED in off state).
	Host loop	Green	• **On** - Normal operation. • **Off** - One of the following situations has occurred: – The host loop is down, not turned on, or not connected. – A SFP has failed, or the host port is not occupied. – The RAID controller circuitry has failed, or the RAID controller has no power.
	Cache active	Green	• **On** - There is data in the RAID controller cache. • **Off** - One of the following situations has occurred: – There is no data in cache. – There are no cache options selected for this array. – The cache memory has failed, or the battery has failed.
	Battery	Green	• **On** - Normal operation. • **Flashing** - The battery is recharging or performing a self-test. • **Off** - The battery or battery charger has failed.

Table 19. DS4300 and DS4100 RAID controller LEDs (continued)

Icon	LED	Color	Operating states[1]
	Expansion port bypass	Amber	• **Off** - Normal operation. • **On** - One of the following situations has occurred: – An SFP module is inserted in the drive loop port and the fibre-channel cable is not attached to it. – The fibre-channel cable is not attached to an expansion unit. – The attached expansion unit is not turned on. – An SFP has failed, a fibre-channel cable has failed, or an SFP has failed on the attached expansion unit.
	Expansion loop	Green	• **On** - Normal operation. • **Off** - The RAID controller circuitry has failed, or the RAID controller has no power.
2Gbps	Fibre channel port speed	Green	• **On** - Normal operation (host connection is at 2Gbps) • **Off** - Host connection is at 1Gbps
10BT	10BT	Green	• **If the Ethernet connection is 10BASE-T:** The 10BT LED is on, 100BT LED flashes faintly. • **If the Ethernet connection is 100BASE-T:** 10BT LED is off, 100BT LED is on. • **If there is no Ethernet connection** - Both LEDs are off.
100BT	100BT		
[1] Always use the Storage Manager client to identify the failure.			

DS4800 RAID controllers

Figure 42 on page 109 shows the RAID controller indicator lights for the DS4800 Storage Subsystem. For complete information about the DS4800 Storage Subsystem, refer to the *IBM TotalStorage DS4800 Storage Subsystem Installation, User's, and Maintenance Guide*.

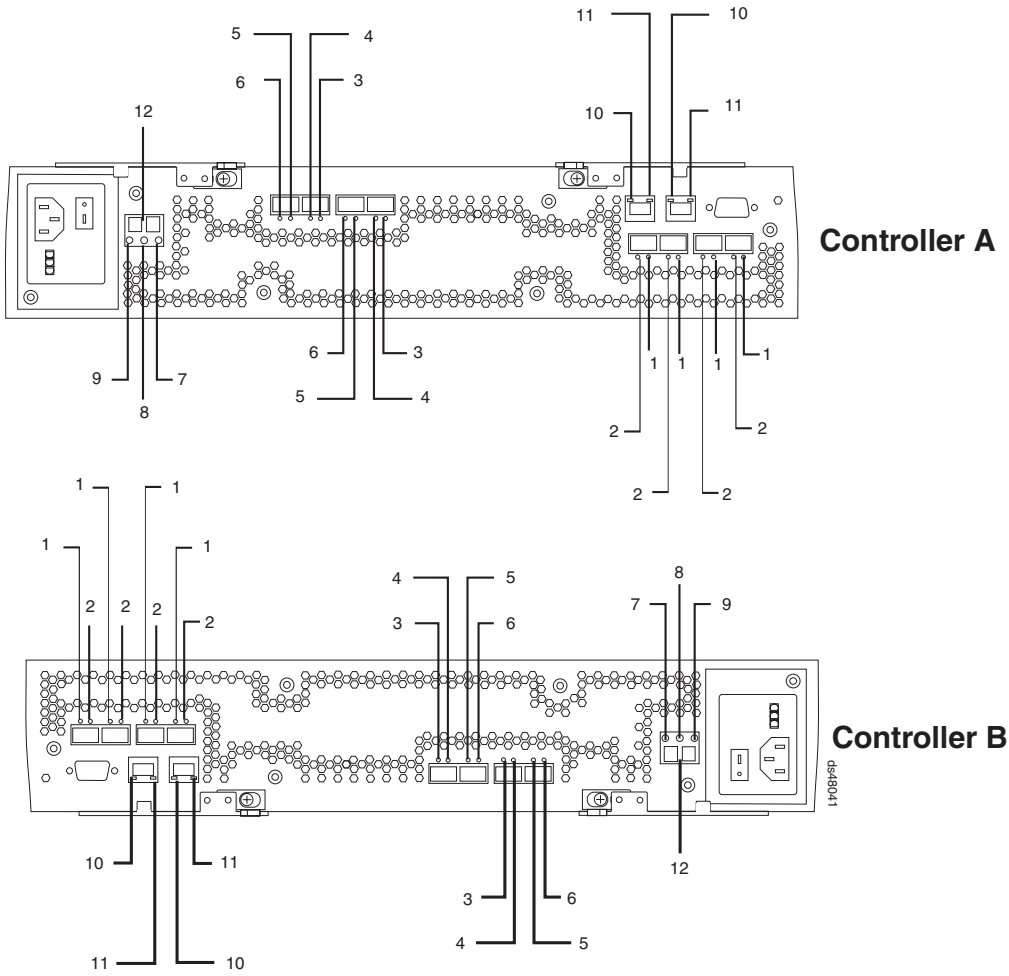

Figure 42. DS4800 RAID controller LEDs

Table 20. DS4800 RAID controller LEDs

Legend	LED	Color	Normal Status	Problem Status
1	Host Channel Speed – L1	Green LED	See Table 21 on page 112.	
2	Host Channel Speed – L2	Green LED		

Table 20. DS4800 RAID controller LEDs (continued)

Legend	LED	Color	Normal Status	Problem Status
3	Drive Port Bypass (one LED per port)	Amber LED	Off	On = Bypass problem • An SFP module is inserted in the port and the connected fibre channel is either absent or not properly connected • The storage expansion enclosure connected to this port is not powered on • There is a problem with the fibre channel connection between this port and the fibre channel port of the connected ESM in the storage expansion enclosure.
4	Drive Channel Speed – L1	Green LED	See Table 21 on page 112.	
5	Drive Channel Speed – L2	Green LED		

Table 20. DS4800 RAID controller LEDs (continued)

Legend	LED	Color	Normal Status	Problem Status
6	Drive Port Bypass (one LED per port)	Amber LED	Off	On = Bypass problem • An SFP module is inserted in the port and the connected fibre channel is either absent or not properly connected • The storage expansion enclosure connected to this port is not powered on • There is a problem with the fibre channel connection between this port and the fibre channel port of the connected ESM in the storage expansion enclosure.
7	Service Action Allowed	Blue LED	Off	On = Safe to remove
8	Needs Attention	Amber LED	Off	On = Controller needs attention There is a controller fault or a controller is off-line.
9	Cache Active	Green LED	On = Data in cache Off = No data in cache	Not applicable
10	Ethernet Link Speed	Green LED	Off = 10BASE-T On = 100BASE-T	Not applicable
11	Ethernet Link Activity	Green LED	Off = No link established On = Link established Blinking = Activity	Not applicable
12	Numeric Display (enclosure ID and Diagnostic Display)	Green/ yellow seven-segment display	Diagnostic LED = off: Controller ID Diagnostic LED = on: Diagnostic code The Diagnostic LED is located on the Numeric Display.	

The L1 and L2 LEDs for each host and drive channel combine to indicate the status and the operating speed of each host or drive channel.

Table 21. DS4800 host and drive channel LED definitions

LED 1	LED 2	Definition
Off	Off	When both LEDs for a host or drive channel are off, this indicates one or more of the following conditions: • The host or drive channel ports are bad. • An SPF module is inserted with no fibre channel cable attached. • No SFP module is inserted in one or both of the host or drive ports in the channel.
On	Off	The host or drive channel is operating at 1 Gbps.
Off	On	The host or drive channel is operating at 2 Gbps.
On	On	The host or drive channel is operating at 4 Gbps.

EXP500 ESM

Figure 43 shows the indicator lights for the EXP500 ESM.

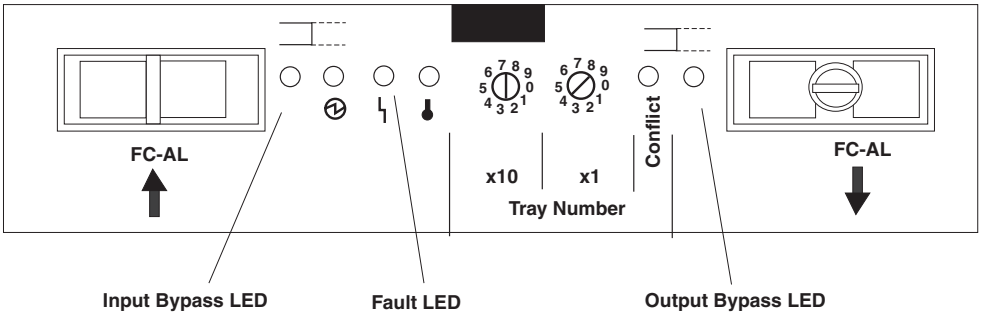

Figure 43. EXP500 ESM indicator lights

Table 22. EXP500 ESM indicator lights

Icon	Indicator Light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Fault	Amber	Off	On	ESM failure **Note:** If fault is on, both In and Out should be in bypass.
	Input Bypass	Amber	Off	On	Port empty • Mini-hub or GBIC failed, is loose, or is missing • Fiber-optic cables are damaged • No incoming signal detected
	Output Bypass	Amber	Off	On	• Port empty • Mini-hub or GBIC failed, is loose, or is missing • Fiber-optic cables are damaged • No incoming signal detected, is loose, or is missing

DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 ESMs

The DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 ESMs and user controls are shown in Figure 44.

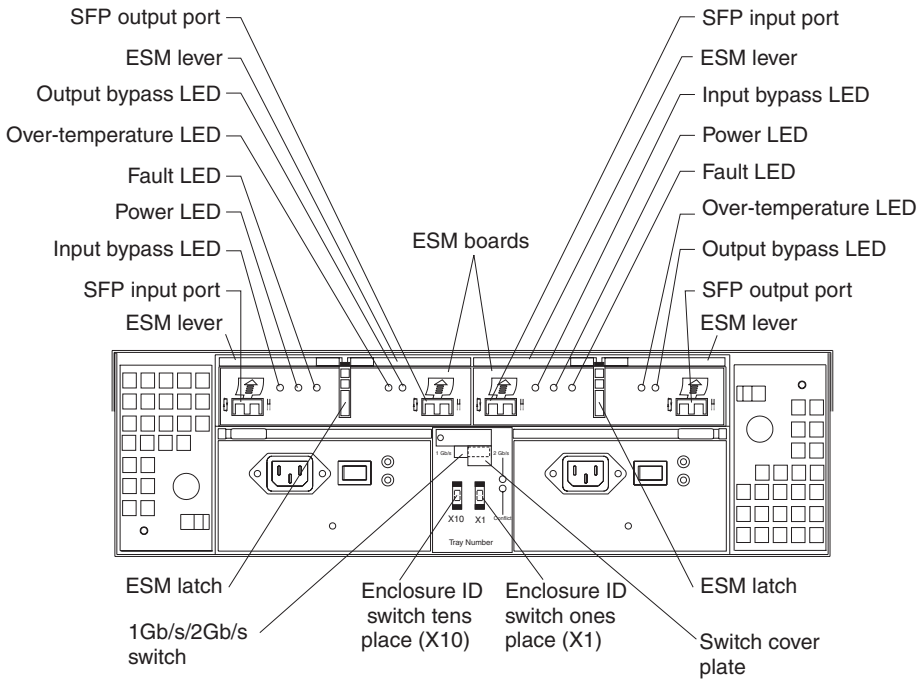

Figure 44. DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 ESMs and user controls

The following table provides diagnostic information on the ESM indicator lights.

Table 23. DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 indicator lights

Problem indicator	Component	Possible cause	Possible solutions
Amber LED is lit	Drive CRU	Drive failure	Replace failed drive.
	Fan CRU	Fan failure	Replace failed fan.
	ESM over-temperature LED	Subsystem is overheated	Check fans for faults. Replace failed fan if necessary.
		Environment is too hot	Check the ambient temperature around the expansion unit. Cool as necessary.
		Defective LED or hardware failure	If you cannot detect a fan failure or overheating problem, replace the ESM.
	ESM Fault LED	ESM failure	Replace the ESM. See your controller documentation for more information.
	ESM Bypass LED	No incoming signal detected	Reconnect the SFP modules and fibre channel cables. Replace input and output SFP modules or cables as necessary.
		ESM failure	If the ESM Fault LED is lit, replace the ESM.
	Front panel	General machine fault	A Fault LED is lit somewhere on the expansion unit (check for Amber LEDs on CRUs).
		SFP transmit fault	Check that the CRUs are properly installed. If none of the amber LEDs are lit on any of the CRUs, this indicates an SFP module transmission fault in the expansion unit. Replace the failed SFP module. See your storage-manager software documentation for more information.
Amber LED is lit and green LED is off	Power-supply CRU	The power switch is turned off or there is an ac power failure	Turn on all power-supply switches.
Amber and green LEDs are lit	Power-supply CRU	Power-supply failure	Replace the failed power-supply CRU.

Table 23. DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 indicator lights (continued)

Problem indicator	Component	Possible cause	Possible solutions
All green LEDs are off	All CRUs	Subsystem power is off	Check that all expansion-unit power cables are plugged in and the power switches are on. If applicable, check that the main circuit breakers for the rack are powered on.
		AC power failure	Check the main circuit breaker and ac outlet.
		Power-supply failure	Replace the power supply.
		Midplane failure	Contact an IBM technical-support representative to service the expansion unit.
Amber LED is flashing	Drive CRUs	Drive rebuild or identity is in process	No corrective action needed.
One or more green LEDs are off	Power supply CRUs	Power cable is unplugged or switches are turned off	Make sure the power cable is plugged in and the switches are turned on.
	All drive CRUs	Midplane failure	Replace the midplane (contact an IBM technical-support representative).
	Several CRUs	Hardware failure	Replace the affected CRUs. If this does not correct the problem, have the ESMs replaced, followed by the midplane. Contact an IBM technical-support representative.
	Front panel	Power-supply problem	Make sure that the power cables are plugged in and that the power supplies are turned on.
		Hardware failure	If any other LEDs are lit, replace the midplane. Contact an IBM technical-support representative.
Intermittent or sporadic power loss to the expansion unit	Some or all CRUs	Defective ac power source or improperly connected power cable	Check the ac power source. Reseat all installed power cables and power supplies. If applicable, check the power components (power units or UPS). Replace defective power cables.
		Power-supply failure	Check the power supply Fault LED on the power supply. If the LED is lit, replace the failed CRU.
		Midplane failure	Have the midplane replaced.

Table 23. DS4000 EXP700, DS4000 EXP710, and DS4000 EXP100 indicator lights (continued)

Problem indicator	Component	Possible cause	Possible solutions
Unable to access drives	Drives and fibre channel loop	Incorrect expansion unit ID settings	Ensure that the fibre channel optical cables are undamaged and properly connected. Check the expansion unit ID settings. **Note:** Change switch position only when your expansion unit is powered off.
		ESM failure	Have one or both ESMs replaced.
Random errors	Subsystem	Midplane feature	Have the midplane replaced.

Troubleshooting the drive side

Always ensure that you are working on the loop side that is no longer active. Unplugging devices in a loop that is still being used by the host can cause loss of access to data.

There are two procedures to troubleshoot problems on the drive side: troubleshooting optical components and troubleshooting copper cables. If the components that make up the FC connections in the drive loops consists of optical FC cables and SFPs/GBICs, see "Troubleshooting optical components." If the components that make up the FC connections in the drive loops consist of copper FC cables, see "Troubleshooting FC copper cables" on page 119.

Note: The diagnostic wrap plug mentioned in these troubleshooting procedures is also known as a loopback adapter.

Troubleshooting optical components

To troubleshoot a problem in the drive side optical components, use the following procedure:

1. Disconnect the cable from the loop element that has the bypass indicator light on. See Figure 45 on page 117.

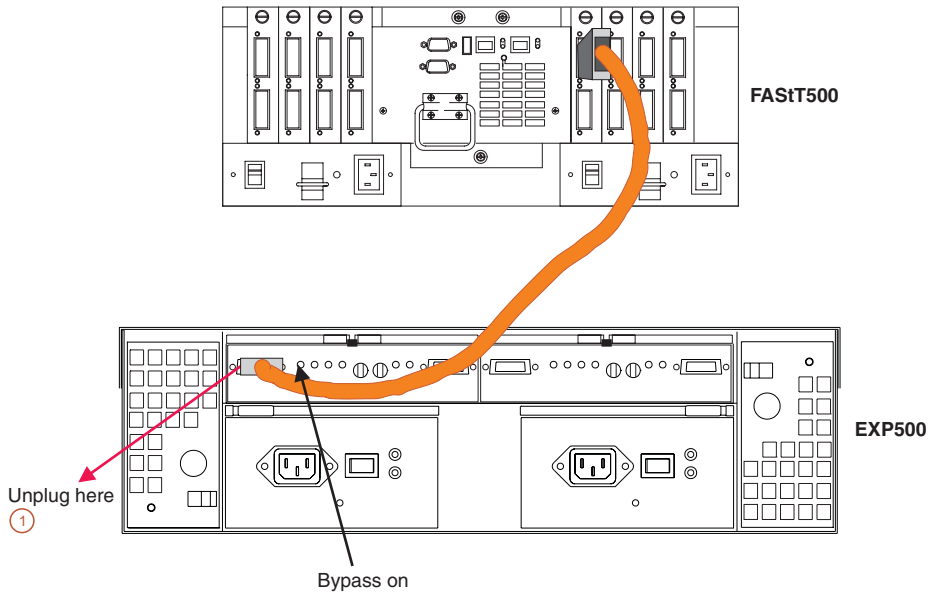

Figure 45. Disconnect cable from loop element

2. Insert a wrap plug in the element from which you disconnected the cable. See Figure 46.
   a. Is the bypass light still on? Replace the element (for example, a GBIC). The procedure is complete.

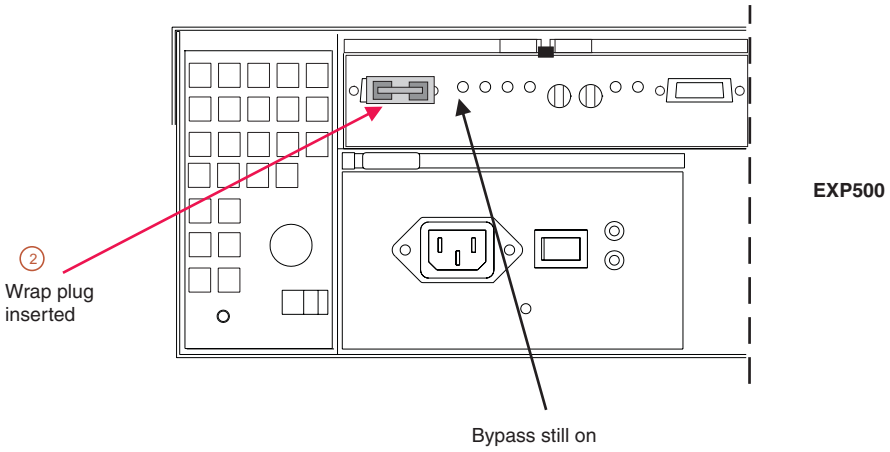

Figure 46. Insert wrap plug

   b. If the bypass light is now out, then this element is not the problem. Continue with step 3.
3. Reinsert the cable. Then unplug the cable at the other end.
4. Insert a wrap plug with an adapter onto the cable end. See Figure 47 on page 118.
   a. Is the bypass light still on? Replace the cable. The procedure is complete.
   b. If the bypass light is now out, then this element is not the problem. Continue with step 5.

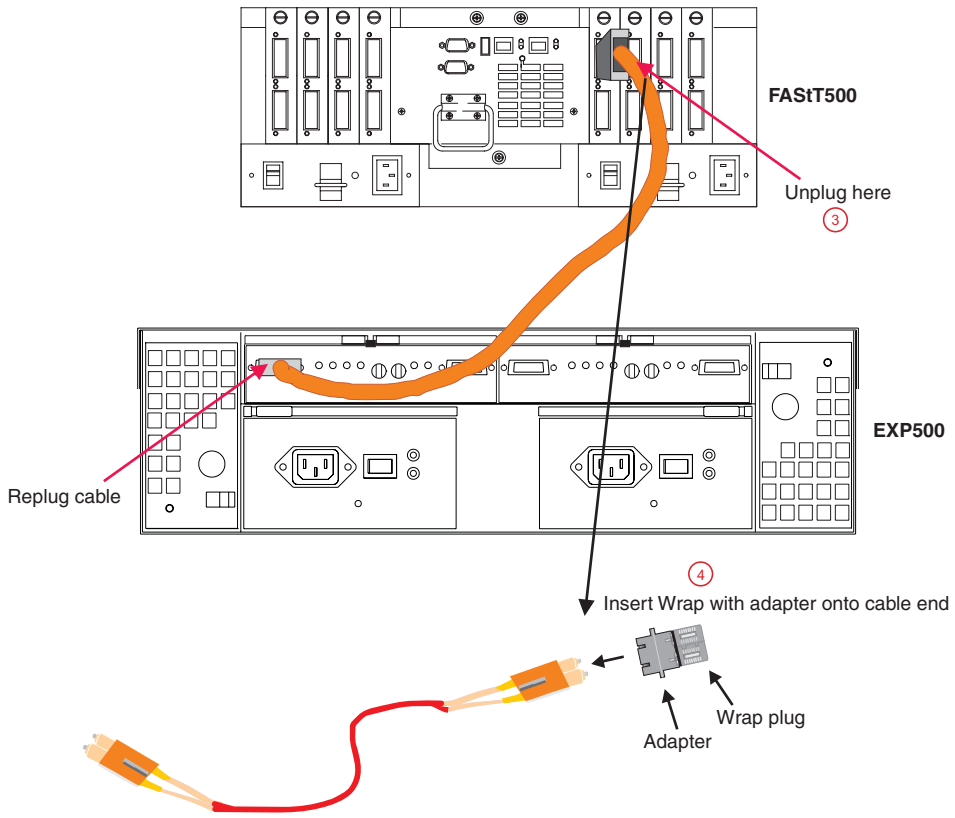

Figure 47. Insert wrap plug with adapter on cable end

5. As was shown in step 4, insert the wrap plug into the element from which the cable was removed in step 3. See Figure 48 on page 119.
   a. Is the bypass light still on? Replace the element (for example, an SFP or a GBIC). The procedure is complete.
   b. If the bypass light is now out, then this element is not the problem. In this fashion, keep moving through the loop until everything is replugged or until there are no more bypass or link down conditions.

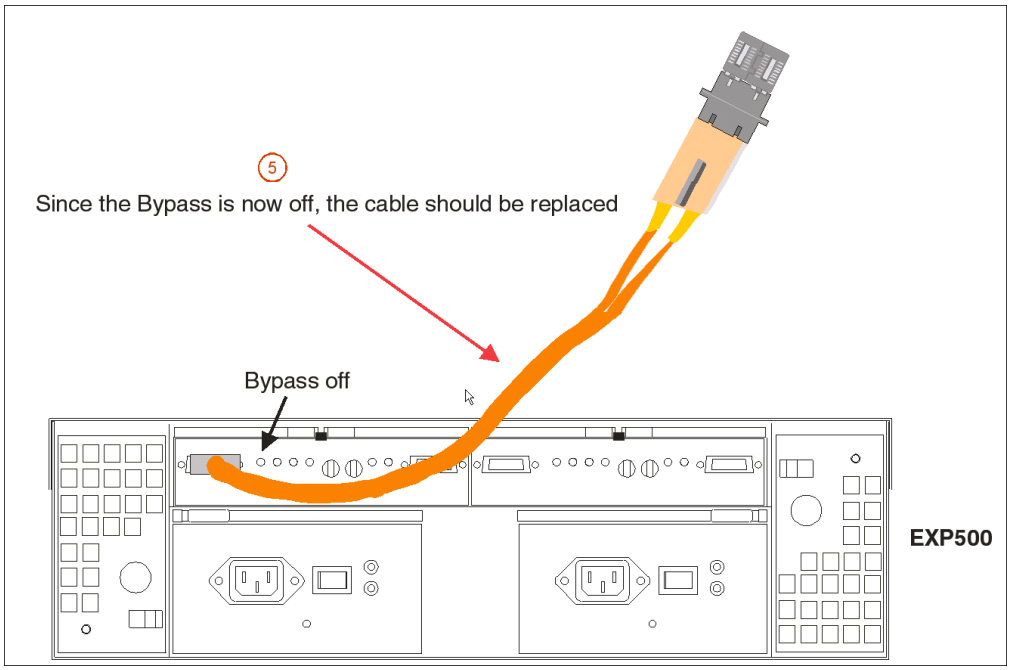

Figure 48. Insert wrap plug into element

Troubleshooting FC copper cables

Use this procedure to troubleshoot the connections between the ESM and controller and between ESMs.

1. Unplug one end of the FC copper cable in the loop element that has the bypass indicator light on. You can start at either cable end. For this example, start by unplugging the end that connects to the controller. See Figure 49.

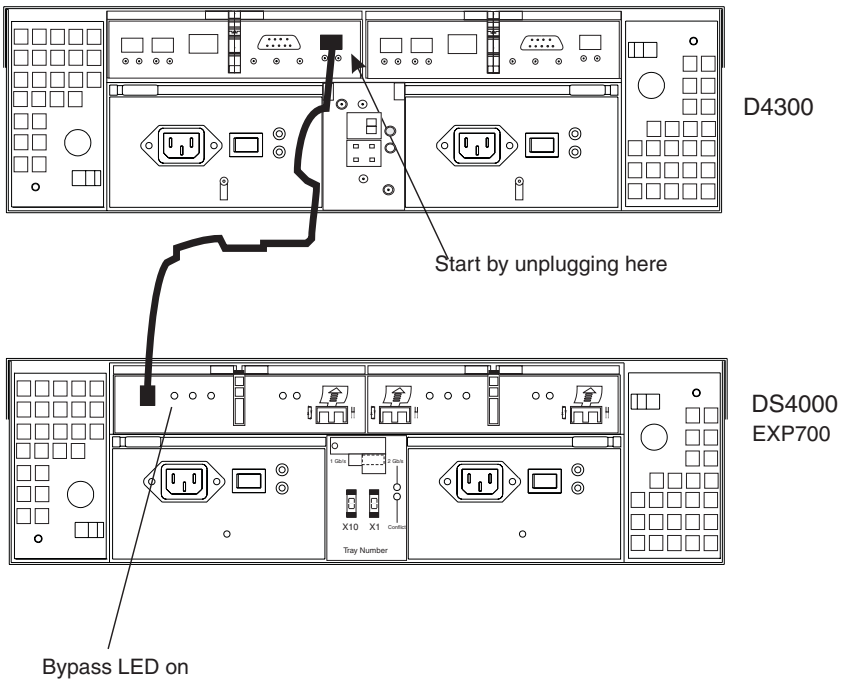

Figure 49. Copper cable and bypass light

2. Insert the FC copper cable wrap plug into the unplugged cable end. See Figure 50. Record the state of the port bypass light on the end where the FC copper cable is still inserted.

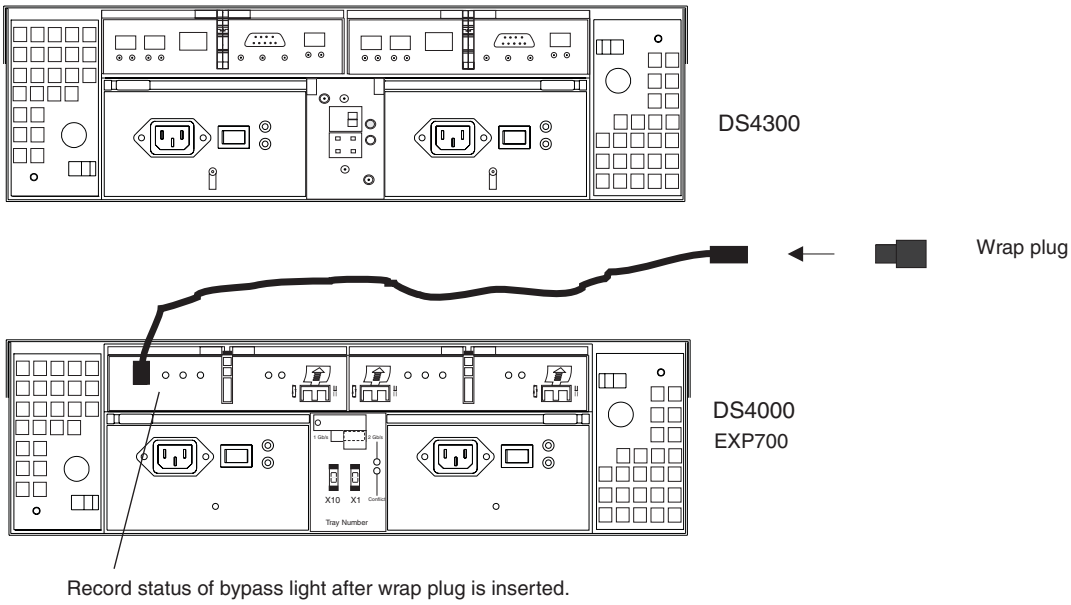

Figure 50. Inserting a wrap plug onto a copper cable

3. Remove the wrap plug and reinsert the FC copper cable into the port slot that you removed it from in Step 1 (in this example, the controller). Unplug the other end of the FC copper cable (in this example, the end that is inserted into the ESM).
4. Insert the FC copper cable wrap plug into the unplugged cable end. Record the state of the port bypass light on the end where the FC copper cable is still inserted.
5. Use the following table to determine which component of the drive loop link is causing the error. ″A″ and ″B″ stand for your hardware components. (In this example, A is the controller and B is the ESM; in some cases both A and B will be ESM).

Table 24. Diagnostic error condition truth table for copper cables

Case No.	Bypass LED at A	Bypass LED at B	Cause
1	On	On	Cable
2	On	Off	The controller is malfunctioning.
3	Off	On	The ESM is malfunctioning.
4	Off	Off	1. Check all of the links in the failing drive loops. 2. If no bad components were found, call IBM support to help troubleshoot marginal components.

Read Link Status (RLS) Diagnostics

A fibre channel loop is an interconnection topology used to connect storage subsystem components and devices. The DS4000 Storage Manager Version 8 or later software uses the connection between the host machine and each controller in the storage subsystem to communicate with each component and device on the loop.

During communication between devices, Read Link Status (RLS) error counts are detected within the traffic flow of the loop. Error count information is accumulated over a period of time for every component and device including:

- Drives
- ESMs
- Fibre channel ports

Error counts are calculated from a baseline, which describes the error count values for each type of device in the fibre channel loop. Calculation occurs from the time when the baseline was established to the time at which the error count information is requested.

The baseline is automatically set by the controller. However, a new baseline can be set manually through the Read Link Status Diagnostics dialog box. For more information, see "How to set the baseline" on page 123.

Overview

Read Link Status error counts refer to link errors that have been detected in the traffic flow of a fibre channel loop. The errors detected are represented as a count (32-bit field) of error occurrences accumulated over time. The errors help to provide a coarse measure of the integrity of the components and devices on the loop.

The Read Link Status Diagnostics dialog box retrieves the error counts and displays the controllers, drives, ESMs, and fibre channel ports in channel order.

By analyzing the error counts retrieved, it is possible to determine the components or devices within the fibre channel loop which might be experiencing problems communicating with the other devices on the loop. A high error count for a particular component or device indicates that it might be experiencing problems, and should be given immediate attention.

Error counts are calculated from the current baseline and can be reset by defining a new baseline.

Analyzing RLS Results

Analysis of the RLS error count data is based on the principle that the device immediately ″downstream″ of the problematic component should see the largest number of Invalid Transmission Word (ITW) error counts.

Note: Because the current error counting standard is vague about when the ITW count is calculated, different vendors' devices calculate errors at different rates. Analysis of the data must take this into account.

The analysis process involves obtaining an ITW error count for every component and device on the loop, viewing the data in loop order, and then identifying any

large jumps in the ITW error counts. In addition to the ITW count, the following error counts display in the Read Link Status Diagnostics dialog box:

Error Count Type	Definition of error
Link Failure (LF)	When detected, link failures indicate that there has been a failure within the media module laser operation. Link failures might also be caused by a link fault signal, a loss of signal or a loss of synchronization.
Loss of Synchronization (LOS)	Indicates that the receiver cannot acquire symbol lock with the incoming data stream, due to a degraded input signal. If this condition persists, the number of Loss of Signal errors increases.
Loss of Signal (LOSG)	Indicates a loss of signal from the transmitting node, or physical component within the fibre channel loop. Physical components where a loss of signal typically occurs include the gigabit interface connectors, and the fibre channel fibre optic cable.
Primitive Sequence Protocol (PSP)	Refers to the number of N_Port protocol errors detected, and primitive sequences received while the link is up.
Link Reset Response (LRR)	A Link Reset Response (LRR) is issued by another N_Port in response to a link reset.
Invalid Cyclic Redundancy Check (ICRC)	Indicates that a frame has been received with an invalid cyclic redundancy check value. A cyclic redundancy check is performed by reading the data, calculating the cyclic redundancy check character, and then comparing its value to the cyclic check character already present in the data. If they are equal, the new data is presumed to be the same as the old data.

If you are unable to determine which component or device on your fibre channel loop is experiencing problems, save the RLS Diagnostics results and forward them to IBM technical support for assistance.

Running RLS Diagnostics

To start RLS Diagnostics, select the storage subsystem from the Subsystem Management Window; then, either click **Storage Subsystem -> Run Read Link Status Diagnostics** from the main menu or right-click the selected subsystem and click **Run Read Link Status Diagnostics** from the pop-up menu. The Read Link Status Diagnostics dialog box displays, showing the error count data retrieved. The following data displays:

Devices
A list of all the devices on the fibre channel loop. The devices display in channel order, and within each channel they are sorted according to the devices position within the loop.

Baseline Time
The date and time of when the baseline was last set.

Elapsed Time
The elapsed time between when the Baseline Time was set, and when the read link status data was gathered using the Run option.

ITW The total number of Invalid Transmission Word (ITW) errors detected on the fibre channel loop from the baseline time to the current date and time. ITW might also be referred to as the Received Bad Character Count.

Note: This is the key error count to be used when analyzing the error count data.

LF The total number of Link Failure (LF) errors detected on the fibre channel loop from the baseline time to the current date and time.

LOS The total number of Loss of Synchronization (LOS) errors detected on the fibre channel loop from the baseline time to the current date and time.

LOSG The total number of Loss of Signal (LOSG) errors detected on the fibre channel loop from the baseline date to the current date and time.

PSP The total number of Primitive Sequence Protocol (PSP) errors detected on the fibre channel loop from the baseline date to the current date and time.

ICRC The total number of Invalid Cyclic Redundancy Check (ICRC) errors detected on the fibre channel loop, from the baseline date to the current date and time.

How to set the baseline

Error counts are calculated from a baseline (which describes the error count values for each type of device in the fibre channel loop), from the time when the baseline was established to the time at which the error count information is requested.

The baseline is automatically set by the controller; however, a new baseline can be set manually through the Read Link Status Diagnostics dialog box using the following steps:

Note: This option establishes new baseline error counts for ALL devices currently initialized on the loop.

1. Click **Set Baseline**. A confirmation dialog box displays.
2. Click **Yes** to confirm baseline change. If the new baseline is successfully set, a success message displays that indicates that the change has been made.
3. Click **OK**. The Read Link Status Diagnostics dialog box displays.
4. Click **Run** to retrieve the current error counts.

How to interpret results

To interpret RLS results, perform the following actions:

1. Open the Read Link Status Diagnostics dialog box.
2. Review the ITW column in the Read Link Status Diagnostics dialog box and identify any unusual increase in the ITW counts.

   Example:

   The following shows the typical error count information displayed in the Read Link Status Diagnostics dialog box. In this example, the first screen displays the values after setting the baseline. The RLS diagnostic is run a short while later and the result shows an increase in error counts at Controller B. This is probably due to either the drive right before (2/9), or more likely the ESM (Drive enclosure 2).

   Figure 51 on page 124 shows the RLS Status after setting the baseline.

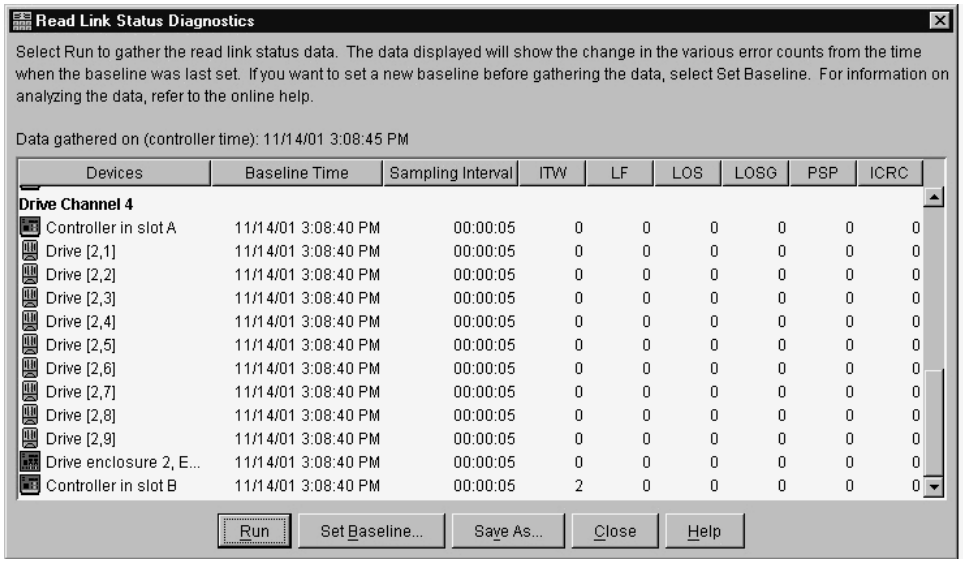

Figure 51. RLS Status after setting baseline

Figure 52 shows the RLS Status after running the diagnostic.

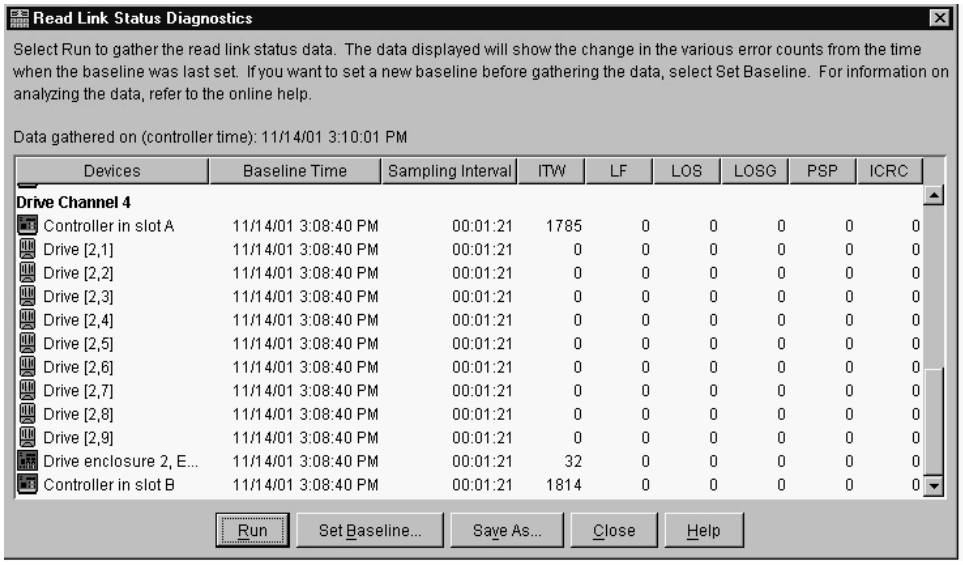

Figure 52. RLS Status after diagnostic

Note: This is only an example and is not applicable to all situations.

Important: Because the current error counting standard is vague about when the ITW error count is calculated, different vendor's devices calculate at different rates. Analysis of the data must take this into account.

3. Click **Close** to return to the Subsystem Management Window, and troubleshoot the problematic devices. If you are unable to determine which component is problematic, save your results and forward them to IBM technical support.

How to save Diagnostics results

For further troubleshooting assistance, save the Read Link Status results and forward them to technical support for assistance.

1. Click **Save As**. The Save As dialog box displays.

2. Select a directory and type the file name of your choice in the **File name** text box. You do not need to specify a file extension.
3. Click **Save**. A comma-delimited file containing the read link status results is saved.

Chapter 12. PD hints: Hubs and switches

You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, “Problem determination starting points,” on page 3.

After you have read the relevant information in this chapter, return to the PD map that directed you here, either “Hub/Switch PD map 2” on page 15 or “Common Path PD map 2” on page 23.

Unmanaged hub

The unmanaged hub is used only with the type 3526 RAID controller. This hub does not contain any management or debugging aids other than the LEDs that give an indicator of port up or down.

Switch and managed hub

The switch and managed hub are used with FAStT500, FAStT200, DS4400, DS4500, DS4300, and DS4100 controllers. The following sections describe tests that can be used with the switch and managed hub.

Note: The following test commands apply specifically to the IBM SAN Fibre Channel Switch 2109 Model S16. The tests commands for your switch might differ slightly. Refer to your switch documentation for details.

Running crossPortTest

The `crossPortTest` verifies the intended functional operation of the switch and managed hub by sending frames from the transmitter for each port by way of the GBIC or fixed port and external cable to another port’s receiver. By sending these frames, the `crossPortTest` exercises the entire path of the switch and managed hub.

A port can be connected to any other port in the same switch or managed hub, provided that the connection is of the same technology. This means that ShortWave ports can only be connected to ShortWave ports; LongWave ports can be connected only to LongWave ports.

Note: An error condition will be shown for any ports that are on the switch or managed hub but that are not connected. If you want more information on the `crossPortTest` and its options, see the Installation and Service Guide for the switch or managed hub you are using.

To repeat the results in the following examples, run the tests in online mode and with the `singlePortAlso` mode enabled. The test will run continuously until your press the Return key on the console being used to perform Ethernet connected management of the switch or managed hub.

To run, the test must find at least one port with a wrap plug or two ports connected to each other. If one of these criteria is not met, the test results in the following message in the telnet shell:

```
Need at least 1 port(s) connected to run this test.
```

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The command syntax is `crossPortTest <nFrames>, <0 or 1>` where `<nFrames>` indicates the number of frames to run.

With `<nFrames>` set to 0, the test runs until you press Return.

With the second field set to 0, no single port wrap is allowed and two ports must be cross-connected. Figure 53 shows the preferred option, which works with either wrap or cross-connect. Figure 54 on page 129 shows the default parms, which work only with cross-connect.

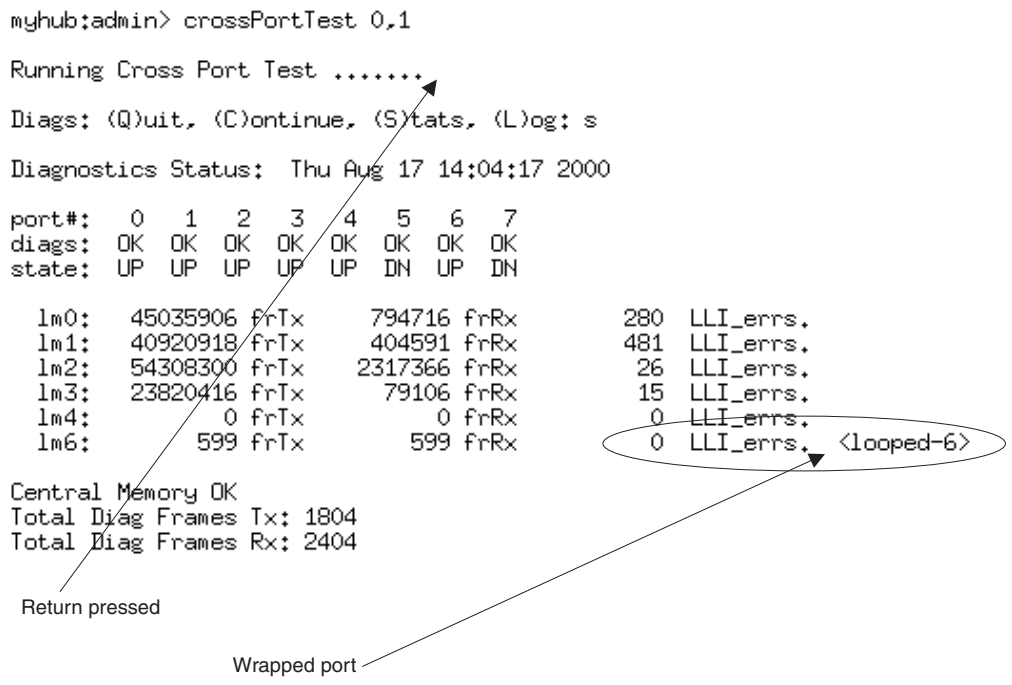


Figure 53. crossPortTest - Wrap or cross-connect

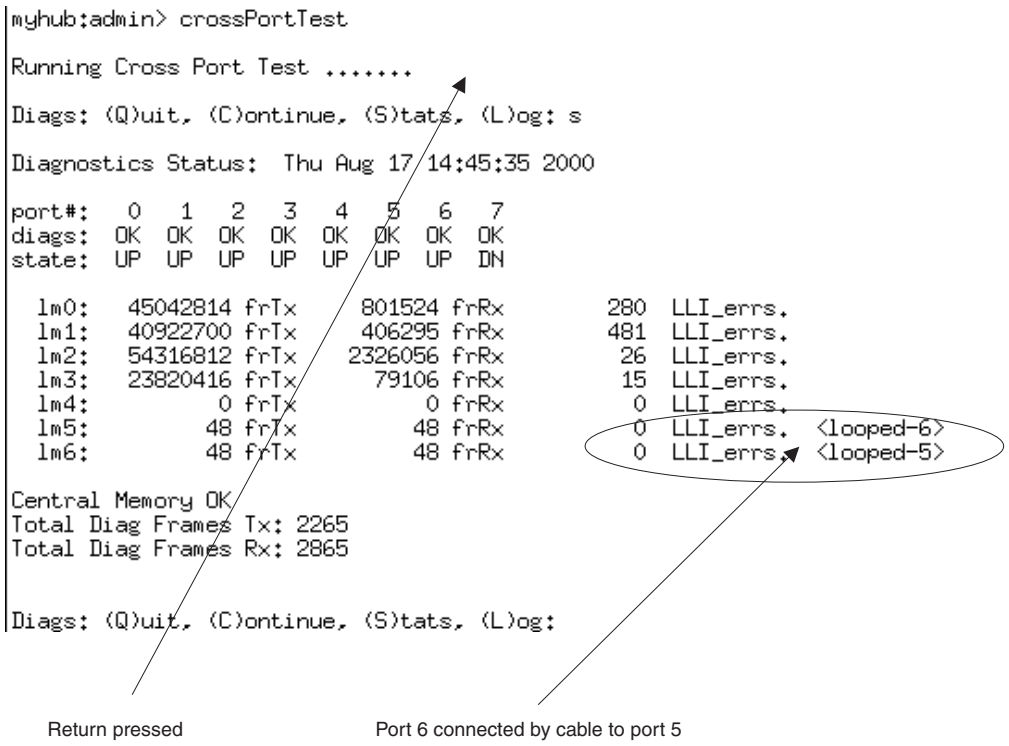


Figure 54. crossPortTest - Cross-connect only

Alternative checks

In some rare cases, you might experience difficulty in locating the failed component after you have checked a path. This section gives alternative checking procedures to help resolve the problem.

Some of these checks require plugging and unplugging components. This could lead to other difficulties if, for instance, a cable is not plugged back completely. Therefore, when the problem is resolved, you should perform a path check to make sure that no other problems have been introduced into the path. Conversely, if you started with a problem and, after the unplugging and replugging, you end up at a non-failing point in the PD maps without any repairs or replacement, then the problem was probably a bad connection. You should go back to the original check, such as FAStT MSJ, and rerun the check. If it now runs correctly, you can assume that you have corrected the problem (but it is a good idea to keep checking the event logs for further indications of problems in this area).

Figure 55 on page 130 shows a typical connection path.

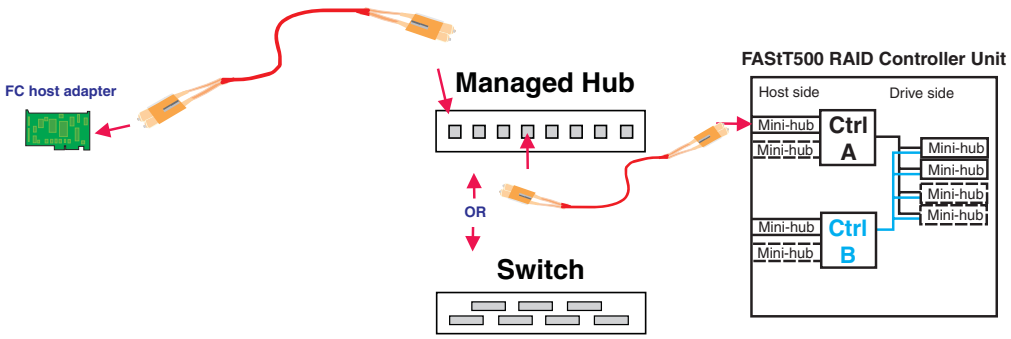


Figure 55. Typical connection path

In the `crossPortTest`, data is sourced from the managed hub or switch and travels the path outlined by the numbers 1, 2, and 3 in Figure 56. For the same path, the `sendEcho` function is sourced from the RAID controller and travels the path 3, 2, 1. Using both tests when problems are hard to find (for example, if the problems are intermittent) offers a better analysis of the path. In this case, the duration of the run is also important because enough data must be transferred to enable you to see the problem.

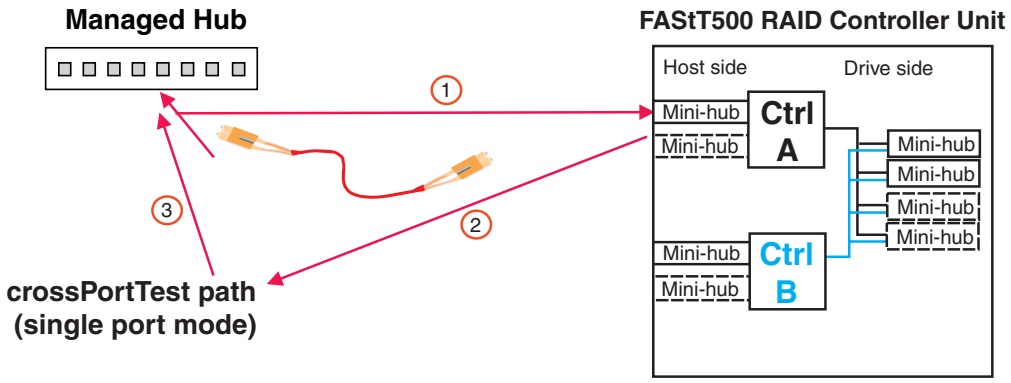
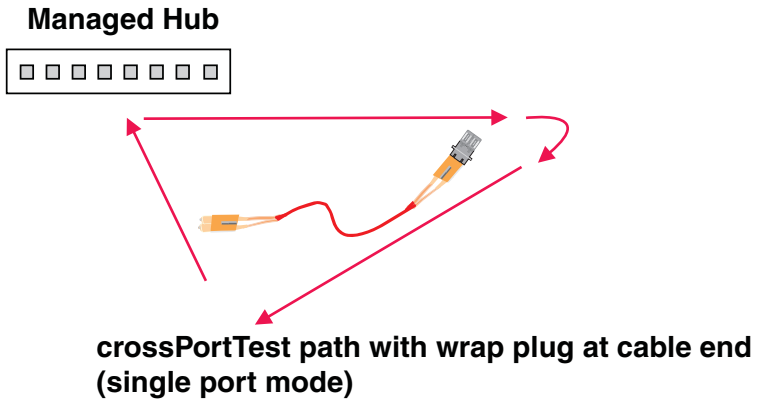


Figure 56. crossPortTest data path

Running crossPortTest and sendEcho path to and from the controller

In the case of wrap tests with the wrap plug, there is also dual sourcing capability by using `sendEcho` from the controller or `crossPortTest` from the managed hub or switch. Figure 57 on page 131 shows these alternative paths.



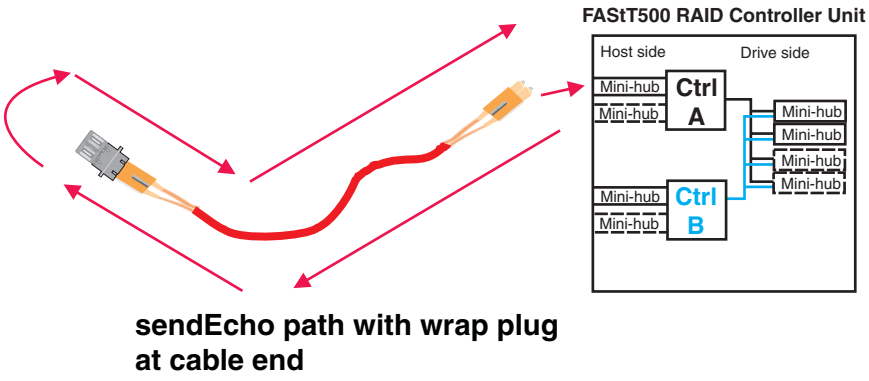


Figure 57. sendEcho and crossPortTest alternative paths

Chapter 13. PD hints: Wrap plug tests

You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, "Problem determination starting points," on page 3.

After you have read the relevant information in this chapter, return to "Single Path Fail PD map 1" on page 20.

The following sections illustrate the use of wrap plugs.

Running sendEcho and crossPortTest path to and from controller

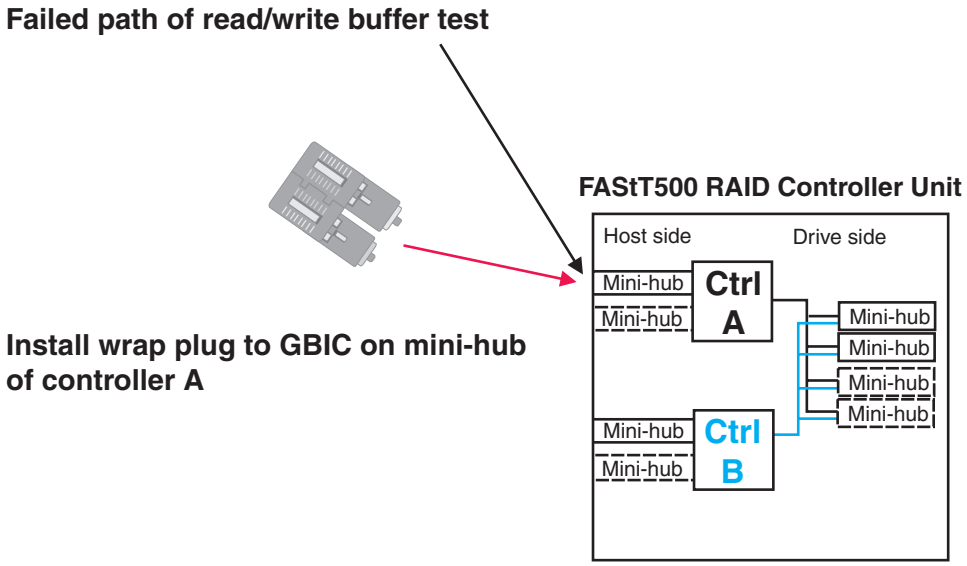


Figure 58. Install wrap plug to GBIC

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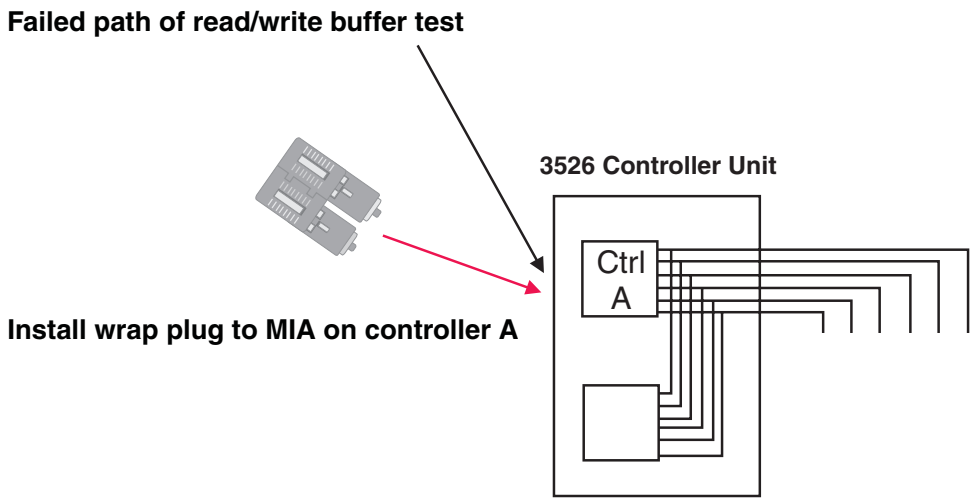

Figure 59. Install wrap plug to MIA

Alternative wrap tests using wrap plugs

There is dual sourcing capability with wrap tests using wrap plugs. Use `sendEcho` from the controller or `crossPortTest` from the managed hub or switch. See "Hub/Switch PD map 1" on page 13 for the information on how to run the `crossPortTest`. Figure 60 and Figure 61 on page 135 show these alternative paths.

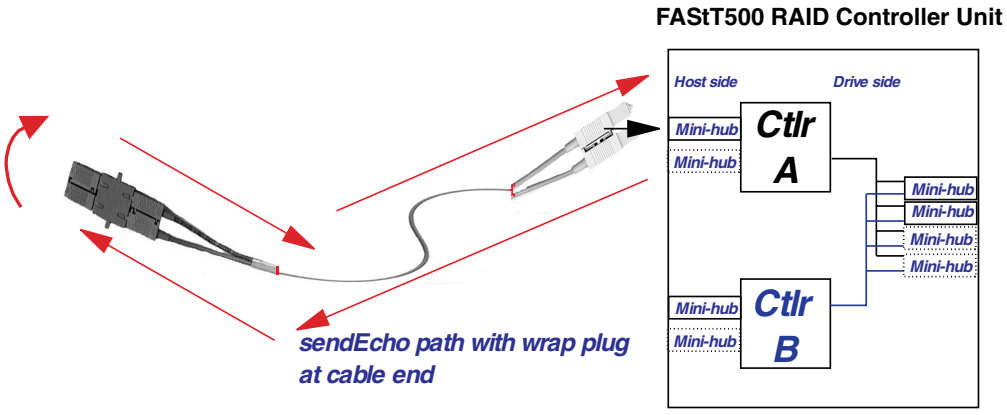

Figure 60. sendEcho path

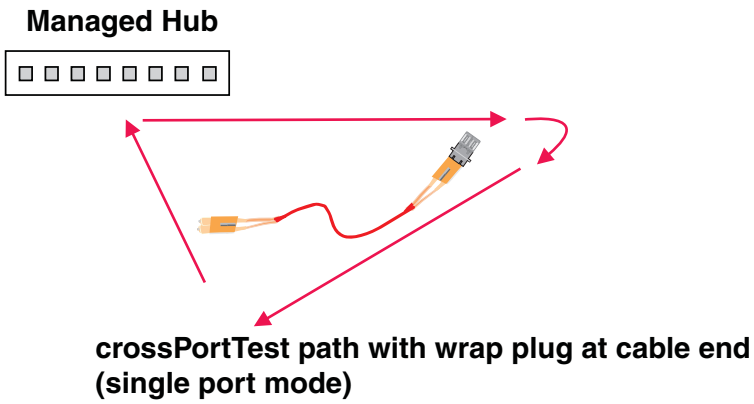

Figure 61. crossPortTest path

Chapter 14. Heterogeneous configurations

You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, “Problem determination starting points,” on page 3.

DS4000 Storage Manager Version 7 or later provides the capability to manage storage in an heterogeneous environment. This does introduce increased complexity and the potential for problems. This chapter shows examples of heterogeneous configurations and the associated configuration profiles from DS4000 Storage Manager. These examples can assist you in identifying improperly configured storage by comparing the customer’s profile with those supplied, assuming similar configurations.

It is very important that the Storage Partitioning for each host be assigned the correct host type (see Figure 62). If not, the host will not be able to see its assigned storage. The host port identifier that you assign a host type to is the HBA WW node name.

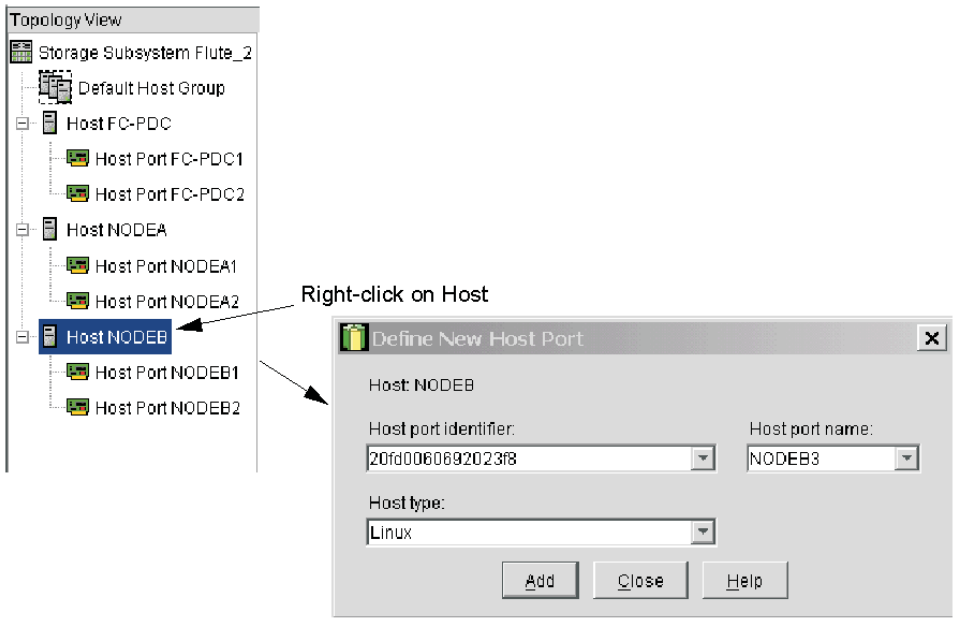

Figure 62. Host information

Configuration examples

Following are examples of heterogeneous configurations and the associated configuration profiles for DS4000 Storage Manager Version 7.10 and above. For more detailed information, see the DS4000 Storage Manager Concept guides for your respective DS4000 Storage Manager version.

Windows cluster

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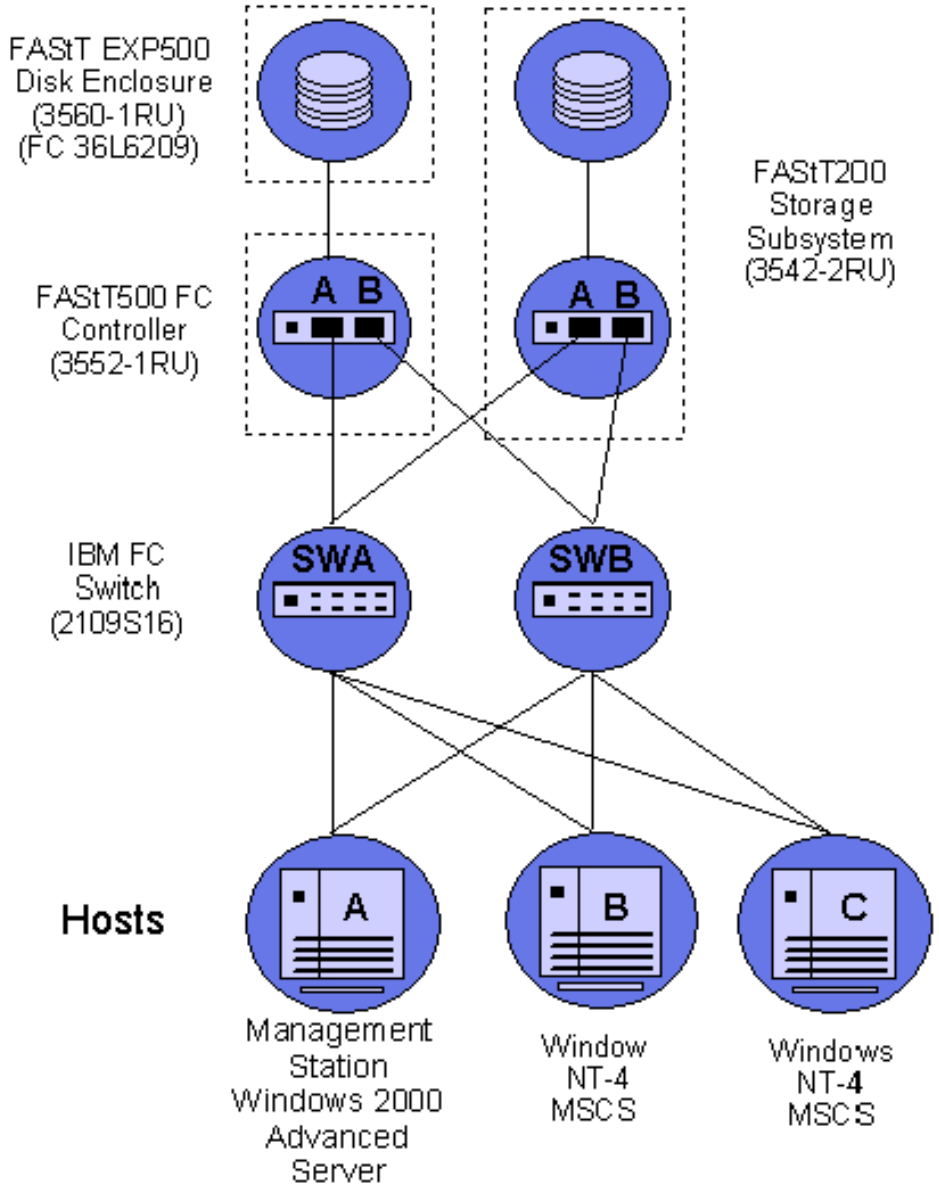

Figure 63. Windows cluster

Table 25. Windows cluster configuration example

	Network Management Type	Partition	Storage Partitioning Topology
Host A	Client Direct attached	Windows 2000 AS	Host Port A1 Type=Windows 2000 Non-Clustered Host Port A2 Type=Windows 2000 Non-Clustered
Host B	Host Agent Attached	Windows NT Cluster	Host Port B1 Type=Windows Clustered (SP5 or later) Host Port B2 Type=Windows Clustered (SP5 or later)

Table 25. Windows cluster configuration example (continued)

	Network Management Type	Partition	Storage Partitioning Topology
Host C	Host Agent Attached	Windows NT Cluster	Host Port C1 Type=Windows Clustered (SP5 or higher) Host Port C2 Type=Windows Clustered (SP5 or higher)

Heterogeneous configuration

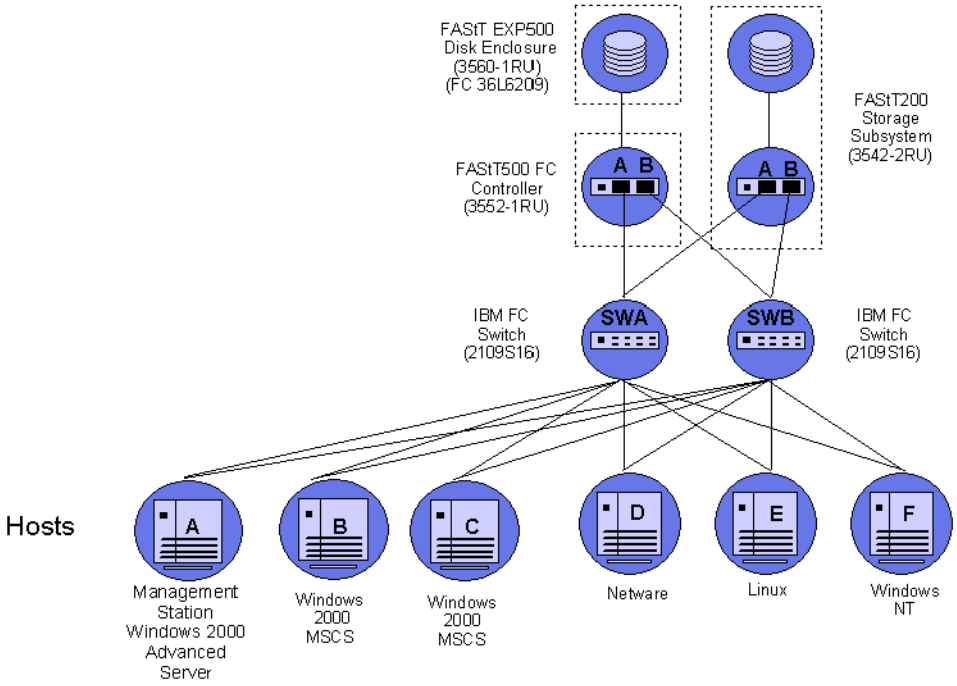

Figure 64. Heterogeneous configuration

Table 26. Heterogeneous configuration example

	Network Management Type	Partition	Storage Partitioning Topology
Host A	Client Direct attached	Windows 2000 AS	Host Port A1 Type=Windows 2000 Non-Clustered Host Port A2 Type=Windows 2000 Non-Clustered
Host B	Host Agent Attached	Windows 2000 Cluster	Host Port B1 Type=Windows Clustered Host Port B2 Type=Windows Clustered
Host C	Host Agent Attached	Windows 2000 Cluster	Host Port C1 Type=Windows Clustered Host Port C2 Type=Windows Clustered
Host D	Host Agent Attached	Netware	Host Port D1/ Type=Netware Host Port D2/Type=Netware

Table 26. Heterogeneous configuration example (continued)

	Network Management Type	Partition	Storage Partitioning Topology
Host E	Host Agent Attached	Linux	Host Port E1/ Type=Linux Host Port E2/Type=Linux
Host F	Host Agent Attached	Windows NT	Host Port F1/Type=Windows NT Host Port F2/ Type=Windows NT

Chapter 15. Using IBM Fast!UTIL

This chapter provides detailed configuration information for advanced users who want to customize the configuration of the following adapters:

- IBM fibre-channel PCI adapter (FRU 01K7354)
- IBM DS4000 host adapter (FRU 09N7292)
- IBM DS4000 FC2-133 host bus adapter (FRU 24P0962)

For more information about these adapters, see the *IBM TotalStorage DS4000 Hardware Maintenance Manual*.

You can configure the adapters and the connected fibre channel devices using the Fast!UTIL utility.

Attention: IBM Fast!UTIL is not available on IBM BladeCenter models.

Starting Fast!UTIL

To access Fast!UTIL, press Ctrl+Q (or Alt+Q for 2100) during the adapter BIOS initialization (it might take a few seconds for the Fast!UTIL menu to display). If you have more than one adapter, Fast!UTIL prompts you to select the adapter you want to configure. After changing the settings, Fast!UTIL restarts your system to load the new parameters.

Important: If the configuration settings are incorrect, your adapter will not function properly. Do not modify the default configuration settings unless you are instructed to do so by an IBM support representative or the installation instructions. The default settings are for a typical Microsoft Windows installation. See the adapter driver readme file for the appropriate operating system for required NVRAM setting modifications for that operating system.

Fast!UTIL options

This section describes the Fast!UTIL options. The first option on the **Fast!UTIL Options** menu is **Configuration Settings**. The settings configure the fibre-channel devices and the adapter to which they are attached.

Note: If your version of Fast!UTIL has settings that are not discussed in this section, then you are working with down-level BIOS or non-supported BIOS. Update your BIOS version.

Host adapter settings

You can use this option to modify host adapter settings. The current default settings for the host adapters are described in this section.

Note: All settings for the IBM fibre-channel PCI adapter (FRU 01K7354) are accessed from the **Host Adapter Settings** menu option (see Table 27 on page 142). The DS4000 host adapter (FRU 09N7292) and the DS4000 FC2-133 host bus adapter (FRU 24P0962) offer additional settings available from the **Advanced Adapter Settings** menu option (see Table 28 on page 142 and Table 29 on page 142). Any settings for the fibre-channel PCI adapter (FRU

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01K7354) not described in this section are described in "Advanced adapter settings" on page 144.

Table 27. IBM fibre-channel PCI adapter (FRU 01K7354) host adapter settings

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Execution throttle	1 - 256	256
Frame size	512, 1024, 2048	2048
Loop reset delay	0-15 seconds	8 seconds
Extended error logging	Enabled or Disabled	Disabled
Port down retry count	0-255	30

Table 28. DS4000 host adapter (FRU 09N7292) host adapter settings

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0-15 seconds	5 seconds
Adapter hard loop ID	Enabled or Disabled	Enabled
Hard loop ID	0-125	125
Connection Options	0, 1, 2, 3	3
Fibre channel tape support	Enabled or Disabled	Disabled

Table 29. DS4000 FC2-133 (FRU 24P0962) host bus adapter host adapter settings

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0-60 seconds	5 seconds
Adapter hard loop ID	Enabled or Disabled	Enabled
Hard loop ID	0-125	125
Spin up delay	Enabled or Disabled	Disabled
Connection Options	0, 1, 2, 3	2
Fibre channel tape support	Enabled or Disabled	Disabled
Data rate [for DS4000 FC2-133 host bus adapter (FRU 24P0962) only]	0, 1, 2	2

Host adapter BIOS

When this option is set to Disabled, the ROM BIOS code on the adapter is disabled, freeing space in upper memory. This setting must be enabled if you are starting from a fibre channel hard disk that is attached to the adapter. The default is Disabled.

Frame size

This setting specifies the maximum frame length supported by the adapter. The default size is 2048. If you are using F-Port (point-to-point) connections, the default is best for maximum performance.

Loop reset delay
After resetting the loops, the firmware does not initiate any loop activity for the number of seconds specified in this setting. The default is 5 seconds.

Adapter hard loop ID
This setting forces the adapter to use the ID specified in the Hard loop ID setting. The default is Enabled. (For DS4000 host adapter [FRU 09N7292] and DS4000 FC2-133 [FRU 24P0962] host bus adapter only.)

Hard loop ID
When the adapter hard loop ID is set to Enabled, the adapter uses the ID specified in this setting. The default ID is 125.

Spin up delay
When this setting is Enabled, the BIOS code waits up to 5 minutes to find the first drive. The default is Disabled.

Connection options
This setting defines the type of connection (loop or point-to-point) or connection preference (see Table 30). The default is 3 for the DS4000 host adapter (FRU 09N7292) or 2 for the DS4000 FC2-133 host bus adapter (FRU 24P0962).

Table 30. Connection options for DS4000 host adapter (FRU 09N7292) and DS4000 FC2-133 host bus adapter (FRU 24P0962)

Option	Type of connection
0	Loop only
1	Point-to-point only
2	Loop preferred; otherwise, point-to-point
3 (for DS4000 host adapter [FRU 09N7292] only)	Point-to-point; otherwise, loop

Fibre channel tape support
This setting is reserved for fibre channel tape support. The default is Disabled.

Data rate (for DS4000 FC2-133 host bus adapter (FRU 24P0962) only):
This setting determines the data rate (see Table 31). When this field is set to 2, the DS4000 FC2-133 host bus adapter determines what rate your system can accommodate and sets the rate accordingly. The default is 2.

Table 31. Data rate options for DS4000 FC2-133 host bus adapter (FRU 24P0962)

Option	Data Rate
0	1 Gbps
1	2 Gbps
2	Auto select

Note: Adapter settings and default values might vary, based on the version of BIOS code installed for the adapter.

Selectable boot settings

When you set this option to Enabled, you can select the node name from which you want to start up (boot). When this option is set to Enabled, the node will start

from the selected fibre channel hard disk, ignoring any IDE hard disks attached to your server. When this option is set to Disabled, the Boot ID and Boot LUN parameters have no effect.

The BIOS code in some new systems supports selectable boot, which supersedes the Fast!UTIL selectable boot setting. To start from a fibre channel hard disk attached to the adapter, select the attached fibre channel hard disk from the system BIOS menu.

Note: This option applies only to disk devices; it does not apply to CDs, tape drives, and other nondisk devices.

Restore default settings

You can use this option to restore the adapter default settings.

Note: The default NVRAM settings are the adapter settings that were saved the last time an NVRAM update operation was run from the BIOS Update Utility program (option U or command line /U switch). If the BIOS Update Utility program has not been used to update the default NVRAM settings since the adapter was installed, the factory settings are loaded.

Raw NVRAM data

This option displays the adapter nonvolatile random access memory (NVRAM) contents in hexadecimal format. This is a troubleshooting tool; you cannot modify the data.

Advanced adapter settings

You can use this option to modify the advanced adapter settings. The current default settings for the adapter are described in this section.

Note: The **Advanced Adapter Settings** menu option is available only for the DS4000 host adapter (FRU 09N7292) (see Table 32) and the DS4000 FC2-133 (FRU 24P0962) host bus adapter (FRU 24P0962) (see Table 33 on page 145). All settings for the IBM fibre-channel PCI adapter (FRU 01K7354) are accessed from the **Host Adapter Settings** menu option.

Table 32. DS4000 host adapter (FRU 09N7292) advanced adapter settings

Setting	Options	Default
Execution throttle	1-256	256
LUNs per target	0, 8, 16, 32, 64, 128, 256	0
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
Extended error logging	Enabled or Disabled	Disabled
RIO Operation Mode	0, 5	0
Interrupt Delay Timer	0-255	0

Table 33. DS4000 FC2-133 (FRU 24P0962) host bus adapter advanced adapter settings

Setting	Options	Default
Execution throttle	1-256	256
LUNs per target	0, 8, 16, 32, 64, 128, 256	0
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
Extended error logging	Enabled or Disabled	Disabled
RIO Operation Mode	0, 5	0
Interrupt Delay Timer	0-255	0

Execution throttle
This setting specifies the maximum number of commands running on any one port. When a port reaches its execution throttle, Fast!UTIL does not run any new commands until the current command is completed. The valid options for this setting are 1 through 256. The default (optimum) is 256.

LUNs per target (for IBM fibre-channel PCI adapter [FRU 01K7354])
This setting specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 8. For Netware, set the number of LUNs to 32.

LUNs per target (for DS4000 host adapter [FRU 09N7292] and DS4000 FC2-133 host bus adapter [FRU 24P0962]
This setting specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 0. For Netware, set the number of LUNs to 32.

Enable LIP reset
This setting determines the type of loop initialization process (LIP) reset that is used when the operating system initiates a bus reset routine. When this option is set to **Yes**, the device driver initiates a global LIP reset to clear the target device reservations. When this option is set to **No**, the device driver initiates a global LIP reset with full login. The default is **No**.

Enable LIP full logon
This setting instructs the ISP chip to log into all ports after any LIP. The default is Yes.

Enable target reset
This setting enables the device drivers to issue a Target Reset command to all devices on the loop when a SCSI Bus Reset command is issued. The default is Yes.

Login retry count
This setting specifies the number of times the software tries to log in to a device. The default is 30 retries.

Port down retry count
This setting specifies the number of times the software retries a command to a port that is returning port-down status. The default is 30 retries.

Extended error logging
This option provides additional error and debugging information to the operating system. When this option is set to Enabled, events are logged into the Windows NT Event Viewer or Windows 2000 Event Viewer (depending on the environment you are in). The default is Disabled.

RIO operation mode
This setting specifies the reduced interrupt operation (RIO) modes, if supported by the software device driver. RIO modes enable posting multiple command completions in a single interrupt (see Table 34). The default is 0.

Table 34. RIO operation modes for DS4000 host adapter (FRU 09N7292) and DS4000 FC2-133 host bus adapter (FRU 24P0962)

Option	Operation mode
0	No multiple responses
5	Multiple responses with minimal interrupts

Interrupt delay timer
This setting contains the value (in 100-microsecond increments) used by a timer to set the wait time between accessing (DMA) a set of handles and generating an interrupt. The default is 0.

Scan fibre channel devices

Use this option to scan the fibre channel loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when you are configuring your adapter and attached devices.

Fibre channel disk utility

Attention: Performing a low-level format removes all data on the disk.

Use this option to scan the fibre channel loop bus and list all the connected devices by loop ID. You can select a disk device and perform a low-level format or verify the disk media.

Loopback data test

Use this option to verify the adapter basic transmit and receive functions. A fibre channel loop back connector option must be installed into the optical interface connector on the adapter before starting the test.

Select host adapter

Use this option to select, configure, or view a specific adapter if you have multiple adapters in your system.

ExitFast!UTIL

After you complete the configuration, use the ExitFast!UTIL option to exit the menu and restart the system.

Chapter 16. Frequently asked questions about DS4000 Storage Manager

This chapter contains answers to frequently asked questions (FAQs) in the following areas:

Global Hot Spare (GHS) drives

What is a Global Hot Spare?

A Global Hot Spare is a drive within the storage subsystem that has been defined by the user as a spare drive. The Global Hot Spare is to be used in the event that a drive that is part of an array with redundancy (RAID 1, 3, 5 array) fails. When the fail occurs, and a GHS drive is configured, the controller will begin reconstructing to the GHS drive. Once the reconstruction to the GHS drive is complete, the array will be promoted from the Degraded state to the Optimal state, thus providing full redundancy again. When the failed drive is replaced with a good drive, the copy-back process will start automatically.

What is reconstruction and copy-back?

Reconstruction is the process of reading data from the remaining drive (or drives) of an array that has a failed drive and writing that data to the GHS drive. Copy-back is the process of copying the data from the GHS drive to the drive that has replaced the failed drive.

What happens during the reconstruction of the GHS?

During the reconstruction process, data is read from the remaining drive (or drives) within the array and used to reconstruct the data on the GHS drive.

How long does the reconstruction process take?

The time to reconstruct a GHS drive will vary depending on the activity on the array, the size of the failed array, and the speed of the drives.

What happens if a GHS drive fails while sparing for a failed drive?

If a GHS drive fails while it is sparing for another drive, and another GHS is configured in the array, a reconstruction process to another GHS will be done.

If a GHS fails, and a second GHS is used, and both the originally failed drive and the failed GHS drive are replaced at the same time, how will the copy-back be done?

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The controller will know which drive is being spared by the GHS, even in the event that the first GHS failed and a second GHS was used. When the original failed drive is replaced, the copy-back process will begin from the second GHS.

If the size of the failed drive is 9Gbyte, but only 3Gbytes of data have been written to the drive, and the GHS is an 18Gbyte drive, how much is reconstructed?

The size of the array determines how much of the GHS drive will be used. For example, if the array has two 9Gbyte drives, and the total size of all logical drives is 18Gbyte, then 9Gbytes of reconstruction will occur, even if only 3Gbytes of data exist on the drive. If the array has two 9Gbyte drives, and the total size of all logical drives is 4Gbytes, then only 2Gbytes of reconstruction will be done to the GHS drive.

How can you determine if a Global Hot Spare (GHS) is in use?

The Global Hot Spare is identified in DS4000 Storage Manager by the following icon:

If a drive fails, which GHS will the controller attempt to use?

The controller will first attempt to find a GHS on the same channel as the failed drive; the GHS must be at least as large as the configured capacity of the failed drive. If a GHS does not exist on the same channel, or if it is already in use, the controller will check the remaining GHS drives, beginning with the last GHS configured. For example, if the drive at location 1:4 failed, and if the GHS drives were configured in the following order, 0:12, 2:12, 1:12, 4:12, 3:12, the controller will check the GHS drives in the following order, 1:12, 3:12, 4:12, 2:12, 0:12.

Will the controller search all GHS drives and select the GHS drive closest to the configured capacity of the failed drive?

No. The controller will use the first available GHS that is large enough to spare for the failed drive.

Can any size drive be configured as a GHS drive?

At the time a drive is selected to be configured as a GHS, it must be equal or larger in size than at least one other drive in the attached drive enclosures that is not a GHS drive. However, it is strongly recommended that the GHS have at least the same capacity as the target drive on the subsystem.

Can a GHS that is larger than the drive that failed act as a spare for the smaller drive?

Yes.

Can a 9Gbyte GHS drive spare for an 18Gbyte failed drive?

A GHS drive can spare for any failed drive, as long as the GHS drive is at least as large as the configured capacity of the failed drive. For example, if the failed drive is an 18Gbyte drive with only 9Gbyte configured as part of an array, a 9Gbyte drive can spare for the failed drive.

However, to simplify storage management tasks and to prevent possible data loss in case a GHS is not enabled because of inadequate GHS capacity, it is strongly recommended that the GHS have at least the same capacity as the target drive on the subsystem.

What happens if the GHS drive is not large enough to spare for the failed drive?

If the controller does not find a GHS drive that is at least as large as the configured capacity of the failed drive, a GHS will not be activated, and, depending on the array state, the LUN will become degraded or failed.

What action should be taken if all drives in the array are now larger than the GHS drive?

Ideally, the GHS drive will be replaced with a drive as large as the other drives in the array. If the GHS drive is not upgraded, it will continue to be a viable spare as long as it is as large as the smallest configured capacity of at least one of the configured drives within the array.

The previous two questions describe what might happen in this case. It is strongly recommended that you upgrade the GHS to the largest capacity drive.

How many GHS drives can be configured in an array?

The maximum number of GHS drives for DS4000 Storage Manager Versions 7 or later is fifteen per subsystem.

How many GHS drives can be reconstructed at the same time?

Controller firmware versions 3.x and older will only allow for one reconstruction process per controller to occur at the same time. An additional requirement is that in order for two reconstruction processes to occur at the same time, the LUNs affected cannot be owned by the same controller. For example, if a drive in LUN_1 and a drive in LUN-4 fail, and both LUNs are owned by Controller_A, then only one reconstruction will occur at a time. However, if LUN-1 is owned by Controller_A, and LUN-4 is owned by Controller_B, then two reconstruction process will occur at the same time. If multiple drives fail at the same time, the others will be queued after the currently-running reconstruction completes.

Once the GHS reconstruction has started, and the failed drive is replaced, does the reconstruction of the GHS stop?

The reconstruction process will continue until complete, and then begin a copy-back to the replaced drive.

What needs to be done to a GHS drive that has spared for a failed drive after the copy-back to the replaced drive has been completed?

Once the copy-back to the replaced drive is complete, the GHS drive will be immediately available as a GHS. There is no need for the user to do anything.

Does the GHS have to be formatted before it can be used?

No. The GHS drive will be reconstructed from the other drive (or drives) within the LUN that had a drive fail.

What happens if a GHS drive is moved to a drive-slot that is part of LUN, but not failed?

When the GHS drive is moved to a drive-slot that is not failed and is part of a LUN, the drive will be spun up, marked as a replacement of the previous drive, and reconstruction started to the drive.

Can a GHS drive be moved to a drive-slot occupied by a faulted drive that is part of a LUN?

Yes. In this case, the GHS drive will now be identified as a replacement for the failed drive, and begin a copy-back or reconstruction, depending on whether a GHS drive was activated for the faulted drive.

What happens if a GHS drive is moved to an unassigned drive-slot, and the maximum GHS drives are already configured?

Once the maximum number of GHS drives have been configured, moving a GHS drive to an unassigned drive-slot will cause the GHS drive to become an unassigned drive.

What happens if a drive from a LUN is accidentally inserted into a GHS drive slot?

Once a drive is inserted into a slot configured as a GHS, the newly inserted drive will become a GHS, and the data previously on the drive will be lost. Moving drives in or out of slots configured as GHS drives must be done very carefully.

How does the controller know which drive slots are GHS drives?

The GHS drive assignments are stored in the dacStore region of the Sundry drives.

Auto Code Synchronization (ACS)

What is ACS?

ACS is a controller function that is performed during the controller Start-Of-Day (SOD) when a foreign controller is inserted into an array, at which time the Bootware (BW) and Appware (AW) versions will be checked and synchronized if needed.

What versions of FW support ACS?

ACS was first activated in controller FW version 3.0.x, but the LED display was added to controller FW version 03.01.x and later.

How to control if ACS is to occur?

ACS will occur automatically when a foreign controller is inserted, or during a power-on, if bit 1 is set to 0 (zero) and bit 2 is set to 1 (one) in NVSRAM byte offset 0x29. If these bits are set appropriately, the newly inserted controller will

check the resident controller BW and AW versions with its own, and if different, will begin the synchronization process.

Bit 1 = 0	Auto Code Synchronization will occur only if the newly inserted controller is a foreign controller (a different controller from the one that was previously in the same slot).
Bit 2 = 1	Enable Automatic Code Synchronization (ACS)

What is a resident controller and what is a foreign controller?

A controller is considered to be resident if it is the last controller to have completed a SOD in that slot and has updated the dacStore on the drives. A foreign controller is one that is not recognized by the array when powered on or inserted.

Example A: In a dual controller configuration that has completed SOD, both controllers are considered to be resident. If the bottom controller is removed, and a new controller is inserted, the new controller will not be known by the array and will be considered foreign, because it is not the last controller to have completed a SOD in that slot.

Example B: In a dual controller configuration that has completed SOD, both controllers are considered to be resident. If controller Y is removed from the bottom slot, and controller Z is inserted into the bottom slot, controller Z will be considered foreign until it has completed the SOD. If controller Z is then removed and controller Y is reinserted, controller Y will be considered foreign because it is not the last controller to have completed the SOD in that slot.

What happens if a single controller configuration is upgraded to dual controller?

If a controller is inserted into a slot that has not previously held a controller since the array was cleared, ACS will not be invoked. This is because there is no previous controller information in the dacStore region to use for evaluating the controller as being resident or foreign.

When will ACS occur?

Synchronization will occur only on power cycles and controller insertion, not on resets. During the power-on, the foreign controller will send its revision levels to the resident controller and ask if ACS is required. The resident controller will check NVSRAM settings and, if ACS is enabled, will then check the revision numbers. A response is then sent to the foreign controller, and if ACS is not required, the foreign controller will continue its initialization. If ACS is required, a block of RPA cache will be allocated in the foreign controller and the ACS process will begin.

Which controller determines if ACS is to occur?

The NVSRAM bits of the resident controller will be used to determine whether synchronization is to be performed. The controller being swapped in will always request synchronization, which will be accepted or rejected based on the NVSRAM bits of the resident controller.

What is compared to determine if ACS is needed?

The entire code revision number will be used for comparison. Both the BW and AW versions will be compared, and, if either are different, both the BW and AW will be erased and rewritten. The number of separate loadable partitions is also compared; if different, the code versions are considered to be different without considering the revision numbers.

How long will the ACS process take to complete?

The ACS process will begin during the Start-Of-Day process, or between 15 and 30 seconds after power-up or controller insertion. The ACS process for Series 3 controller code will take approximately three minutes to complete. As the code size increases, the time to synchronize will also increase. Once ACS is complete, do not remove the controllers for at least three minutes, in case NVSRAM is also synchronized during the automatic reset.

What will happen if a reset occurs before ACS is complete?

It is important that neither of the controllers are reset during the ACS process. If a reset occurs during this process, it is likely that the foreign controller will no longer boot or function correctly, and it might have to be replaced.

Is NVSRAM synchronized by ACS?

NVSRAM synchronization is not part of ACS, but is checked with dacStore on the drives every time the controller is powered on. The synchronization is not with the alternate controller, but with the NVSRAM as written to dacStore for the controller slot. Each controller, slot-A and slot-B, have individual NVSRAM regions within dacStore. The update process takes approximately five seconds, does not require a reset, and synchronizes the following NVSRAM regions: UserCfg, NonCfg, Platform, HostData, SubSys, DrvFault, InfCfg, Array, Hardware, FCCfg, SubSysID, NetCfg, Board.

Note: No LED display will be seen during the synchronization of the NVSRAM.

What is the order of the synchronization?

Both the BW and AW are synchronized at the same time. NVSRAM will be checked and synchronized during the automatic reset following the ACS of the controller code.

Will the controller LEDs flash during ACS?

The function to flash the LEDs during ACS was first enabled in controller Firmware version 03.01.01.01. If the foreign controller has a release prior to 03.01.01.01, the LED display will not be seen during ACS. The controller being updated controls the LED synchronization display.

What is the LED display sequence?

If the foreign controller has a Firmware version equal to or newer than 03.01.01.01, the LEDs will be turned on from right to left, and then turned off left to right. This sequence will continue until the ACS process is complete.

Is a reset required after ACS is complete?

When the ACS process is complete, the controller will automatically reset.

What is the ACS sequence for controllers with AW prior to 03.01.01.01?

If the foreign controller has AW prior to 03.01.01.01, the LED display will not be displayed. In this case, the controllers should not be removed or reset for at least 15 minutes. Once the foreign controller has reset, the controller will be ready for use within two minutes.

Will ACS occur if the controller is cold swapped?

Yes, providing the NVSRAM bits are set to allow ACS to occur.

What happens if both controllers are cold swapped?

If both controllers are cold swapped (that is, if both are foreign), the controller with the higher FW version number will be loaded onto the alternate controller. This is simply a numerical comparison. For example, if controller A is 03.01.01.08, and controller B is 03.01.01.11, then controller A will be upgraded to 03.01.01.11. The NVSRAM will be updated from dacStore.

What sequence of events should be expected during ACS?

If ACS is enabled, the process will begin about 30 seconds after the controller is inserted or powered on. When ACS begins, the SYM1000 and the foreign controller fault lights will begin to flash, and the controller LEDs will begin to turn on one at a time from right to left, then off left to right. This process will continue for approximately three minutes until the ACS process is complete. Once the ACS process is complete, the foreign controller will reset automatically and during the reset, the NVSRAM will be checked, and updated if needed. The entire process will take approximately five minutes to complete.

Storage partitioning

Does the Storage Partitions feature alleviate the need to have clustering software at the host end?

No. Clustering software provides for the movement of applications between hosts for load balancing and failover. Storage Partitions just provides the ability to dedicate a portion of the storage to one or more hosts. Storage partitions should work well with clustering in that a cluster of hosts can be grouped as a Host Group to provide access to the same storage as needed by the hosts in that cluster.

If I have two hosts in a host group sharing the same logical drives, and both hosts trying to modify the same data on the same logical drive, how are conflicts resolved?

This is one of the primary value adds of clustering software. Clustering software comes in two flavors:

- Shared Nothing - In this model, clustered hosts partition the storage between the hosts in the cluster. In this model, only one host at a time obtains access to a particular set of data. In the event load balancing or a server failure dictates, the cluster software manages a data ownership transition of the set of data to another host. Microsoft MSCS is an example.

- Shared Clustering - In this model, clustered hosts all access the same data concurrently. The cluster software provides management of locks between hosts that prevents two hosts from accessing the same data at the same time. Sun Cluster Server is an example.

Note: In the DS4000 Storage Manager 7 client, you cannot change the default host type until the Write Storage Partitioning feature is disabled.

How many partitions does the user really get?

By default, the user has one partition always associated with the default host group. Therefore, when the user enables (up to 4) or (up to 8) partitions, they are technically getting 4 or 8 partitions in addition to the ″default″ partition. However, there is a caveat for leaving any logical drives in the Default Host Group (see next question).

Why wouldn't I use the default host group's partition?

You can potentially run into logical drive/LUN collisions if you replace a host port in a host without using the tools within the Definitions Window to associate the new host port with the host.

Furthermore, there is no read/write access control on logical drives that are located in the same partition. For operating systems running Microsoft Windows, data corruption will occur if a logical drive is mounted on more than two systems without the presence of middleware, such as Cluster Service, to provide read/write access locking.

Example: You have Host 1 mapped to logical drive Fred using LUN 1. There is also a logical drive George, which is still part of the Default Host Group that uses LUN 1. If you replace a host adapter in Host 1 without associating the new host adapter with Host 1, then Host 1 will now have access to logical drive George, instead of logical drive Fred, through LUN 1. Data corruption could occur.

Miscellaneous

What is the best way to identify which NVSRAM file version has been installed on the system when running in the controller?

In DS4000 Storage Manager, use the profile command. The NVSRAM version is included in the board/controller area.

Alternatively, in the subsystem management window, right-click in the storage subsystem and select **Download -> NVSRAM**. The NVSRAM version displays.

When using arrayPrintSummary in the controller shell, what does *synchronized* really mean and how is it determined?

The term *synchronized* in the shell has nothing to do with firmware or NVSRAM. Simply put, *synchronized* usually means the controllers have successfully completed SOD in an orderly manner and have synchronized cache. A semaphore is passed back and forth between the controllers as one or more of the controllers are going through SOD. If this semaphore gets stuck on one controller, or if a controller does not make it through SOD, the controllers will not come up synchronized.

One way the semaphore can get stuck is if a LUN or its cache cannot be configured. In addition, if a controller has a memory parity error, the controllers will not be synchronized. There have been cases where one controller states the controllers are synchronized while its alternate states that they are not. One cause of this is that a LUN might be 'locked' by the non-owning controller; this can sometimes be fixed by turning off bit 3 of byte 0x29 in NVSRAM (Reserve and Release).

DS4000 Storage Manager shows the nodes in the enterprise window with either IP address or machine name. Why is this not consistent?

DS4000 Storage Manager tries to associate a name with each host node, but if one is not found, then the IP address is used. The inconsistency occurs because the client software cannot resolve the IP address to a name, or the user has manually added a host node by IP address.

Why do you see shared fibre drives twice during text setup of NT/W2K? The UTM does not seem protected (because you can create/delete the partition).

The UTM is only necessary if the Agent software is installed on a host. If you are direct-attached (network-attached) to a module, you do not need the Agent. This, in turn, means you do not need the UTM LUN. RDAC is what 'hides' the UTM from the host and creates the failover nodes. If RDAC is not installed on an operating system, then the UTM will appear to be a normal disk (either 20 Mbytes or 0 MBytes) to the operating system. However, there is no corresponding data space "behind" the UTM; the controller code write-protects this region. The controller will return an error if an attempt is made to write to this non-existent data region. The error is an ASC/ASCQ of 21/00 - Logical block address out of range, in the Event Viewer.

For Linux operating systems, the UTM LUN is not required and should not be present for a Linux Host.

If RDAC is not installed on a host, and NVSRAM offset 0x24 is set to 0, then you will see each LUN twice (once per controller). This is necessary because most HBAs need to see a LUN 0 on a controller in order for the host to come up. You should only be able to format one of the listed devices by using the node name which points to the controller that really owns the disk. You will probably get an error if you try to format a LUN through the node pointing to the non-owning controller. The UTM is "owned" by both controllers as far as the controller code is concerned, so you will probably be able to format or partition the UTM on either node.

In short, if RDAC is not installed, the UTM will appear to be a regular disk to the host. Also, you will see each disk twice. In this case, it is up to the user to know not to partition the UTM, and to know which of the two nodes for each device is the true device.

How can you determine from the MEL which node has caused problems (that is, which node failed the controller)?

You cannot tell which host failed a controller in a multi-host environment. You need to use the host Event Log to determine which host is having problems.

When RDAC initiates a Path failure and sets a controller to passive, why does the status in the enterprise window of DS4000 Storage Manager shows the subsystem as optimal?

This is a change in the design from older code which should prove to be a useful support tool once we get used to it. A 'failed' controller which shows as passive in the EMW window, but which has been failed by RDAC, indicates that no hardware problem could be found on the controller. This type of state implies that we have a problem in the path to the controller, not with the controller itself. In short, a bad cable, hub, GBIC, and so on, on the host side is probably why the failover occurred. Hopefully, this will minimize the number of controllers which are mistakenly returned as bad.

(NT/W2K) What is the equivalent for symarray (NT) with DS4000 Storage Manager W2K?

rdacfltr is the ″equivalent″ of symarray. However, symarray was a class driver, whereas rdacfltr is a Low level filter driver. rdacfltr will report Event 3 (configuration changes) and Event 18 (failover events) information. Any errors which are not of this type (such as check conditions) will be reported by W2K's class driver. These errors will be logged by the (disk) class driver. ASC/ASCQ codes and SRB status information should appear in the same location in these errors. The major difference is this break up of errors in W2K, but the error information should be available under one of these two sources in the Event Log.

Chapter 17. pSeries supplemental problem determination information

If a problem occurs in the fibre channel environment, you will need a number of pieces of information to successfully correct the problem. This chapter discusses fibre channel environment-specific problems on IBM pSeries servers and 6228 HBAs. If problems are experienced with the AIX® system, see your AIX documentation.

Note: For more detailed information about using and troubleshooting problems with the FC 6228 2 Gigabit fibre channel adapter in IBM @server pSeries AIX hosts, see *Fibre Channel Planning and Integration: User's Guide and Service Information*, SC23-4329.

The fibre channel environment can be complex, and because of the potential distances between components of the system, and the diverse nature of these components, additional information will be required to aid in problem determination. The information is available from several sources:

- Gigabit Fibre Channel PCI Adapter service LEDs

  The Gigabit Fibre Channel PCI Adapter has two LEDs located near the connectors. These can be used to determine the state of the adapter.
- AIX system problem determination information

  The AIX system provides problem determination information from its operator display codes, error logging facilities, and application messages.
- Fibre Channel Director problem determination information

  The Fibre Channel Director provides problem determination information from its operator panel, LED indicators on the port cards, and the Enterprise Fabric Connectivity Management Terminal.
- Problem determination information from other devices

  Other fibre channel devices, including disk storage subsystems, provide problem determination information in various ways, such as status LEDs, operator panels, and logout information.

Nature of fibre channel environment problems

In the complex and diverse fibre channel environment, a wide variety of problems can be encountered. These problems may include, but are by no means limited to:

- A Gigabit Fibre Channel PCI Adapter in an AIX system has a hardware defect.
- A Gigabit Fibre Channel PCI Adapter has been incorrectly configured.
- The device driver for a Gigabit Fibre Channel PCI Adapter has been incorrectly installed or is exhibiting incorrect behavior.
- A fibre channel SCSI I/O Controller Protocol Device is not properly configured.
- A logical hard disk in the AIX system is not properly configured.
- A port adapter in a fibre channel switch has a hardware defect.
- A port in a fibre channel switch is incorrectly zoned or blocked.
- Ports in a fibre channel switch have been soft-rezoned and the **cfgmgr** command has not been run to set up the new configuration parameters.

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- Host-to-switch cabling has been changed or swapped and the **cfgmgr** AIX command has not been run to update the configuration attributes. In this case, results of commands such as **lsattr -El** will not yield the correct information for attributes such as the **scsi_id** field.
- A port adapter in a fibre channel hub has a hardware defect.
- A fibre channel port adapter in a SAN Data Gateway has a hardware defect.
- A SCSI port adapter in a SAN Data Gateway has a hardware defect.
- A port adapter in a Disk Storage Subsystem has a hardware defect.
- A disk drive in a Disk Storage Subsystem has a hardware defect.
- A fibre channel jumper cable is defective.
- A fibre channel cable connector is not properly seated or is dirty.
- A fibre channel trunk has a defective fiber.
- A patch panel connection is defective or incorrectly plugged.
- A host or device has defective logic, memory, or control circuitry, or a defective power or cooling system.
- Optical components somewhere in the environment are defective and are causing intermittent failures.

As can be seen in the above list, problems can be encountered anywhere throughout the fibre channel configuration. Sometimes the problem is distinctly reported by, and at the failing component. Often however, the AIX system host, as the initiator, detects and reports the error condition. As a result, fibre channel errors reported by the AIX system must be analyzed carefully to determine the true origin of the failure.

Note: You must not pursue problem determination by Field Replaceable Unit (FRU) replacement in the AIX system unless the problem is actually isolated to this host component.

Fibre channel environment problem determination procedures

This section provides basic problem-determination procedures for the fibre channel environment. These procedures are intended to help isolate the problem and provide information needed to resolve it.

It should be noted that because of the complexity of the environment, a single fibre channel problem can result in a large volume of error reports in the AIX system. In such a case, it is necessary to carefully analyze these logged errors to find the one which represents the original, root cause.

In addition, while fibre channel environment problems are often reported by the AIX system, indiscriminate replacement of the Gigabit Fibre Channel PCI Adapter is not the recommended problem-determination procedure.

Requirements before starting problem determination

A knowledgeable person is needed to perform the problem determination procedures. Someone with skills in fibre channel basics, AIX operations and RS/6000® hardware, Storage Area Network (SAN) basics, Disk Storage Subsystems, Tape Subsystems, and fibre channel switch basics is required. In addition, for some configurations, a knowledge of SCSI interfaces and the SAN Data Gateway is required.

Also, the following skills and information will likely be required and must be available as required:

- An AIX system administrator
- An AIX system operator with root user authority.
- A chart showing the fibre channel cabling scheme, including location of patch panels and trunk cables.
- A list of hardware, microcode, and device driver levels for the Gigabit Fibre Channel PCI Adapter and all devices in the fibre channel configuration.
- Service manuals for all fibre channel devices in the environment. For information on these manuals, refer to the appropriate appendix for each device. Each device's appendix contains a section called "Publications and Other Sources of Information." This section contains a list of publications and Web sites that provide device-specific instructions and information needed for servicing that device.
- In addition, the following publications will be helpful in isolating link failures:
  - *Link Fault Isolation*, SY22-9533
  - *S/390® Fiber Optic Links (ESCON®, FICON®, Coupling Links, and Open system Adapters)*, SY27-2597

Start of PDP PD0010 - Start of Call

Start here to troubleshoot the fibre channel environment.

Step 0010-1

Determine if the fibre channel adapter is available in the AIX system. Run the following AIX command:

```
lsdev -C | grep fcs
```

The results should be similar to the following (assuming three adapters are installed in slots 14-08, 21-08, and 2A-08):

```
fcs0        Available 14-08           FC Adapter
fcs1        Available 21-08           FC Adapter
fcs2        Available 2A-08           FC Adapter
```

Is the adapter available?

NO Go to Step 0020-1.

YES Go to Step 0010-2.

Step 0010-2

Determine if the fibre channel SCSI I/O Controller Protocol Device is available in the AIX system. Run the following AIX command:

```
lsdev -C | grep fscsi
```

The results should be similar to the following (using the same assumptions as in Step 0010-1, above):

```
fscsi0      Available 21-08-01      FC SCSI I/O Controller Protocol Device
fscsi1      Available 14-08-01      FC SCSI I/O Controller Protocol Device
fscsi2      Available 2A-08-01      FC SCSI I/O Controller Protocol Device
```

Note: The instance number of the FC SCSI I/O Controller Protocol Device does not necessarily match its corresponding FC Adapter instance number. That is, fscsi0 may or may not correspond to fcs0. Either condition is valid.

Is the SCSI I/O Controller Protocol Device available?

NO Go to Step 0030-1.

YES Go to Step 0010-3.

Step 0010-3

Determine if the logical hard disks (hdisks) associated with the fibre channel adapter are available in the AIX system.

Note: If there are no disk devices in the configuration, skip this step.

Run the following AIX command:

```
lsdev -C | grep hdisk | pg
```

The result should be similar to the following (assuming the adapter under test is adapter zero in slot 20-70, hdisk4 is one of the hard disks that has been configured, and the Disk Subsystem is an EMC Symmetrix Storage System):

```
hdisk4    Available 20-70-01        EMC Symmetrix FCP Disk
```

There should be an entry in the above output for each hdisk defined for this adapter.

Note: See the AIX system administrator for this installation for assistance in identifying which hdisks have been assigned to this adapter.

Are the appropriate logical hard disks available?

NO Go to Step 0040-1.

YES Go to Step 0010-4.

Step 0010-4

Determine if the logical tape drives associated with the fibre channel adapter are available in the AIX system.

Note: If there are no tape drives in the configuration, skip this step.

Run the following AIX command:

```
lsdev -Cc tape | pg
```

The result should be similar to the following (assuming the adapter under test is adapter zero in slot 20-70, rmt1 is one of the tape drives that has been defined, and the tape drive is a 3590).

```
rmt1      Available 20-70-01        3590 Tape Drive
```

There should be an entry in the above output for each tape drive defined for this adapter.

Note: See the AIX System Administrator for this installation for assistance in identifying which tape drives have been defined for this adapter.

Are the appropriate logical tape drives available?

NO Go to Step 0050-1.

YES Go to Step 0010-5.

Step 0010-5

Determine if there are errors reported by or associated with a disk storage subsystem.

The number of possible indications that a problem may exist in a Disk Storage subsystem include:

- The AIX application reports data or other errors associated with a specific disk device.
- The Disk Storage Subsystem displays error LEDs for one or more disk devices associated with this adapter.
- The Disk Storage Subsystem displays error LEDs for one or more fibre channel ports connected in the fibre channel path for this adapter.
- The Disk Storage Subsystem displays error LEDs that indicate power or cooling faults.
- The AIX error log has entries associated with this adapter or fibre channel SCSI I/O Controller Protocol Device whose Probable Causes list includes the Device.
- Configuration attributes do not reflect the current configuration. For example, the **lsattr -El** command yields an incorrect scsid_id field. Run the **cfgmgr** AIX command to update configuration attributes. This will likely resolve the problem.

Are there errors reported by or associated with a disk storage subsystem?

NO Go to Step 0010-6.

YES Refer to the Service Manual for the disk storage subsystem and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the **cfgmgr** AIX command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

Step 0010-6

Determine if there are errors reported by or associated with a tape subsystem.

The number of possible indications that a problem may exist in a tape subsystem include:

- The AIX application reports data or other errors associated with a specific tape device.
- The tape device displays error messages on its LCD Display.
- The AIX error log has entries associated with this adapter or fibre channel SCSI I/O Controller Protocol Device whose Probable Causes list includes the device.

Are there errors reported by or associated with a tape subsystem?

NO Go to Step 0010-7.

YES Refer to the Service Manual for the tape subsystem and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

Step 0010-7

Determine if there are errors reported by or associated with a fibre channel switch.

Note: If there is no fibre channel switch in the configuration, skip this step.

The number of possible indications that a problem may exist in the fibre channel switch include:

- The AIX application reports link or protocol errors associated with the path which includes the fibre channel switch.
- The fibre channel switch displays error LEDs for one or more fibre channel ports connected in the fibre channel path for this adapter.
- The fibre channel switch displays error conditions through its Enterprise Fabric Connectivity Management Terminal.
- The fibre channel switch indicates power or cooling faults.
- The AIX error log has entries associated with this adapter or fibre channel SCSI I/O Controller Protocol Device whose Probable Causes list includes the fibre channel switch.
- Soft rezoning has not yielded the expected results. Run the **cfgmgr** AIX command to set up the new configuration parameters. This will likely resolve the problem.
- Configuration attributes do not reflect the current configuration. For example, the **lsattr -El** command yields an incorrect **scsid_id** field. Run the AIX **cfgmgr** command to update configuration attributes. This will likely resolve the problem.

Are there errors reported by or associated with a fibre channel switch?

NO Go to Step 0010-8.

YES Refer to the Service Manual for the fibre channel switch and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the **cfgmgr** AIX command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

Step 0010-8

Determine if there are errors reported by or associated with a SAN Data Gateway.

Note: If there is no SAN Data Gateway in the configuration, skip this step.

The number of possible indications that a problem may exist in a SAN Data Gateway include:

- The AIX application reports data or other errors associated with a SCSI Tape Device or SCSI Disk Storage Subsystem connected to the fibre channel configuration through a SAN Data Gateway, and you have already eliminated the tape or disk device as the point of failure.
- The AIX error log has entries associated with this adapter or fibre channel SCSI I/O Controller Protocol Device whose Probable Causes list includes a device connected through a SAN Data Gateway, and the device has been eliminated as the point of failure.
- The SAN Data Gateway's fibre channel port, SCSI port, or Power Status LEDs indicate a error.

Are there errors reported by or associated with a SAN Data Gateway?

NO Go to Step 0010-9.

YES Refer to the Service Manual for the SAN Data Gateway and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

Step 0010-9

Determine if there are errors reported by or associated with a fibre channel storage hub.

Note: If there is no fibre channel storage hub in the configuration, skip this step. Go to Step 0060-1.

The number of possible indications that a problem may exist in a fibre channel storage hub include:

- The AIX application reports data or other errors associated with a Disk Storage Subsystem connected to the fibre channel configuration through a fibre channel storage hub, and you have already eliminated the Disk Storage Subsystem and its devices as the point of failure.
- The AIX error log has entries associated with this adapter or fibre channel SCSI I/O Controller Protocol Device whose Probable Causes list includes a device connected through a fibre channel storage hub, and the device has already been eliminated as the point of failure.
- The fibre channel storage hub's Port Status LEDs indicate an error.

Are there errors reported by or associated with a fibre channel storage hub?

NO Go to Step 0060-1.

YES Refer to the Service Manual for the fibre channel storage hub and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with Step 0060-1.

Start of PDP PD0020 - Fibre Channel Adapter not Available

Step 0020-1

Determine if the fibre channel adapter is defined (recognized) in the AIX system. Run the following AIX command:

```
lsdev -C | grep fcs
```

Note: If the Gigabit Fibre Channel PCI Adapter is a vendor-solution adapter, the **lsdev** command might not recognize the adapter.

The result should be similar to the following (assuming the adapter under test is adapter zero, and in slot 20-70):

```
fcs0      Defined   20-70           FC Adapter
```

Is the adapter defined?

NO Go to Step 0020-2.

YES Go to Step 0020-3.

Step 0020-2

Verify that the fibre channel adapter is physically installed and properly seated in the AIX system.

Is the fibre channel adapter installed in the AIX system?

NO Follow the proper procedures for your system to have the Gigabit Fibre Channel PCI Adapter installed.

Done

YES Go to Step 0020-3.

Step 0020-3

Attempt to configure the Channel adapter by running Configuration Manager. Run the following AIX command:

```
cfgmgr
```

After the **cfgmgr** command has completed, run the following AIX command:

```
lsdev -C | grep fcs
```

Is the adapter defined or available now?

NO Go to Step 0020-4.

YES **Done**

Step 0020-4

Determine if the device drivers for the fibre channel adapter are properly installed on the AIX system. Run the following AIX command:

```
lslpp -l | grep df1000f
```

The result should be similar to the following:

```
devices.pci.df1000f7.com  4.3.3.0 COMMITTED Common PCI FC Adapter Device
devices.pci.df1000f7.diag 4.3.3.0 COMMITTED PCI FC Adapter Device
devices.pci.df1000f7.rte  4.3.3.0 COMMITTED PCI FC Adapter Device Software
devices.pci.df1000f7.com  4.3.3.0 COMMITTED Common PCI FC Adapter Device
```

Notes:

1. The above data is for the Gigabit Fibre Channel PCI Adapter (FC 6227, Type 4-S). If you are troubleshooting the 2 Gigabit Fibre Channel Adapter for 64-bit PCI Bus (FC 6228, Type 4-W), the data displayed will show *df1000f9* instead of *df1000f7*.
2. If no data displays on the screen, or if some of the above components are missing, the device drivers are not properly installed.

Are the device drivers properly installed?

NO Reinstall the device drivers.

Done

YES Go to Step 0020-5.

Step 0020-5

Run diagnostics on the fibre channel adapter.

Did the diagnostics fail?

NO Go to Step 0070-1.

YES Follow the correct procedure to have the Gigabit fibre channel Adapter replaced.

Done

Start of PDP PD0030 - Fibre Channel SCSI I/O Controller Protocol Device not Available

Step 0030-1

Determine if the device drivers for the fibre channel adapter are properly installed on the AIX system. Run the following AIX command:

```
lslpp -l | grep df1000f
```

The result should be similar to the following:

```
devices.pci.df1000f7.com  4.3.3.0 COMMITTED Common PCI FC Adapter Device
devices.pci.df1000f7.diag 4.3.3.0 COMMITTED PCI FC Adapter Device
devices.pci.df1000f7.rte  4.3.3.0 COMMITTED PCI FC Adapter Device Software
devices.pci.df1000f7.com  4.3.3.0 COMMITTED Common PCI FC Adapter Device
```

Notes:

1. The above data is for the Gigabit Fibre Channel PCI Adapter (FC 6227, Type 4-S). If you are troubleshooting the 2 Gigabit Fibre Channel Adapter for 64-bit PCI Bus (FC 6228, Type 4-W), the data displayed will show *df1000f9* instead of *df1000f7*.
2. If no data displays on the screen, or if some of the above components are missing, the device drivers are not properly installed.

Are the device drivers properly installed?

NO Reinstall the device drivers.

Done

YES Go to Step 0070-1.

Start of PDP PD0040 - Logical Hard Disks Not Available

Step 0040-1

Determine that the disk storage subsystem is operational, online, and correctly set up.

Perform the following steps:

1. Ensure that the applicable disk storage subsystem is powered on.
2. Ensure that its appropriate fibre channel (or SCSI, if connected through a SAN Data Gateway) port(s) are correctly cabled and enabled.
3. Ensure that the disk storage subsystem is properly configured, that is, the correct number of LUNs are assigned to the applicable port(s).
4. Examine the AIX system's error log for entries associated with this failure whose Probable Causes list includes the disk storage subsystem.
5. Using the Service Manual for the disk storage subsystem, verify (run diagnostics, and so on) that the subsystem is fully operational.

Is the disk storage subsystem operational, online and correctly set up?

NO Refer to the Service Manual for the disk storage subsystem and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

YES Go to Step 0040-2.

Step 0040-2

Determine that the SAN Data Gateway is operational, online, and correctly set up.

Note: If there is no SAN Data Gateway in the configuration, skip this step.

Perform the following steps:

1. Ensure that the SAN Data Gateway is powered on.
2. Ensure that its appropriate fibre channel port(s) are cabled correctly.
3. Ensure that its appropriate SCSI port(s) are cabled correctly.
4. Using the Service Manual for the SAN Data Gateway, verify that the SAN Data Gateway is fully operational.

Is the SAN Data Gateway operational, online, and correctly set up?

NO Refer to the Service Manual for the SAN Data Gateway and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with the next step.

YES Go to Step 0040-3.

Step 0040-3

Determine that the fibre channel switch is operational, online, and correctly set up.

Note: If there is no fibre channel switch in the configuration, skip this step. Go to Step 0060-1.

Perform the following steps:

1. Ensure that the fibre channel switch is powered on.
2. Ensure that its appropriate fibre channel port(s) are cabled.
3. Ensure that its appropriate fibre channel port(s) are enabled.
4. Ensure that the fibre channel switch is properly configured, that is, it is correctly zoned and the applicable ports are not blocked.
5. Examine the AIX system's error log for entries associated with this failure whose Probable Causes list includes the fibre channel switch.
6. Using the Service Manual for the fibre channel switch, verify (run diagnostics, and so on) that the switch is fully operational.
7. Determine if ports on the switch have been soft-rezoned recently. If so, run the AIX **cfgmgr** command to set up the new configuration parameters. This will likely resolve the problem.
8. Determine if host-to-switch cabling has been changed or swapped recently. If so, run the AIX **cfgmgr** command (unless you ran it above) to update the configuration attributes. If these attributes are not updated, results of commands such as the **lsattr -El** will not yield the correct information for attributes such as the scsi_id field. Running the **cfgmgr** AIX command will likely resolve the problem.

Is the fibre channel switch operational, online, and correctly set up?

NO Refer to the Service Manual for the fibre channel switch and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might have to run the **cfgmgr** AIX command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with Step 0060-1.

YES Go to Step 0060-1.

Start of PDP PD0050 - Logical Tape Drives Not Available

Step 0050-1

Determine if the logical tape drives associated with the fibre channel adapter are defined (recognized) in the AIX system. Run the following AIX command:

```
lsdev -Cc tape | pg
```

The result should be similar to the following (assuming the adapter under test is adapter zero in slot 20-70, rmt1 is one of the tape drives that has been configured, and the tape drive is a 3590).

```
rmt1      Defined 20-70-01        3590 Tape Drive
```

There should be an entry in the above output for each tape drive defined for this adapter.

Are the appropriate logical tape drives defined?

NO Refer to the Installation Manual for the Tape Drives and, using SMIT, define the appropriate tape drive(s) to be associated with the fibre channel Adapter. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0050-2.

Step 0050-2

Determine that the tape drive(s) are operational, online and correctly set up. Perform the following steps:

1. Ensure that the applicable tape drive(s) are powered on.
2. Ensure that the appropriate SCSI interfaces from the SAN Data Gateway, if present, are correctly cabled and enabled.
3. Ensure that the fibre channel interfaces, if applicable, are correctly cabled and enabled.
4. Ensure that the tape drive(s) are properly configured, that is, the correct port and device addresses are set up.
5. Examine the AIX system's error log for entries associated with this failure whose Probable Causes list includes the tape drives(s).
6. Using the Service Manual for the tape drives, verify that the tape drive(s) are fully operational.

Are the tape drives operational, online and correctly set up?

NO Refer to the Service Manual for the tape drives and continue problem-determination procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem determination-procedure and continue with the next step.

YES Go to Step 0050-3.

Step 0050-3

Determine that the SAN Data Gateway is operational, online, and correctly set up.

Note: If there is no SAN Data Gateway in the configuration, skip this step. Go to Step 0060-1.

Perform the following steps:

1. Ensure that the SAN Data Gateway is powered on.
2. Ensure that its appropriate fibre channel port(s) are cabled correctly.
3. Ensure that its appropriate SCSI port(s) are cabled correctly.
4. Using the Service Manual for the SAN Data Gateway, verify that the SAN Data Gateway is fully operational.

Is the SAN Data Gateway operational, online, and correctly set up?

NO Refer to the Service Manual for the SAN Data Gateway and continue problem determination-procedures using the information provided therein. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

Note: If the problem is not resolved using the Service Manual information for this device, return to this problem-determination procedure and continue with Step 0060-1.

YES Go to Step 0060-1.

Start of PDP PD0060 - Fiber Path Failures

Step 0060-1

Determine that the fiber jumpers, trucks, patch panels, and any other devices (such as hubs) in this configuration provide a complete signal path from the AIX System fibre channel Adapter to the disk storage subsystem or tape drive.

The number of possible indications that a problem may exist in the signal path to the disk storage subsystem or tape drive include:

- The AIX error log has entries associated with this adapter or fibre channel device whose Probable Causes list includes Cables and Connectors.
- The Hard Disks cannot be configured (made Available) and the Disk Storage Subsystem and intervening switches or SAN Data Gateway have been eliminated as the cause of failure.
- The AIX application reports link or protocol errors associated with the path which includes a specific device, and that device and intervening switches or SAN Data Gateway have been eliminated as the cause of failure.
- A fibre channel device displays error LEDs for one or more fibre channel ports, indicating a link problem.
- A fibre channel switch displays link error conditions through its Enterprise Fabric Connectivity Management Terminal.
- The AIX application reports data or other errors associated with a specific fibre channel device, and that device has been eliminated as the cause of failure.
- The AIX error log has entries associated with this failure whose Probable Causes list includes a fibre channel device, and that device has been eliminated as the cause of failure.
- You were sent to this step from anywhere else in the problem-determination procedures, or there are other reasons to suspect fiber cabling or connector problems.

Is there any reason to suspect problems associated with fiber jumpers, trucks, patch panels, or any other devices (such as hubs) in this configuration?

NO Go to Step 0070-1.

YES Go to Step 0060-2.

Step 0060-2

Determine that the fiber jumper from the AIX System fibre channel Adapter provides a complete signal path to the disk storage subsystem, tape drive, patch panel, or other device (such as a hub) to which it is connected.

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the fiber jumper connector is clean and properly plugged into the Fibre Adapter in the AIX system.
2. Ensure that the connector at the other end of this fiber jumper is clean and properly plugged into the patch panel, switch, SAN Data Gateway, hub, disk storage subsystem, or tape drive as intended.
3. Ensure that the fiber jumper is not defective.

Does the fiber jumper from the AIX System fibre channel Adapter provide a complete signal path to the disk storage subsystem, tape drive, patch panel, or other device (such as a hub, etc) to which it is connected?

NO Correct the fault. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-3.

Step 0060-3

Determine that the patch panels and interconnecting trunk or jumpers in this configuration provide a complete end-to-end signal path.

Note:

- If this path does not include a patch panel, skip this step.
- If this configuration contains more than one patch panel/trunk set, use the following procedure to check all of them, regardless of whether they exist in the configuration:

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the correct truck fibers or interconnecting jumper is plugged into the correct, clean patch-panel connection.
2. Ensure that the trunk fibers or interconnecting jumpers deliver the light properly to the patch panel at the other end.
3. Ensure that these truck fibers or interconnecting jumper is plugged into the correct, clean patch-panel connection at the other end.
4. Ensure that the fiber jumper connector at this patch-panel is clean and correctly connected.

Do the patch-panels and interconnecting trunk or jumper in this configuration provide a complete end-to-end signal path?

NO Correct the fault. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-4.

Step 0060-4

Determine that the fiber jumpers plugged into the fibre channel switch in this configuration provide a complete signal path through the switch.

Note: If this path does not include a fibre channel switch, skip this step.

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the connectors in both the inbound and outbound ports are clean and properly plugged into the correct ports.
2. Ensure that both the inbound and outbound fiber jumpers are not defective.
3. Ensure that the fibre channel switch is properly configured and does not indicate any port failures.
4. Determine if host-to-switch cabling has been changed or swapped recently. If so, run the AIX **cfgmgr** command to update the configuration attributes. If these attributes are not updated, results of commands such as the **lsattr -El** will not yield the correct information for attributes such as the **scsi_id** field. Running the AIX **cfgmgr** command will likely resolve the problem.

Do the fiber jumpers plugged into the fibre channel switch in this configuration provide a complete signal path through the switch?

NO Correct the fault. After the problem is resolved, you might need to run the **cfgmgr** AIX command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-5.

Step 0060-5

Determine that the fiber jumper and SCSI interface cables plugged into the SAN Data Gateway in this configuration provide a complete signal path through the gateway.

Note: If this path does not include a SAN Data Gateway, skip this step.

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the fiber jumper connector is clean and properly plugged into the correct fibre channel port.
2. Ensure that the SCSI interface is correctly cabled.
3. Ensure that the fiber jumper is not defective.
4. Ensure that the SCSI interface cables are not defective.
5. Ensure that the SAN Data Gateway does not indicate a port or interface failure.

Do the fiber jumper and SCSI interface cables plugged into the SAN Data Gateway in this configuration provide a complete signal path through the gateway?

NO Correct the fault. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-6.

Step 0060-6

Determine that the fiber jumpers plugged into the hub in this configuration provide a complete signal path through the hub.

Note: If this path does not include a hub, skip this step.

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the inbound fiber jumper connector is clean and properly plugged into the correct hub port.
2. Ensure that the outbound fiber jumper connector is clean and properly plugged into the correct hub port.
3. Ensure that the both inbound and outbound fiber jumpers are not defective.
4. Ensure that all other fiber jumpers plugged into ports on this hub have good connections and are not defective.
5. Ensure that all open (unplugged) ports are correctly bypassing the signal.

Do the fiber jumpers plugged into the hub in this configuration provide a complete signal path through the Hub?

NO Correct the fault. After the problem is resolved, you may need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-7.

Step 0060-7

Determine that the fiber jumpers plugged into any other fibre channel device in this configuration provide a complete signal path through the device.

Note:

- If this path has no other devices prior to the disk storage subsystem or tape drive, skip this step.
- If this configuration contains more than one device not covered in previous steps, use the following procedure to check all of them, regardless of whether they exist in the configuration:

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the inbound fiber jumper connector is clean and properly plugged into the correct port.
2. Ensure that the outbound fiber jumper connector is clean and properly plugged into the correct port.
3. Ensure that the both inbound and outbound fiber jumpers are not defective.

Do the fiber jumpers plugged into this device provide a complete signal path through this device?

NO Correct the fault. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0060-8.

Step 0060-8

Determine that the fiber jumper plugged into the disk storage subsystem or tape drive provides a complete signal path to it.

Using an accurate fiber-cabling chart, perform the following steps:

1. Ensure that the fiber jumper connector is clean and properly plugged into the correct port.
2. Ensure that the fiber jumper is not defective.

Does the fiber jumper plugged into this device provide a complete signal path to it?

NO Correct the fault. After the problem is resolved, you might need to run the AIX **cfgmgr** command to restore the fibre channel environment to a functional state.

Done

YES Go to Step 0070-1.

Start of PDP PD0070 - Other Failures

Step 0070-1

Perform the following steps:

1. Start the Device Driver Trace on the AIX system.
2. If the problem you are investigating involves an application, refer to the documentation for the application and start the application trace, if available, on the AIX system.
3. Reproduce the failing scenario.
4. Stop all traces.
5. Have the following information available:
   - All trace data gathered above.
   - Any errpt data in the AIX Error Log.
   - Any errors reported by the application.
   - Any error data present in any of the fibre channel Devices, including LED indicators.
   - A detailed description of the fibre channel cabling scheme.
   - Hardware, microcode, and device driver levels for the fibre channel PCI adapter and all fibre channel devices in the failing configuration.
   - A detailed description of the error, failure, or problem.
6. Call AIX Support.

Done

Chapter 18. MEL data format

The following table lists all the critical events for firmware version 06.10. These critical events are logged in the Event Log in the Subsystem Management Window of the DS4000 Storage Manager client. In addition, the critical events are also sent via email and/or SNMP depending on the alert notification set-up that the user performed within the Enterprise Management Window of the storage management software. See Event Descriptions for more information about these events. The critical events throughout Event Descriptions are highlighted with a gray shade.

Critical Event Number	Critical Event Description (SYMsm Description)
0x1001	Channel failed
0x1010	Impending drive failure (PFA) detected
0x1207	Fibre channel link errors - threshold exceeded
0x1208	Data rate negotiation failed
0x1209	Drive channel set to Degraded
0x150E	Controller loop-back diagnostics failed
0x150F	Channel miswire
0x1510	ESM miswire
0x1513	Individual drive – degraded path
0x1600	Uncertified drive detected
0x1601	Reserved blocks on ATA drives cannot be discovered
0x200A	Data/parity mismatch on volume
0x202E	Read drive error during interrupted write
0x2109	Controller cache not enabled – cache sizes do not match
0x210C	Controller cache battery failed
0x210E	Controller cache memory recovery failed after power cycle or reset
0x2110	Controller cache memory initialization failed
0x2113	Controller cache battery nearing expiration
0x211B	Batteries present but NVSRAM file configured for no batteries
0x2229	Drive failed by controller
0x222D	Drive manually failed
0x2247	Data lost on volume during unrecovered interrupted write
0x2248	Drive failed – write failure
0x2249	Drive capacity less than minimum
0x224A	Drive has wrong block size
0x224B	Drive failed – initialization failure
0x224D	Drive failed – no response at start of day
0x224E	Drive failed – initialization/reconstruction failure
0x2250	Volume failure

Critical Event Number	Critical Event Description (SYMsm Description)
0x2251	Drive failed – reconstruction failure
0x2252	Drive marked offline during interrupted write
0x2255	Volume definition incompatible with ALT mode – ALT disabled
0x2602	Automatic controller firmware synchronization failed
0x2801	Storage Array running on UPS battery
0x2803	UPS battery – two minutes to failure
0x2807	ESM Failed
0x2808	Tray ID not unique
0x280A	Controller tray component removed
0x280B	Controller tray component failed
0x280D	Drive tray component failed or removed
0x280E	Standby power source not fully charged
0x280F	ESM – loss of communication
0x2813	Mini-hub canister failed
0x2815	GBIC failed
0x2816	Tray ID conflict – duplicate IDs across drive trays
0x2818	Tray ID mismatch – duplicate IDs in same drive tray
0x281B	Nominal temperature exceeded
0x281C	Maximum temperature exceeded
0x281D	Temperature sensor removed
0x281E	ESM firmware mismatch
0x2821	Incompatible mini-hub canister
0x2823	Drive by-passed
0x2827	Controller inadvertently replaced with an ESM
0x2828	Unsupported drive tray detected
0x2829	Controller redundancy lost
0x282B	Drive tray path redundancy lost
0x282D	Drive path redundancy lost
0x282F	Incompatible version of ESM firmware detected
0x2830	Mixed drive types not supported
0x3019	Volume ownership changed due to failover
0x4011	Volume not on preferred path due to AVT/RDAC failover
0x5005	Place controller offline
0x5038	Storage array 10-minute lockout; maximum incorrect passwords attempted
0x5040	Place controller in service mode

Critical Event Number	Critical Event Description (SYMsm Description)
0x5602	This controller's alternate failed – timeout waiting for results
0x560B	Diagnostics rejected – CtlrDiag task cannot obtain Mode Select lock
0x560C	Diagnostics rejected – CtlrDiag task on controller's alternate cannot obtain Mode Select lock
0x560D	Diagnostics read test failed on controller
0x560E	This controller's alternate failed diagnostics read test
0x560F	Diagnostics write test failed on controller
0x5610	This controller's alternate failed diagnostics write test
0x5616	Diagnostics rejected – configuration error on controller
0x5617	Diagnostics rejected – configuration error on this controller's alternate
0x6101	Internal configuration database full
0x6107	This controller's alternate is non-functional and is being held in reset
0x6200	Snapshot repository volume capacity – threshold exceeded
0x6201	Snapshot repository volume capacity – full
0x6202	Snapshot volume failed
0x6400	Dual primary volume conflict
0x6401	Dual secondary volume conflict
0x6402	Data on mirrored pair unsynchronized
0x6503	Communication to remote volume - down
0x6505	Failed to communicate storage array's world-wide name
0x6600	Volume copy operation failed
0x6700	Unreadable sector(s) detected – data loss occurred
0x6703	Overflow in unreadable sector database

MEL Data Format

The SYMsm8 event viewer formats and displays the most meaningful fields of major event log entries from the controller. The data displayed for individual events varies with the event type and is described in the Events Description section. The raw data contains the entire major event data structure retrieved from the controller subsystem. The event viewer displays the raw data as a character string. Fields that occupy multiple bytes may appear to be byte swapped depending on the host system. Fields that may appear as byte-swapped are noted in the table below.

	7	6	5	4	3	2	1	0
Byte	**Constant Data Fields**							
0-3	(MSB)			Signature				
								(LSB)
4-7	(MSB)			Version (Value of 2)- *(byte swapped)*				
								(LSB)
8-15	(MSB)			Sequence Number - *(byte swapped)*				
								(LSB)
16-19	(MSB)			Event Number - *(byte swapped)*				
								(LSB)
20-23	(MSB)			Timestamp - *(byte swapped)*				
								(LSB)
24-27	(MSB)			Location Information - *(byte swapped)*				
				(Channel & Device or Tray & Slot Number)				(LSB)
28-31	(MSB)			IOP ID - *(byte swapped)*				
								(LSB)
32-33	I/O Origin - *(byte swapped)*							
34-35	Reserved							
36-39	(MSB)			LUN/Volume Number - *(byte swapped)*				
								(LSB)
40-43	Controller Number- *(byte swapped)*							
44-47	Category- *(byte swapped)*							
48-51	Component Type- *(byte swapped)*							
52-119	Component Location- *(byte swapped)*							
120-123	Location Valid- *(byte swapped)*							
124	Number of Optional Fields Present (M)							
125	Total Length of Optional Field(N)							

	7	6	5	4	3	2	1	0
Byte	**Constant Data Fields**							
126 – 127	Pad (unused)							
	Optional Field Data							
128	Data Length (L)							
129	Pad (unused)							
130 – 131	Data Field Type - *(byte swapped)*							
132 – 132+L …	Data **…**							
	Last Optional Field Data Entry							

Note: If the log entry field does not have a version number, the format will be as shown below.

Byte	Constant Data Fields
0-7	Sequence Number
8-11	Event Number
12-15	Time Stamp
16-19	Device
20-23	ID
24-25	Origin
26-27	LUN Number
28	Controller Number
29	Number Data Fields
30	Data Field Length

If the log entry field contains Version 1, the format will be as shown below.

Byte	Constant Data Fields
0-3	Signature
4-7	Version (Value is 1)
8-15	Sequence Number
16-19	Event
20-23	Time Stamp
24-27	Device
28-31	Id
32-33	Origin
34-35	Reserved1
36-39	LUN Number
40	Controller Number
41	Number of Data Fields
42	Data Field Length
43	Reserved2

Constant Data Fields

Signature (Bytes 0-3)

The Signature field is used internally by the controller. The current value is ‘MELH’.

Version (Bytes 4-7)

When the Version field is present, the value should be 1 or 2, depending on the format of the MEL entry.

Sequence Number (Bytes 8-15)

The Sequence Number field is a 64 bit incrementing value starting from the time the system log was created or last initialized. Resetting the log does not affect this value.

Event Number (Bytes 16-19)

The Event Number is a 4 byte encoded value that includes bits for drive and controller inclusion, event priority and the event value. The Event Number field is encoded as follows:

	7	6	5	4	3	2	1	0
19	Internal Flags		Log Group		Priority			
18	Event Group				Component			
17	(MSB)	Event Value						
16	Event Value (LSB)							

Internal Flags

The Internal Flags are used internally within the controller firmware for events that require unique handling, the host application ignores these values:

Flag	Value
Mod Controller Number	0x2
Flush immediate	0x1

Log Group

The Log Group field indicates what kind of event is being logged. All events are logged in the system log. The values for the Log Group Field are describes as follows:

Log Group	Value
System Event	0x0
Controller Event	0x1
Drive Event	0x2

Priority

The Priority field is defined as follows:

Priority	Value
Informational	0x0
Critical	0x1
Reserved	0x2 - 0xF

Event Group

Event Group	Value
Unknown	0x0
Error	0x1
Failure	0x2
Command	0x3
Notification	0x4
State	0x5
Host	0x6
General	0x7
Reserved	0x8-0xF

Component

Component	Value
Unknown/Unspecified	0x0
Drive	0x1
Power Supply	0x2
Cooling Element	0x3
Minihub	0x4
Temperature Sensor	0x5
Channel	0x6
Environmental Services Electronics (ESM)	0x7
Controller Electronics	0x8
Nonvolatile Cache (RPA Cache Battery)	0x9
Enclosure	0xA
Uninterruptible Power Supply	0xB
Chip - I/O or Memory	0xC
Volume	0xD
Volume Group	0xE
I/O Port CRU	0xF

Timestamp (Bytes 20-23)

The Timestamp field is a 4 byte value that corresponds to the real time clock on the controller. The real time clock is set (via the boot menu) at the time of manufacture. It is incremented every second and started relative to January 1, 1970.

Location Information (Bytes 24-27)

The Location Information field indicates the Channel/Drive or Tray/Slot information for the event. Logging of data for this field is optional and is zero when not specified.

IOP ID (Bytes 28-31)

The IOP ID is used by MEL to associate multiple log entries with a single event or I/O. The IOP ID is guaranteed to be unique for each I/O. A valid IOP ID may not be available for certain MEL entries and some events use this field to log other information. The event descriptions will indicate if the IOP ID is being used for unique log information.

Logging of data for this field is optional and is zero when not specified.

I/O Origin (Bytes 32-33)

The I/O Origin field specifies where the I/O or action originated that caused the event. It uses one of the Error Event Logger defined origin codes:

Value	Definition
0	Active Host
1	Write Cache
2	Hot Spare
3	Other Internal

A valid I/O Origin may not be available for certain MEL entries and some events use this field to log other information. The event descriptions will indicate if the I/O Origin is being used for unique log information. Logging of data for this field is optional and is zero when not specified.

When decoding MEL events, additional FRU information can be found in the Software Interface Specification.

LUN/Volume Number (Bytes 36-39)

The LUN/Volume Number field specifies the LUN or volume associated with the event being logged. Logging of data for this field is optional and is zero when not specified.

Controller Number (Bytes 40-43)

The Controller Number field specifies the controller associated with the event being logged.

Value	Definition
0x01	Controller with Drive side SCSI ID 6 (normally the bottom controller in the subsystem)
0x00	Controller with Drive side SCSI ID 7 (normally the top controller in the subsystem)

Logging of data for this field is optional and is zero when not specified.

Category Number (Bytes 44-47)

This field identifies the category of the log entry. This field is identical to the event group field encoded in the event number.

Event Group	Value
Unknown	0x0
Error	0x1
Failure	0x2
Command	0x3
Notification	0x4
State	0x5
Host	0x6
General	0x7
Reserved	0x8-0xF

Component Type (Bytes 48-51)

Identifies the component type associated with the log entry. This is identical to the Component Group list encoded in the event number.

Component	Value
Unknown/Unspecified	0x0
Drive	0x1
Power Supply	0x2
Cooling Element	0x3
Minihub	0x4
Temperature Sensor	0x5
Channel	0x6
Environmental Services Electronics (ESM)	0x7
Controller Electronics	0x8
Nonvolatile Cache (RPA Cache Battery)	0x9
Enclosure	0xA
Uninterruptible Power Supply	0xB
Chip - I/O or Memory	0xC
Volume	0xD
Volume Group	0xE
I/O Port CRU	0xF

Component Location (Bytes 52-119)

The first entry in this field identifies the component based on the Component Type field listed above. The definition of the remaining bytes is dependent on the Component Type.

Component	Value	Location Data
Unknown/Unspecified	0x0	None
Drive	0x1	Tray Number 4 bytes Slot Number 4 bytes
Power Supply	0x2	Tray Number 4 bytes
Cooling Element	0x3	Tray Number 4 bytes
Minihub	0x4	Minihub Type 1 Host, 2 Drive Channel Number 4 bytes Slot Number 4 bytes
Temperature Sensor	0x5	Tray Number 4 bytes
Channel	0x6	Channel Type 0 host, 1 Drive Index 4 bytes Slot Number 4 bytes
Environmental Services Electronics (ESM)	0x7	Tray Number 4 bytes
Controller Electronics	0x8	Tray Number 4 bytes
Nonvolatile Cache (RPA Cache Battery)	0x9	Tray Number 4 bytes
Enclosure	0xA	Tray Number 4 bytes
Uninterruptible Power Supply	0xB	Tray Number 4 bytes
Chip - I/O or Memory	0xC	Tray Number 4 bytes Slot Number 4 bytes
Volume	0xD	Label Length 4 bytes Label Value 60 bytes maximum
Volume Group	0xE	Volume group number 4 bytes
I/O Port CRU	0xF	Tray Number 4 bytes

Location Valid (Bytes 120-123)
This field contains a value of 1 if the component location field contains valid data. If the component location data is not valid or cannot be determined the value is 0.

Number of Optional Fields Present (Byte 124)
The Number of Optional Fields Present specifies the number (if any) of additional data fields that follow. If this field is zero then there is no additional data for this log entry.

Optional Field Data

The format for the individual optional data fields follows:

0-1	Data Length (L)
2-3	Data Field Type
4 L	Data ...

Data Length (Byte 128)
The length in bytes of the optional field data (including the Data Field Type).

Data Field Type (Bytes 130-131)
See Section Data Field Types for the definitions for the various optional data fields.

Data (Byte 132)
Optional field data associated with the Data Field Type. This data may appear as byte-swapped when using the event viewer.

Event Descriptions

The following sections contain descriptions for all events. Note that some events may not be logged in a given release. The critical events are highlighted with a gray shade. These critical events are logged in the Event Log in the Array Management Window of the storage management software. In addition, the critical events are also sent via email and/or SNMP depending on the alert notification set-up that the user performed within the Enterprise Management Window of the storage management software.

Destination Driver Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Channel Failure: (SYMsm Description - Channel failed) Logged when the parallel SCSI destination driver detects a channel failure.					
Controller (0x1)	Critical (0x1)	Failure (0x2)	Chip (0xC)	0x1001	Device: FRU info Origin: FRU info
Channel Revival: (SYMsm Description - Channel revived) Currently Not Logged.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Chip (0XC)	0x1002	
Tally Exceeded: (SYMsm Description - Drive error tally exceeded threshold) Currently Not Logged.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x1003	
Open Error: (SYMsm Description – Error on drive open) Logged for any error that causes the open sequence to terminate without the drive being opened.					
System (0x0)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1004	Id: 11: The mode sense to determine the initial value of the QERR bit failed. 12: Either the mode select to change the QERR bit failed or the mode sense to verify the value of the bit after the mode select indicates that the bit is still set. 13 The mode sense used to verify the mode select to change the QERR bit failed. 21 The mode sense to determine the initial value of the WCE bit failed. 22 Either the mode select to change the WCE bit failed or the mode sense to verify the value of the bit after the mode select indicates that the bit is still set. 23: The mode sense used to verify the mode select to change the WCE bit failed. 31: The mode sense to determine the initial value of the AWRE and ARRE bits failed. 32: Either the mode select to set the AWRE and ARRE bits failed or the mode sense to verify the value of the bits after the mode

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
					select indicates that either one or both bits are still clear. 33: The mode sense used to verify the mode select to change the AWRE and ARRE bits failed. The drive open will not be failed if unable to set the AWRE and ARRE bits. Report the error and continue the open.
Read Failure: (SYMsm Description - Drive read failure - retries exhausted) Currently Not Logged.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1005	
Write Failure: (SYMsm Description - Drive write failure - retries exhausted) Currently Not Logged.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1006	
No Memory: (SYMsm Description - Controller out of memory) Logged when memory allocation failed.					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1007	Id: 0: SCSI Device Structure 1: SCSI_Op NCE Structure 2: SCSI_Op NCE Structure (non-cache) 3: SCSI Ops Data Field Type: 0x0206
Unsupported Chip: (SYMsm Description: Unsupported SCSI chip) Currently Not Logged.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Chip (0xC)	0x1008	
Memory Parity Error: (SYMsm Description: Controller memory parity error) Logged when a memory parity error is detected by the destination driver.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1009	
Drive Check Condition: (SYMsm Description: Drive returned CHECK CONDITION) Logged when the driver was unable to recover the specified device returned a check condition to the driver and driver retries have been exhausted.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x100A	Data Field Type: 0x010D

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Destination SOD Error: (SYMsm Description: Start-of-day error in destination driver) Logged when the destination driver can't complete SOD initialization successfully.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100B	Origin: Indicates the structure that couldn't be allocated. 1: Call to VKI_REBOOT_HOOK failed. 2: Status byte structure allocation failed 3: Data_phase_tag_ptrs structure allocation failed 4: Invalid_Reselect_data structure allocation failed Data Field Type: 0x0206
Destination Hardware Error: (SYMsm Description: Hardware error on drive side of controller) Currently Not Logged.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100C	
Destination Timeout: (SYMsm Description: Timeout on drive side of controller) Logged when a command from controller to drive or ESM takes longer than expected.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x100D	
Unexpected Interrupt: (SYMsm Description: Unexpected interrupt on controller) Logged due to an unexpected interrupt with no active device on chip.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100E	Data Field Type: 0x0201
Bus Parity Error: (SYMsm Description: Bus parity error on controller) Logged when a Bus Parity error is detected by the destination driver.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x100F	
Drive PFA: (SYMsm Description: Impending drive failure (PFA) detected) The logged device generated a PFA condition.					
Controller (0x1)	Critical (0x1)	Error (0x1)	Drive (0x1)	0x1010	None
Chip Error: (SYMsm Description: Chip error) Currently Not Logged.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Chip (0XC)	0x1011	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Destination Driver: (SYMsm Description: Destination driver error) Logged when the destination driver has an unrecovered error from the drive.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1012	Origin: Contains the low level destination driver internal error. Id: Contains the raw error logger error number.
Destination Diagnostic Failure: (SYMsm Description: Destination driver level 0 diagnostic failed) Logged when destination driver level 0 diagnostics failed for the specified channel.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1013	Id: Contains diagnostic test that failed. 1: Read/Write registers 2: 64 byte FIFO 3: DMA FIFO Data Field Type: 0x010B
Destination Reassign Block: (SYMsm Description: Destination driver successfully issued reassign blocks command) Logged when the destination driver issues a reassign block to the drive due to a write failure.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1014	Origin: Block List
Bad Mode Parameters: (SYMsm Description: Incorrect mode parameters modified and saved on drive) Logged when the controller has successfully modified and saved mode page settings on a drive.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1015	Origin: FRU info Id: 1: The QERR bit (mode page10) was successfully cleared. 2: The WCE bit (mode page 8) was successfully cleared. 3: The AWRE and ARRE bits (mode page 1) were successfully set.
Drv Medium Err: (SYMsm Description: Hardware error – Unrecoverable read error on drive) Logged when an unrecoverable read error is detected on a drive.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1016	
Dst Channel Down: (SYMsm Description: Fibre channel link down) Logged when the destination channel is down.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x1017	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Dst Channel Up: (SYMsm Description: Fibre channel link up) Logged when the destination channel is up.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x1018	
Dst Channel Ext Down: (SYMsm Description: Channel link down (60 seconds)) Logged when the destination channel is down (60 seconds).					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x1019	
Drv Unresponsive: (SYMsm Description: Unresponsive drive – extended I/O timeout) Logged when the drive is unresponsive.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x101A	

SCSI Source Driver Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
SCSI Chip: (SYMsm Description: SRC driver detected exception on SCSI chip) Logged when the SRC driver detects an exception condition from the SCSI chip.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1101	Device: Base address of the SCSI chip Id: Register offset where exception was detected possible values are: 0xC dstat register 0x42 SIST0_REG 0x43 SIST1_REG Origin: Value of the register
Host Bus Reset: (SYMsm Description: Host bus reset asserted) Logged when the source SCSI driver asserts the RESET signal on the host SCSI bus. This is usually done as a response to have a host bus reset propagated to it by the alternate controller in a Wolfpack environment.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x1102	None
Host Bus Reset Received: (SYMsm Description: Host bus reset received) Logged when a host bus reset was received and the controller is going to propagate it to the alternate controller in a wolf pack environment. Log entries for Host Bus Reset Received and Host Bus Reset should always appear in pairs in the system log.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x1103	None
Unknown Interrupt: (SYMsm Description: Unknown interrupt) Logged when the source SCSI driver detects an unknown interrupt.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1104	Device: Base address of the SCSI chip Origin: Value in the interrupt register.

Fibre Channel Source Driver Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
LIP Reset Received: (SYMsm Description: Fibre channel - LIP reset received) Logged when a selective LIP reset (LipPdPs) is received.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1201	Id: Internal Checkpoint Code Origin: 0 = Source Side FC LUN: Channel number
Target Reset Received: (SYMsm Description: Fibre channel - TGT reset received) Logged when a Target Reset if received.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1202	Id: Internal Checkpoint Code Origin: 0 = Source Side FC LUN: Channel number
Third Party Logout Reset Received: (SYMsm Description: Fibre channel - TPRLO reset received) Logged when a Third Party Logout with the Global Logout bit set. This is treated as a Target Reset by the controller.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1203	Id: Internal Checkpoint Code Origin: 0 = Source Side FC LUN: Channel number
Initialization Error: (SYMsm Description: Fibre channel - driver detected error after initialization) Logged when a controller is unable to initialize an internal structure.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1204	Id: Internal Checkpoint Code Origin: 0 = Source Side FC LUN: Channel number
General Error: (SYMsm Description: Fibre channel - driver detected error during initialization) Logged when an internal error (e.g. unable to obtain memory, unable to send frame) occurs.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1205	Id: Internal Checkpoint Code Origin: 0 = Source Side FC LUN: Channel number
Link Error Threshold: (SYMsm Description: Fibre channel link errors continue) Logged when Link Error count exceeds the threshold value after the initial notification.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Channel (0x6)	0x1206	Dev: Link Error Information Id: Internal Checkpoint Code LUN: Channel number

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Link Error Threshold Critical: (SYMsm Description: Fibre channel link errors - threshold exceeded) Logged when Link Error count exceeds the threshold the first time.					
Controller (0x1)	Critical (0x1)	Error (0x1)	Channel (0x6)	0x1207	Dev: Link Error Information Id: Internal Checkpoint Code LUN: Channel number
FC Speed Neg Failure: (SYMsm Description: Data rate negotiation failed) Logged when the data rate negotiation fails.					
Controller (0x1)	Critical (0x1)	Error (0x1)	Channel (0x6)	0x1208	
Degrade Channel: (SYMsm Description: Drive channel set to Degraded) Logged when the drive channel is set to degraded.					
Controller (0x1)	Critical (0x1)	Error (0x1)	Channel (0x6)	0x1209	

Fibre Channel Destination Driver Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Init Error: (SYMsm Description: Channel initialization error) Logged when a controller is unable to initialize hardware or an internal structure.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1500	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Drive Reset: (SYMsm Description: Selective LIP reset issued to drive) Logged when the fibre channel driver resets a device.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1501	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Alt Controller Reset: (SYMsm Description: Selective LIP reset issued to alternate controller) Logged when the fibre channel driver resets the alternate controller.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1502	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Enclosure Reset: (SYMsm Description: Selective LIP reset issued to ESM) Logged when the fibre channel driver resets an enclosure.					
System (0x0)	Informational (0x0)	Error (0x1)	ESM (0x7)	0x1503	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Drive Enable: (SYMsm Description: Loop port enable (LPE) issued to drive) Logged when the fibre channel driver enables a drive.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x1504	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Alternate Enclosure Enable: (SYMsm Description: Loop port enable (LPE) issued to alternate controller) Logged when the alternate controller enables an enclosure.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x1505	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Enclosure Enable: (SYMsm Description: Loop port enable (LPE) issued to ESM) Logged when the fibre channel driver enables an enclosure.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x1506	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Drive Bypass: (SYMsm Description: Loop port bypass (LPB) issued to drive) Logged when the fibre channel driver bypasses a device.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1507	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Alternate Controller Bypass: (SYMsm Description: Loop port bypass (LPB) issued to alternate controller) Logged when the alternate controller is bypassed by the fibre channel driver.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x1508	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Enclosure Bypass: (SYMsm Description: Loop port bypass (LPB) issued to ESM) Logged when an enclosure is bypassed by the fibre channel driver.					
System (0x0)	Informational (0x0)	Error (0x1)	ESM (0x7)	0x1509	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Drive Missing: (SYMsm Description: Unresponsive drive (bad AL_PA error)) Logged when the fibre channel driver detects that a drive is missing.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x150A	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Alternate Controller Missing: (SYMsm Description: Unresponsive alternate controller (bad AL_PA error)) Logged when the fibre channel driver detects that the alternate controller is missing.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x150B	
Enclosure Missing: (SYMsm Description: Unresponsive ESM (bad AL_PA error)) Logged when the fibre channel driver detects that an enclosure is missing.					
System (0x0)	Informational (0x0)	Error (0x1)	ESM (0x7)	0x150C	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Channel Reset: (SYMsm Description: Channel reset occurred) Logged when a fibre channel port is reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x150D	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Loop Diagnostic Failure: (SYMsm Description: Controller loop-back diagnostics failed) Logged when loop or minihub diagnostics detect that the controller is the bad device on the loop.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x150E	ID: 01=Chip Init 02=SGB Allocation 03=Spy SGB Allocation 04=Op Allocation 05=Channel Reset 06=Device Reset 07=Device Bypass 08=Device Enable 09=Build SGL Special 0A=Target Write SGL Reply 0B=Replay Bad Alpa
Channel Miswire: (SYMsm Description: Channel miswire) Logged when two channels are connected with one or more ESMs in between.					
System (0x0)	Critical (0x1)	Error (0x1)	Channel (0x6)	0x150F	
ESM Miswire: (SYMsm Description: ESM miswire) Logged when two ESMs of the same tray are seen on the same channel.					
System (0x0)	Critical (0x1)	Error (0x1)	ESM (0x7)	0x1510	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Channel Miswire Clear: (SYMsm Description: Channel miswire resolved) Logged when the channel miswire is cleared.					
System (0x0)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x1511	
ESM Miswire Clear: (SYMsm Description: ESM miswire resolved) Logged when the ESM miswire is cleared.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x1512	
Channel Failover: (SYMsm Description: Individual drive - Degraded path) Logged when drive fails.					
System (0x0)	Critical (0x1)	Error (0x1)	Channel (0x6)	0x1513	
Channel Failback: (SYMsm Description: Drive channel changed to optimal) Logged when drive channel is active.					
System (0x0)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x1514	

Drive Signature Validation Failure Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Inv Signature: (SYMsm Description: Uncertified drive detected) Logged when an uncertified drive is detected.					
Drive (0x2)	Critical (0x1)	Error (0x1)	Drive (0x1)	0x1600	
Disk Discovery Failed: (SYMsm Description: Reserved blocks on SATA drives cannot be discovered) Logged when the reserved blocks on the ATA drives are not recognized.					
Drive (0x2)	Critical (0x1)	Error (0x1)	Drive (0x1)	0x1601	

VDD Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Repair Begin: (SYMsm Description: Repair started) Logged when a repair operation is started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2001	None
Repair End: (SYMsm Description: Repair completed) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2002	Data Field Type: 0x0613
Interrupted Write Begin: (SYMsm Description: Interrupted write started) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2003	
Interrupted Write End: (SYMsm Description: Interrupted write completed) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2004	
Fail Vdisk: (SYMsm Description: Virtual disk failed - interrupted write) Logged when the specified LUN is internally failed.					
System (0x0)	Informational (0x0)	Failure (0x2)	Volume (0xD)	0x2005	Origin: LBA of the detected failure
Fail Piece: (SYMsm Description: Piece failed) Currently Not Logged.					
System (0x0)	Informational (0x0)	Failure (0x2)	Drive (0x1)	0x2006	
Fail Piece Delay: (SYMsm Description: Fail piece delayed) Currently Not Logged.					
System (0x0)	Informational (0x0)	Failure (0x2)	Drive (0x1)	0x2007	
DEAD LUN Reconstruction: (SYMsm Description: Failed volume started reconstruction) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2008	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
RAID 0 Write Fail: (SYMsm Description: RAID 0 write failures) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x2009	
Data Parity Mismatch: (SYMsm Description: Data/parity mismatch on volume) Logged when a data/parity mismatch is detected during data scrubbing.					
System (0x0)	Critical (0x1)	Error (0x1)	Volume (0xD)	0x200A	Data Field Type: 0x0706
Unrecovered Deferred Error: (SYMsm Description: Unrecovered deferred error on volume) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x200B	
Recovered Error: (SYMsm Description: Recovered error on volume) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x200C	
I/O Aborted: (SYMsm Description: I/O aborted on volume) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x200D	
VDD Reconfigure: (SYMsm Description: Virtual disk driver reconfigured) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x200E	
VDD Synchronize Begin: (SYMsm Description: Cache synchronization started) Logged when cache synchronization is begun from an external (to VDD) source. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x200F	Data Field Type: 0x0706 0's in Number of blocks filed indicate entire LUN will be synchronized.
VDD Synchronize End: (SYMsm Description: Cache synchronization completed) Logged when cache synchronization for the specified unit completes. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2010	Device: Contains ending error status Origin: Contains buf flags value

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
VDD Purge Begin: (SYMsm Description: Cache flush started) Logged when an operation to flush cache for the specified unit is begun. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2011	None
VDD Purge End: (SYMsm Description: Cache flush completed) Logged when an operation to flush cache for the specified unit has completed. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2012	None
VDD Cache Recover: (SYMsm Description: Unwritten data/parity recovered from cache) Logged when unwritten data and parity is recovered from cache at start-of-day or during a forced change in LUN ownership between the controllers.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2013	Origin: Contains the number of cache blocks recovered.
VDD Error: (SYMsm Description: VDD logged an error) Logged when VDD logs an error.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2014	Data Field Type: 0x0707
Uncompleted Write Count: (SYMsm Description: Uncompleted writes detected in NVSRAM at start-of-day) Logged at start-of-day when uncompleted writes are detected in NVSRAM.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2015	Origin: Contains the number of uncompleted writes found
Write Count: (SYMsm Description: Interrupted writes processed) Logged when VDD processes interrupted writes for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2016	Origin: Number of interrupted writes processed.
Log Write Count: (SYMsm Description: Interrupted writes detected from checkpoint logs) Logged when VDD creates a list of interrupted writes from the data/parity checkpoint logs.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2017	Origin: Number of interrupted writes processed.
VDD Wait: (SYMsm Description: I/O suspended due to no pre-allocated resources) Logged when an I/O is suspended because of no preallocated resources. This event is logged once per resource.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2018	Data Field Type: 0x0700 Data: First 4 characters of the resource name.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
VDD Long I/O: (SYMsm Description: Performance monitor: I/O's elapsed time exceeded threshold) Logged if performance monitoring is enabled and an I/Os elapsed time equal to or exceeds the threshold limit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2019	Origin: Contains the elapsed time for the I/O Device: Contains the threshold value.
VDD Restore Begin: (SYMsm Description: VDD restore started) Logged at the beginning of a RAID 1 or RAID 5 VDD restore operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201A	Data Field Type: 0x0612
VDD Restore End: (SYMsm Description: VDD restore completed) Logged at the end of a restore operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201B	Data Field Type: 0x0613
VDD Recover Begin: (SYMsm Description: VDD recover started) Logged at the beginning of a RAID 1 or RAID 5 VDD recover operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201C	Data Field Type: 0x0617
VDD Recover End: (SYMsm Description: VDD recover completed) Logged at the end of a recover operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201D	Data Field Type: 0x0613
VDD Repair Begin: (SYMsm Description: VDD repair started) Logged at the beginning of a repair operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201E	None
VDD Repair End: (SYMsm Description: VDD repair completed) Logged at the end of a repair operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x201F	Data Field Type: 0x0613
Interrupted Write Fail Piece: (SYMsm Description: Piece failed during interrupted write) Logged when a piece is failed during an interrupted write operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2020	Data Field Type: 0x0612

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Interrupted Write Fail Vdisk: (SYMsm Description: Virtual disk failed during interrupted write) Logged when a virtual disk is failed as part of a interrupted write operation.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2021	Origin: LBA of the LUN that caused the failure.
Scrub Start: (SYMsm Description: Media scan (scrub) started) Logged when scrubbing is started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2022	None
Scrub End: (SYMsm Description: Media scan (scrub) completed) Logged when scrubbing operations for the specified unit have completed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2023	Data Field Type: 0x0618
Scrub Resume: (SYMsm Description: Media scan (scrub) resumed) Logged when scrubbing operations are resumed for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2024	None
Reconstruction Begin: (SYMsm Description: Reconstruction started) Logged when reconstruction operations are started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2025	None
Reconstruction End: (SYMsm Description: Reconstruction completed) Logged when reconstruction operations for the specified unit have completed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2026	Data Field Type: 0x0613
Reconstruction Resume: (SYMsm Description: Reconstruction resumed) Logged when reconstruction operations are resumed for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2027	None
Reconfiguration Begin: (SYMsm Description: Modification (reconfigure) started) Logged when reconfiguration operations are started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2028	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Reconfiguration End: (SYMsm Description: Modification (reconfigure) completed) Logged when reconfiguration operations for the specified unit have completed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2029	Data Field Type: 0x0613
Reconfiguration Resume: (SYMsm Description: Modification (reconfigure) resumed) Logged when reconfiguration operations are resumed for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x202A	None
Parity Scan Begin: (SYMsm Description: Redundancy check started) Logged when parity scan operations are started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x202B	None
Parity Scan End: (SYMsm Description: Redundancy check completed) Logged when parity scan operations for the specified unit have completed					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x202C	None
Parity Scan Resume: (SYMsm Description: Redundancy check resumed) Logged when parity scan operations are resumed for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x202D	None
Miscorrected Data: (SYMsm Description: Read drive error during interrupted write) Logged when an Unrecoverable Read Error is detected.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x202E	Origin: LBA of the LUN that caused the failure.
Auto LUN Transfer End: (SYMsm Description: Automatic volume transfer completed) Logged when an auto lun transfer operation has completed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x202F	None
Format End: (SYMsm Description: Initialization completed on volume) Logged when a volume format has completed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2030	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Format Begin: (SYMsm Description: Initialization started on volume) Logged when a volume format has begun.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2031	None
Format Resume: (SYMsm Description: Initialization resumed on volume) Logged when a volume format has resumed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2032	None
Parity Repair: (SYMsm Description: Parity reconstructed on volume) Logged when parity has been reconstructed on a volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2033	None
HSTSCANMismatch: (SYMsm Description: Data/parity mismatch detected on volume) Logged when a data/parity mismatch is detected on a volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2034	None

EDC Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
EDC Channel Error: (SYMsm Description: Protection information mismatch detected by the channel interface) Logged when the channel interface and protection information do not match.					
System (0x0)	Informational (0x0)	Error (0x1)	Channel (0x6)	0x2060	0x0320
EDC Volume Error: (SYMsm Description: Protection information mismatch detected for cached volume data) Logged when cached volume data and protection information do not match.					
System (0x0)	Informational (0x0)	Error (0x1)	Volume (0xD)	0x2061	0x0320
Late Check In: (SYMsm Description: Alternate controller checked in late) Logged when the alternate controller checked in late.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2101	None
Mirror Out Of Sync: (SYMsm Description: Cache mirroring on controllers not synchronized) The mirror is out of sync with the alternate controllers mirror.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2102	None
UPS: (SYMsm Description: UPS battery is fully charged) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	UPS	0x2103	
Synchronize and Purge: (SYMsm Description: Controller cache synchronization/purge event) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2104	
Reconfigure Cache: (SYMsm Description: Controller cache reconfigure event) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2105	
Set Configuration: (SYMsm Description: Update requested on controller cache manager's DACSTORE) A request to update the cache managers DACSTORE area was received.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2106	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Clear Configuration: (SYMsm Description: Clear requested on controller cache manager's DACSTORE) A request to clear the cache manager's DACSTORE area was received.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2107	None
Cache Manager Errors: (SYMsm Description: Controller cache manager experiencing errors) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2108	
CCM Hardware Mismatch: (SYMsm Description: Controller cache not enabled - cache sizes do not match) Write back cache could not be enabled due to different cache sizes of the controllers in the subsystem. ASC/ASCQ value of 0xA1/0x00 is also logged with this event.					
System (0x0)	Critical (0x1)	Error (0x1)	Controller (0x8)	0x2109	None
Cache Disabled Internal: (SYMsm Description: Controller cache not enabled or was internally disabled) Write back cache could not be enabled or was internally disabled. The ASC/ASCQ value of 0xA0/0x00 is also logged with this event.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210A	None
Cache Synchronize Failed: (SYMsm Description: Cache between controllers not synchronized) Cache synchronization between the controllers failed. The ASC/ASCQ value of 0x2A/0x01 is also logged with this event.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210B	None
Cache Battery Failure: (SYMsm Description: Controller cache battery failed) Cache battery has failed. ASC/ASCQ of 0x0C/0x00 is also logged with this event.					
System (0x0)	Critical (0x1)	Notification (0x4)	Battery (0x9)	0x210C	None
Deferred Error: (SYMsm Description: Controller deferred error) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x210D	
Cache Data Loss: (SYMsm Description: Controller cache memory recovery failed after power cycle or reset) Logged by cache manager when cache blocks can't be successfully recovered. Companion to an ASC/ASCQ status of 0x0C/0x81.					

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Controller (0x1)	Critical (0x1)	Error (0x1)	Controller (0x8)	0x210E	The LUN and LBA(in Id field) are logged in the event data if they are available. An unavailable LUN is logged as 0xFF. An unavailable LBA is logged as 0. No additional data is logged.
Memory Parity Error Detected: (SYMsm Description: Controller cache memory parity error detected) Logged when a memory parity error is detected.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x210F	Device: **0** = Processor Memory **1** = RPA Memory **2** = Spectra Double Bit Error **3** = Spectra Multi-Bit Error **4** = Spectra PCI Error **5** = RPA PCI Error
Cache Memory Diagnostic Fail: (SYMsm Description: Controller cache memory initialization failed) Logged when a persistent RPA Memory Parity error is detected.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x2110	
Cache Task Fail: (SYMsm Description: Controller cache task failed) Currently Not Logged.					
System (0x0)	Informational (0x0)	Failure (0x2)	Controller (0x8)	0x2111	
Cache Battery Good: (SYMsm Description: Controller cache battery is fully charged) Logged when the cache battery has transitioned to the good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2112	None
Cache Battery Warning: (SYMsm Description: Controller cache battery nearing expiration) Logged when the cache battery is within the specified number of weeks of failing. The ASC/ASCQ value of 0x3F/0xD9 is also logged with this event.					
System (0x0)	Critical (0x1)	Error (0x1)	Battery (0x9)	0x2113	
Alternate Cache Battery Good: (SYMsm Description: Alternate controller cache battery is fully charged) Logged when the alternate controller's cache battery has transitioned to the good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2114	None
Alternate Cache Battery Warning: (SYMsm Description: Alternate controller cache battery nearing					

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
expiration) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Battery (0x9)	0x2115	
Alternate Cache Battery Fail: (SYMsm Desription: Alternate controller cache battery failed) Logged when the alternate controller's cache battery has transitioned to the failed state.					
System (0x0)	Informational (0x0)	Failure (0x2)	Battery (0x9)	0x2116	None
CCM Error Cleared: (SYMsm Description: Controller cache manager error cleared) On occasion CCM may log an error prematurely and then clear it later. For example errors may be logged when the alternate controller is removed from the subsystem. If the controller is replaced before a write is done CCM will cancel the errors logged since the controller is replaced and functioning normally.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2117	Id: Contains the event that is being cleared
Memory Parity ECC Error: (SYMsm Description: Memory parity ECC error) Logged when a memory parity error occurs and information on the error is available.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2118	Data Field Type: 0x0111
Recovered Data Buffer Memory Error: (SYMsm Description: Recoverable error in data buffer memory detected/corrected) Logged when the controller has detected and corrected a recoverable error in the data buffer memory.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2119	
Cache Error Was Corrected: (SYMsm Description: Cache corrected by using alternate controller's cache) Logged when the cache manager has corrected using the alternate controller's cache memory.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x211A	None
OCB Setting Conflict: (SYMsm: Batteries present but NVSRAM file configured for no batteries) Logged when a conflict is detected between the NVSRAM setting and the presence of batteries.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x211B	None

Configuration Manager Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Mark LUN Optimal: (SYMsm Description: Volume marked optimal) Currently Not Logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2201	
Add Vdisk: (SYMsm Description: Volume added) Logged when a LUN is added to the subsystem.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2202	Data Field Type: 0x0612
Delete Vdisk: (SYMsm Description: Volume group or volume deleted) Logged when the specified virtual disk is deleted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2203	None
Resume I/O: (SYMsm Description: I/O is resumed) Logged when vdResumeIo is called for specified device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2204	None
Fail Copy Source: (SYMsm Description: Source drive failed during copy operation) Logged when the source drive of a copy type operation fails.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2205	None
CFG Reconstruction Device Complete: (SYMsm Description: Reconstruction completed) Logged when CFG manager has completed reconfiguring the specified device successfully.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2206	None
CFG Copy Device Complete: (SYMsm Description: Device copy complete) Logged when the configuration manager has completed the copy process to the specified device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2207	None
CFG Reconfiguration Setup: (SYMsm Description: Modification (reconfigure) started) Logged by the configuration manager when it has set up the specified unit and device number for reconfiguration and is going to call VDD to start the reconfiguration.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2208	Data Field Type: 0x0612

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
CFG Reconfiguration: (SYMsm Description: Modification (reconfigure) completed) Logged when the LUN has finished reconfigure process the new LUN state is in origin.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2209	None
CFG Copyback Start: (SYMsm Description: Copyback started) Logged when copy task is started.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x220A	None
CFG Copyback Restart: (SYMsm Description: Copyback restarted) Logged when copy task is restarted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x220B	None
CFG Fail Delayed: (SYMsm Description: Device failed during interrupted write processing) Logged when the specified device or LUN is failed during interrupted write processing. SK/ASC/ASCQ = 0x06/0x3F/0x8E will be reported for the device that is failed. SK/ASC/ASCQ = 0x06/0x3F/0xE0 will be reported for each LUN that is goes dead.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x220C	None
CFG Scrub Enabled: (SYMsm Description: Media scan (scrub) enabled) Logged when the configuration manager enables scrubbing for the specified device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x220D	Origin: 0 – Scrub & parity check are turned off 1 - Scrub is enabled 2 - Parity check is enabled 3 - Scrub & parity check enabled
CFG Scrub Start: (SYMsm Description: Media scan (scrub) started) Logged when a scrub operation is started for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x220E	Origin: Actual buf address
CFG Scrub Complete: (SYMsm Description: Media scan (scrub) completed) Logged when a scrub operation is completed for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x220F	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
CFG Restore Begin: (SYMsm Description: Restore started) Logged when cfg manager begins a restore operation on specified unit and device number.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2210	None
CFG Restore End: (SYMsm Description: Restore completed) Logged when cfg manager successfully completes a restore operation. If an error occurred during the restore this entry may not appear.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2211	None
CFG Parity Scan Restore: (SYMsm Description: Parity repaired) Logged when the configuration manager repairs the parity of specified unit and device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2212	Origin: Starting LBAs for the LUN
Zero LUN: (SYMsm Description: Volume initialized with zeros) Logged when zeros are written to the specified LUN.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2213	Data Field Type: 0x0706
CFG Copy Sundry: (SYMsm Description: One or more Sundry regions created) Logged when configuration manager creates 1 or more sundry drives.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2214	Origin: The number of sundry drives created
CFG Post Fail: (SYMsm Description: Drive marked failed) Logged when configuration manager posts a UA/AEN for a failed drive.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2215	
Piece Out of Service (OOS): (SYMsm Description: Piece taken out of service) Logged when the configuration manager take a piece of the specified LUN out of service.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2216	Origin: New LUN state
Piece Fail: (SYMsm Description: Piece failed) Logged when a piece of specified LUN is failed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2217	Origin: Piece number

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Piece Fail Delay: (SYMsm Description: Piece failed during uncompleted write processing) Logged when a piece of specified LUN is failed during uncompleted write processing.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2218	Origin: Piece number
Piece Removed: (SYMsm Description: Piece removed from volume) Logged when a piece of specified LUN has been removed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2219	Origin: LUN State
Piece Replace: (SYMsm Description: Piece replaced) Logged when a piece of specified LUN has been replaced.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x221A	Origin: LUN State
Piece In Service: (SYMsm Description: Piece placed in service) Logged when the configuration manager places a LUN piece in service.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x221B	None
Drive Group Offline: (SYMsm Description: Volume group placed offline) Logged when an entire drive group is placed online the first 16 devices of the drive group are recorded in the data buffer.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume Group (0xE)	0x221C	Data Field Type: 0x0603
Drive Group Online: (SYMsm Description: Volume group placed online) Logged when an entire drive group is placed online.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume Group (0xE)	0x221D	Data Field Type: 0x0603
LUN Initialized: (SYMsm Description: Volume group or volume initialized) Logged when a LUN has been created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x221E	Device: Contains the LUN number initialized
IAF LUN Initialized: (SYMsm Description: Immediate availability initialization (IAF) completed on volume) Logged when the volume completes the Immediate Availability Format.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x221F	Device: Contains the LUN number initialized

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
GHS Added: (SYMsm Description: Hot spare drive added to hot spare list) Logged when a drive is added to the global hot spare list.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2220	None
GHS Removed: (SYMsm Description: Hot spare drive removed from hot spare list) Logged when a drive is removed from the hot spare list.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2221	None
Change Unit Number: (SYMsm Description: Logical unit number for volume reassigned) Logged when a new rank has a duplicate unit number as an existing LUN.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2222	Origin: New unit number LUN: Old unit number
Duplicate Physical Device: (SYMsm Description: Duplicate data structure exists for two devices) Logged when cfg mgr discovers a duplicate data structure exists for two devices.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2223	Origin: Device id of first device Device: Device id of second device
CFG Reconstruction Start: (SYMsm Description: Reconstruction started) Logged when reconstruction is started for the specified device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2224	None
CFG Reconstruction Restart: (SYMsm Description: Reconstruction restarted) Logged when reconstruction is restarted for the specified device.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2225	None
CFG Spin Down: (SYMsm Description: Drive spun down) Logged when the specified drive is spun down.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2226	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Set Device Operational: (SYMsm Description: Drive marked optimal) Logged when the routine cfgSetDevOper (external interface) is called from the shell, by the format command handler, or by the mode select command handler.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2227	None
Delete Device: (SYMsm Description: Drive deleted) Logged when cfgDelDrive (external interface) or cfgDriveDeleted is called. This interface can be called from the shell or mode select command handler.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2228	None
Ctl Fail Drive: (SYMsm Description: Drive failed by controller) Logged when the configuration manager internally fails the device.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2229	Origin: Reason for failure 0x91: Locked Out 0xA3: User Failed via Mode Select
Mark Drive GHS: (SYMsm Description: Hot spare drive assigned) Logged when an unassigned drive is specified as a global hot spare.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222A	None
CFG Cold Replaced: (SYMsm Description: Drive replaced when Storage Array was turned off) Logged when the configuration manager finds a drive that has been cold replaced. i.e. Replaced when the controller & subsystem were powered off.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222B	None
Device Unassigned: (SYMsm Description: Drive marked unassigned) Logged when a drive is to be marked unassigned, also Logged if an unknown drive that was part of a LUN is to be brought online.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222C	None
Device Fail: (SYMsm Description: Drive manually failed) Logged when cfgFailDrive (external interface) or cfgDriveFailed is called.					
Drive (0x2)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x222D	Origin: Reason for the device failure (contents unspecified)
Device Removed: (SYMsm Description: Mark drive removed) Logged when a drive is to be marked removed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222E	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Device Replace: (SYMsm Description: Drive marked replaced) Logged when a notification is received that a failed drive is to be replaced and that data reconstruction on this device should begin.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x222F	None
Device Manager Fail: (SYMsm Description: Drive failed by device manager) Logged when the configuration manager state machine has been called to fail the device. This is an additional event that indicates the configuration manager has determined that processing has to be done in order to fail the device. Appearance of this entry depends on the drive's previous state prior to being failed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2230	Origin: Reason for Failure
Device Manager Removed: (SYMsm Description: Drive marked removed) Logged when the configuration manager state machine is going to mark a drive removed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2231	None
Device Manager Removed 1: (SYMsm Description: Removed drive marked removed) Logged when the configuration manager is called to remove a drive that has already been removed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2232	None
Device Manager Removed 2: (SYMsm Description: Unassigned drive marked removed) Logged when an unassigned drive has been marked as removed by the configuration manager.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2233	None
Device Manager Removed 3: (SYMsm Description: Reconstructing drive marked removed) Logged when a drive has been removed that hasn't finished reconstruction, usually happens when a drive that is waiting for reconstruction to begin is removed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2234	None
Device Manager Removed 4: (SYMsm Description: Optimal/Replaced drive marked removed) Logged when an optimal or replaced drive has been removed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2235	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Device Manager Copy Done: (SYMsm Description: Hot spare drive copy completed) Logged by the configuration manager state machine when a copy operation has completed on a global hot spare drive.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2236	Origin: Internal device flags managed by the configuration manager, definition is unspecified.
Device Manager Copy Done 1: (SYMsm Description: Replaced drive completed reconstruction) Copy Done: Logged when a replaced drive has finished reconstruction.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2237	None
Device Manager New: (SYMsm Description: Drive added in previously unused slot) Logged when a drive has been inserted in a previously unused slot in the subsystem.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2238	None
Device Manager GHS Unassigned: (SYMsm Description: Hot spare drive assigned internally) Logged when an unassigned drive is marked as a global hot spare internally.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2239	None
Device Manager Delete: (SYMsm Description: Drive marked deleted) Logged when a drive is to be marked as deleted. Previously the drive was unassigned or failed.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223A	None
Device Manager Replace: (SYMsm Description: Failed/Replaced drive marked replaced) Logged when a failed or replaced drive is marked as replaced.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223B	None
Device Manager Replace 1: (SYMsm Description: Drive reinserted) Logged when a removed optimal drive or replaced drive has been reinserted or when a failed drive is reinserted.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223C	Origin: Location where event is logged, value unspecified
Device Manager Replace 2: (SYMsm Description: Unassigned drive replaced) Logged when an unassigned drive has been replaced.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223D	Origin: Location where event is logged, value is unspecified

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Device Manager Operational: (SYMsm Description: Drive marked optimal) Logged when a drive has been marked operational.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223E	None
Device Manager Operational: (SYMsm Description: Partially reconstructed drive marked optimal) Logged when a optimal drive that hasn't completed reconstruction is marked operational.					
Drive (0x2)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x223F	None
Device Manager No DACSTORE Unassigned: (SYMsm Description: DACSTORE created for unassigned or hot spare drive) Logged when an unassigned drive or unassigned global hot spare has no DACSTORE and a DACSTORE has been created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2240	None
Device Manager No DACSTORE Fail: (SYMsm Description: Unassigned drive with no DACSTORE failed) Logged when an unassigned drive without a DACSTORE has been failed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2241	None
Device Manager No DACSTORE Delete: (SYMsm Description: Unassigned drive with no DACSTORE deleted) Logged when an unassigned drive without a DACSTORE has been deleted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2242	None
Device Manager No DACSTORE Remove: (SYMsm Description: Unassigned drive with no DACSTORE removed) Logged when an unassigned drive without a DACSTORE has been removed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2243	None
Device Manager Unassigned: (SYMsm Description: Unknown drive marked unassigned) Logged when an unknown drive is marked unassigned.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2244	None
CFG Scrub Stop: (SYMsm Description: Media scan (scrub) stopped) Logged when a scrub operation is stopped for the specified unit.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2245	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
CFG Scrub Resume: (SYMsm Description: Media scan (scrub) resumed) Logged when a scrub operation is resumed for the specified unit or drive group.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2246	None
CFG Unrecovered Interrupted Write: (SYMsm Description: Data lost on volume during unrecovered interrupted write) Logged when a LUN is marked DEAD due to a media error failure during SOD. An error occurred during Interrupted Write processing causing the LUN to transition to the DEAD State. SK/ASC/ASCQ = 0x06/0x3F/0xEB will be offloaded for this error.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x2247	None
CFG Unrecovered Write Failure: (SYMsm Description: Drive failed – write failure) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x80 indicating the controller set the drive state to “Failed – Write Failure”.					
System (0x0)	Critical (0x1)	Failure (0x2)	Drive (0x1)	0x2248	Origin: FRU info
CFG Drive Too Small: (SYMsm Description: Drive capacity less than minimum) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x8B indicating the controller set the drive state to “Drive Capacity < Minimum”.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2249	Origin: FRU info
Wrong Sector Size: (SYMsm Description: Drive has wrong block size) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x8C indicating the controller set the drive state to “Drive has wrong blocksize”.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224A	Origin: FRU info
Drive Format Failed: (SYMsm Description: Drive failed - initialization failure) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x86 indicating the controller set the drive state to “Failed – Format failure”.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224B	Origin: FRU info
Wrong Drive: (SYMsm Description: Wrong drive removed/replaced) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x89 indicating the controller set the drive state to “Wrong drive removed/replaced”.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x224C	Origin: FRU info

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Drive No Response: (SYMsm Description: Drive failed - no response at start of day) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x85 indicating the controller set the drive state to “Failed – No Response”.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x224D	Origin: FRU info
Reconstruction Drive Failed: (SYMsm Description: Drive failed - initialization/reconstruction failure) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x82 indicating the controller set the drive state to “Failed” be it was unable to make the drive usable after replacement.					
System (0x0)	Critical (0x1)	Failure (0x2)	Drive (0x1)	0x224E	Origin: FRU info
Partial Global Hot Spare: (SYMsm Description: Hot spare capacity not sufficient for all drives) Logged when a defined Global Hot Spare device is not large enough to cover all of the drives in the subsystem.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x224F	None
LUN Down: (SYMsm Description: Volume failure) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0xE0 indicating Logical Unit Failure.					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x2250	None
CFG Read Failure: (SYMsm Description: Drive failed - reconstruction failure) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x8E indicating that the drive failed due to a reconstruction failure at SOD.					
System (0x0)	Critical (0x1)	State (0x5)	Drive (0x1)	0x2251	Origin: FRU info
Fail Vdisk Delayed: (SYMsm Description: Drive marked offline during interrupted write) Logged when the specified device is failed during interrupted write processing. SK/ASC/ASCQ = 0x06/0x3F/0x98 will be offloaded for each failing device.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2252	None
LUN Modified: (SYMsm Description: Volume group or volume modified (created or deleted)) Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0x0E indicating that previous LUN data reported via a Report LUNs command has changed (due to LUN creation/deletion or controller hot swap.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2253	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Not Used				0x2254	
Bad LUN Definition: (SYMsm Description: Volume definition incompatible with ALT mode-ALT disabled) Logged when there is an improper LUN definition for Auto-LUN transfer. The controller will operate in normal redundant controller mode without performing Auto-LUN transfers.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x2255	None
Copyback Operation Complete: (SYMsm Description: Copyback completed on volume) Logged when copyback is completed on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2256	None
Volume Reconfiguration Start: (SYMsm Description: Modification (reconfigure) started on volume) Logged when reconfiguration is started on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2257	None
Volume Reconfiguration Completed: (SYMsm Description: Modification (reconfigure) completed on volume) Logged when reconfiguration is completed on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2258	None
LUN Initialization Start: (SYMsm Description: Initialization started on volume) Logged when initialization is started on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x2259	None
Immediate Availability Format Start: (SYMsm Description: Immediate availability initialization (IAF) started on volume Logged when IAF started on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x225A	None
HLV Cleared: (SYMsm Description: Premium feature not supported – snapshot volumes and mirror relationships deleted) Logged when a user attempts to import a drive tray/volume group and the premium features are not supported.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x225B	None
CTLR In Stop State: (SYMsm Description: Controller in stopped state) Logged when controller stops.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x225C	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
CFG AUTOCFG Start: (SYMsm Description: Automatic configuration started) Logged when automatic configuration starts.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x225D	None
CFG AUTOCFG Complete Success: (SYMsm Description: Automatic configuration completed successfully) Logged when automatic configuration completes successfully.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x225E	None
CFG AUTOCFG Complete Failed: (SYMsm Description: Automatic configuration failed) Logged when automatic configuration fails.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x225F	None

Hot Swap Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
HSM Drive Removed: (SYMsm Description: Hot swap monitor detected drive removal) Logged in the system log when the hot swap monitor detects that a drive has been removed from the system.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2400	Device: Device number of the removed drive
HSM Drive Inserted: (SYMsm Description: Hot swap monitor detected drive insertion) Logged in the system log when the hot swap monitor detects that a drive has been inserted in the system.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2401	Device: Device number of the inserted drive
Controller: (SYMsm Description: Controller inserted or removed) Logged when a controller is inserted or removed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2500	
Mode Switch Active: (SYMsm Description: Controller mode changed to active) Currently Not Logged.					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2501	
Icon Error: (SYMsm Description: Controller icon chip error) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2502	
Mode Switch Active/Passive: (SYMsm Description: Controller mode changed to passive) Logged on successful completion of an Active/Passive mode switch.					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2503	Origin: Local and alternate mode information
Mode Switch Dual Active: (SYMsm Description: Controller mode changed to active) Logged on successful completion of a Dual Active mode switch.					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2504	Origin: Local and alternate mode information
Mode Switch: (SYMsm Description: Controller mode switch occurred) Currently Not Logged.					
System (0x0)	Informational (0x0)	State (0x5)	Controller (0x8)	0x2505	

Start of Day Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
ACS Download Start: (SYMsm Description: Automatic controller firmware synchronization started) Logged when an ACS Download is started.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2600	
ACS Download Completed: (SYMsm Description: Automatic controller firmware synchronization completed) Logged after the controller has been rebooted after auto code synchronization has been preformed. An ASC/ASCQ value of 0x29/0x82 is also logged with this event.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2601	Origin: Non-zero indicated download failure
ACS Error: (SYMsm Description: Automatic controller firmware synchronization failed) Logged when auto code synchronization failed.					
System (0x0)	Critical (0x1)	Error (0x1)	Controller (0x8)	0x2602	Data Field Type: 0x0701
Default LUN Created: (SYMsm Description: Default volume created) Logged when the default LUN was created at SOD.					
System (0x0)	Informational (0x0)	State (0x5)	Volume (0xD)	0x2603	None
Persistent Memory Parity Error: (SYMsm Description: Persistent controller memory parity error) Logged when SOD detects that the persistent memory parity error state has been set.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2604	None
Start of Day Completed: (SYMsm Description: Start-of-day routine completed) Logged when the controller has completed initialization.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2605	None
Start of Day Begun: (SYMsm Description: Start-of-day routine begun) Logged when the controller begins the start-of-day routine.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2606	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
RPA Parity Error: (SYMsm Description: Controller RPA memory parity error detected) Logged during ccmInit during start of day if a parity error is found in RPA memory.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2700	Id: Error block Device: 1 = RPA Memory
PCI Parity Error: (SYMsm Description: PCI controller parity error) Currently Not Logged.					
Controller (0x1)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x2701	
RPA Unexpected Interrupt: (SYMsm Description: Controller unexpected RPA interrupt detected) Logged when an unexpected RPA Interrupt is detected.					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2702	Data Field Type: 0x0110
Recovered Processor DRAM Error: (SYMsm Description: Recoverable error in processor memory detected/corrected) Logged when the controller has encountered recoverable processor DRAM ECC errors (below the maximum threshold).					
Controller (0x1)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2703	

Subsystem Monitor Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Power Supply: (SYMsm Description: Power supply state change detected) Logged when a power supply changes state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Power Supply (0x2)	0x2800	Id: Power Supply Status: 0 = Failed 1 = Good
On Battery: (SYMsm Description: Storage Array running on UPS battery) Logged when the UPS battery starts to supply power to the subsystem.					
System (0x0)	Critical (0x1)	Notification (0x4)	Battery (0x9)	0x2801	None
UPS Battery Good: (SYMsm Description: UPS battery is fully charged) Logged when the UPS battery has charged and transitioned to the good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Battery (0x9)	0x2802	None
UPS Battery 2 Minute Warning: (SYMsm Description: UPS battery - two minutes to failure) Logged when the UPS battery has transitioned and given the 2 minute warning. The UPS has signaled that it has 2 minutes of power left before failing. The controllers will flush any dirty data in their caches and turn off data caching.					
System (0x0)	Critical (0x1)	Notification (0x4)	Battery (0x9)	0x2803	None
Not Used				0x2804	
Line State Change: (SYMsm Description: Controller tray component change detected) Logged when a discreet line state change is detected and an AEN is posted. This can either be a good to bad transition or bad to good. This does not include the cache battery line. Cache battery events are logged by the cache manager.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x2805	Data Field Type: 0x0704
Drive Enclosure: (SYMsm Description: Tray component change) Logged when SSM has detected a change in an enclosure device, other than a drive status.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2806	Data Field Type: 0x0705

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Enclosure Fail: (SYMsm Description: ESM Failed) Logged when an ESM fails.					
System (0x0)	Critical (0x1)	Failure (0x2)	ESM (0x7)	0x2807	
Enclosure ID Not Unique: (SYMsm Description: Tray ID not unique) Logged when the controller determines that there are multiple sub-enclosures with the same ID value selected.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x2808	Device: Sub-enclosure ID in conflict
Line Good: (SYMsm Description: Controller tray component changed to optimal) Logged when a subsystem line has transitioned to the Good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Enclosure (0xA)	0x2809	Device: Line number that has changed state
Line Missing: (SYMsm Description: Controller tray component removed) Logged when an expected subsystem line is removed.					
System (0x0)	Critical (0x1)	Notification (0x4)	Enclosure (0xA)	0x280A	Device: Line number that is removed
Line Failed: (SYMsm Description: Controller tray component failed) Logged when a subsystem line has transitioned to the Failed state.					
System (0x0)	Critical (0x1)	Notification (0x4)	Unknown (0x0)	0x280B	Device: Line number that has changed state
Enclosure Good: (SYMsm Description: Drive tray component changed to optimal) Logged when an enclosure has transitioned to the Good state.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x280C	Device: Enclosure ID Origin: FRU Info
Enclosure Fail: (SYMsm Description: Drive tray component failed or removed) Logged when an enclosure has transitioned to the Failed state.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x280D	Device: Enclosure ID Origin: FRU Info
Battery Low: (SYMsm Description: Standby power source not fully charged) Logged when the battery charge is low.					
System (0x0)	Critical (0x1)	Notification (0x4)	Battery (0x9)	0x280E	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Redundancy Loss: (SYMsm Description: ESM - loss of communication) Logged when a redundant path is not available to devices.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x280F	Device: Enclosure ID Origin: FRU Group Qualifier for Sub-enclosure group (Byte 27) or drive slot
Redundancy Restored: (SYMsm Description: ESM - communication restored) Logged when a redundant path to devices is restored.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2810	Device: Enclosure ID Origin: FRU Group Qualifier for Sub-enclosure group (Byte 27) or drive slot
Not Used					
				0x2811	
Minihub Normal: (SYMsm Description: Mini-hub canister changed to optimal) Logged when Mini-hub canister is changed to optimal.					
System (0x0)	Informational (0x0)	Notification (0x4)	Minihub (0x4)	0x2812	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
Minihub Failed: (SYMsm Description: Mini-hub canister failed) Logged when Mini-hub canister is failed.					
System (0x0)	Critical (0x1)	Notification (0x4)	Minihub (0x4)	0x2813	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
GBIC Optimal: (SYMsm Description: GBIC/SFP changed to optimal) Logged when GBIC/SFP is changed to optimal.					
System (0x0)	Informational (0x0)	Notification (0x4)	Minihub (0x4)	0x2814	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side
GBIC Failed: (SYMsm Description: GBIC/SFP failed) Logged when GBIC/SFP is failed.					
System (0x0)	Critical (0x1)	Notification (0x4)	Minihub (0x4)	0x2815	ID = Type/Channel Type = 1: Host Side Type = 2: Drive Side

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Enclosure ID Conflict: (SYMsm Description: Tray ID conflict - duplicate IDs across drive trays) Logged when the controller detects duplicate drive tray IDs in the subsystem.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x2816	None
Enclosure ID Conflict Cleared: (SYMsm Description: Tray ID conflict resolved) Logged when the controller detects that an enclosure ID conflict no longer exists.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2817	None
Enclosure ID Mismatch: (SYMsm Description: Tray ID mismatch – duplicate IDs in same drive tray) Logged when the controller detects that the two ESM boards in the same drive tray have different IDs.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x2818	None
Enclosure ID Mismatch Cleared: (SYMsm Description: Tray ID mismatch resolved) Logged when the controller detects that the drive tray ESM board ID mismatch has been cleared.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x2819	None
Temperature Sensor Good: (SYMsm Description: Temperature changed to optimal) Logged when the controller detects that a temperature sensor has transitioned to a good status.					
System (0x0)	Informational (0x0)	Notification (0x4)	Temp Sensor (0x5)	0x281A	Data Field Type: 0x0800
Temperature Sensor Warning: (SYMsm Description: Nominal temperature exceeded) Logged when the controller detects that a temperature sensor has transitioned to a warning status.					
System (0x0)	Critical (0x1)	Failure (0x2)	Temp Sensor (0x5)	0x281B	Data Field Type: 0x0800
Temperature Sensor Failed: (SYMsm Description: Maximum temperature exceeded) Logged when the controller detects that a temperature sensor has transitioned to a failed status.					
System (0x0)	Critical (0x1)	Failure (0x2)	Temp Sensor (0x5)	0x281C	Data Field Type: 0x0800
Temperature Sensor Missing: (SYMsm Description: Temperature sensor removed) Logged when the controller detects that a temperature sensor is missing.					
System (0x0)	Critical (0x1)	Failure (0x2)	Temp Sensor (0x5)	0x281D	Data Field Type: 0x0800

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
ESM Version Mismatch: (SYMsm Description: ESM firmware mismatch) Logged when the controller detects that two ESMs do not have the same version of firmware running					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x281E	Data Field Type: 0x0800 The tray number appears in the device field and as extra data.
ESM Version Mismatch Clear: (SYMsm: ESM firmware mismatch resolved) Logged when the controller detects that the firmware mismatch has been cleared					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x281F	Data Field Type: 0x0800 The tray number appears in the device field and as extra data.
Controller Report Warning: (SYMsm: Two controllers present but NVSRAM (offset 0x35, bit 6) set for NOT reporting a missing second controller) Logged when two controllers are present even though the NVSRAM bit for not reporting a missing second controller is set.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x2820	None
Mini Hub Unsupported: (SYMsm: Incompatible mini-hub canister) Logged when an incompatible mini-hub canister is detected.					
System (0x0)	Critical (0x1)	Notification (0x4)	MiniHub (0x4)	0x2821	None
Not Used				0x2822	None
Bypass Generic: (SYMsm: Drive by-passed) Logged when the drive is bypassed on both ports.					
System (0x0)	Critical (0x1)	Failure (0x2)	Drive (0x1)	0x2823	None
Bypass Corrected: (SYMsm: Drive by-passed condition resolved) Logged when the drive is available on at least one port.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x2824	None
Tray Harness Removed: (SYMsm: Tray ID harness removed) Logged when the Tray ID harness is removed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Enclosure (0xA)	0x2825	None
Tray Harness Corrected: (SYMsm: Tray ID harness replaced) Logged when the Tray ID harness is replaced.					
System (0x0)	Informational (0x0)	Notification (0x4)	Enclosure (0xA)	0x2826	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Alternate Slot Has ESM (SYMsm: Controller inadvertently replaced with an ESM) Logged at Start of Day if the user inadvertently replaces a controller with an ESM canister.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x2827	None
Unsupported Encl (SYMsm: Unsupported drive tray detected) Logged when an unsupported drive tray is detected.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x2828	None
Cont Redundancy Loss (SYMsm: Controller redundancy lost) Logged when the array determines that one controller is in a failed mode.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x2829	Device: Tray number Origin: FRU
Cont Redundancy Restored (SYMsm: Controller redundancy restored) Logged when the array determines that the controller has been restored to optimal.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x282A	Device: Tray number Origin: FRU
Tray Redundancy Loss (SYMsm: Drive tray path redundancy lost) Logged when a drive tray path fails.					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x282B	Device: Tray number
Tray Redundancy Restored (SYMsm: Drive tray path redundancy restored) Logged when the drive tray path is restored.					
System (0x0)	Informational (0x0)	Notification (0x4)	ESM (0x7)	0x282C	Device: Tray number
Drive Redundancy Loss (SYMsm: Drive path redundancy lost) Logged when the array determines that a loss of drive path redundancy is a persistent condition.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x282D	Device: Tray number Origin: Slot number
Drive Redundancy Restored (SYMsm: Drive path redundancy restored) Logged when the array determines that the loss of redundancy condition is no longer present.					
System (0x0)	Informational (0x0)	Notification (0x4)	Drive (0x1)	0x282E	Device: Tray number Origin: Slot number
Unsupported LHA SATA ESM Detected (SYMsm: Incompatible version of ESM firmware detected) Logged when a firmware download to an ESM fails because the ESM firmware is not compatible with the version of controller firmware on the storage array..					
System (0x0)	Critical (0x1)	Notification (0x4)	ESM (0x7)	0x282F	Device: Tray number

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Mixed Drive Types Not Allowed (SYMsm: Mixed drive types not supported) Logged when mixed drive types are not supported.					
System (0x0)	Critical (0x1)	Notification (0x4)	Drive (0x1)	0x2830	None

Command Handler Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Format Unit: (SYMsm Description: Format unit issued) Logged when the controller processes a format command. The LUN value indicates the LUN that the controller is formatting.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3000	ID field: Indicates the status of the format command : 0 - Write zeros is being done to the unit 1 - The configuration manager is initializing the LUN and controller data structures used. 2 - The entire format operation has successfully completed, status has been returned to the host.
Quiesce: (SYMsm Description: Quiescence issued) Logged for the quiescence command.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3001	Id field: Indicates the state of the quiesce command : 0 - Quiescence is stopped. 1 - Quiescence was started.
Reassign Blocks: (SYMsm Description: Reassign blocks issued from host) Logged for a reassign blocks command that has been issued from the host.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3002	Id: Total number of blocks to be reassigned. Data Field Type: 0x0208
Reserve: (SYMsm Description: Reserve issued) Logged for the reserve command. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3003	LUN: LUN being reserved. Id: Indicates the reserving host Device: If non-zero, Third party reservation information. The high order byte indicates that a 3rd party reservation was done the low order byte is the third party id.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Release: (SYMsm Description: Release issued) Logged for the release command. Defined but not logged in this release.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3004	LUN: LUN being released. Id: Indicates the reserving host Device: If non-zero, Third party reservation information. The high order byte indicates that a 3rd party reservation was done the low order byte is the third party id.
Synchronize Cache: (SYMsm Description: Synchronize controller cache issued) Logged when controllers begins execution of Synchronize Cache.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3005	None
Safe Pass Through: (SYMsm Description: Safe pass-through issued) These log entries are made by the set pass through and save pass through command handlers respectively before the pass through command is sent to the drive. The following passed through commands are not logged: Test Unit Ready, Read Capacity, Inquiry, Mode Sense. All other commands are logged regardless of their success or failure.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3006	Data Field Type: 0x0614
Mode Select 1: (SYMsm Description: Mode select for page 1 received) Logged when Mode Select for Page 0x01 is received and the Post Error bit value has changed from the value stored in NVSRAM.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3007	Id: Contains new post error (PER) bit value
Mode Select 2: (SYMsm Description: Mode select for page 2 received) Logged when mode select for Page 0x02 is received..					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3008	Data Field Type: 0x0608 Data buffer length = 16 Data: Page 0x02 Mode Select data sent to the controller in SCSI format.
Mode Select 8: (SYMsm Description: Mode for caching page 8 received) Logged when Mode Select Page 0x08 (Caching page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x3009	Data Field Type: 0x0608 Data buffer length = 12 Data: Page 0x08 Mode Select data sent to the controller in SCSI format.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Mode Select A: (SYMsm Description: Mode select for control mode page A received) Logged when Mode Select Page 0x0A (Control mode page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300A	Data Field Type: 0x0608 Data buffer length = 8 Data: Page 0x0A Mode Select data sent to the controller in SCSI format
Mode Select 2A: (SYMsm Description: Mode select for array physical page 2A received) Logged when Mode Select Page 0x2A (Array physical page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300B	Data Field Type: 0x060C
Mode Select 2B: (SYMsm Description: Mode select for array logical page 2B received) Logged when Mode Select Page 0x2B (Logical Array page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x300C	Data Field Type: 0x0608 Data buffer length = 132 Data: Page 0x2B Mode Select data sent to the controller in SCSI format.
Mode Select 2C: (SYMsm Description: Mode select for redundant controller page 2C received) Logged when Mode Select Page 0x2C (Redundant controller page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300D	Data Field Type: 0x0608 Data buffer length: = 106 Data: Page 0x2C Mode Select data sent to the controller in SCSI format.
Mode Select 2E: (SYMsm Description: Mode select for vendor-unique cache page 2E received) Logged when Mode Select Page 0x2E - (Vendor unique cache page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300E	Data Field Type: 0x0608 Data buffer length = 30 Data: Page 0x2E Mode Select data sent to the controller in SCSI format.
Mode Select 2F: (SYMsm Description: Mode select for time page 2F received) Logged when Mode Select Page 0x2F (Time page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x300F	Device: Contains the time passed to the controller

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Mode Select 3A: (SYMsm Description: Mode select for hot spare page 3A received) Logged when Mode Select Page 0x3A (The global hot spare page) is received.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3010	Id: Action code specified in the page data Device: Hot spare device specified in the page data
Defect List: (SYMsm Description: Defect list received) Currently Not Logged.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3011	
Write Buffer: Write buffer received Logged when Write Buffer is received to the following buffer ids: 0xE8 – SubSystem Identifier 0xE9 – Subsystem Fault 0xEA – Drive Fault 0xED – Host Interface Parameters 0xEE - User configuration options 0xF0 - BootP Storage					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3012	Origin: contains the buffer id. Data Field Type: 0x0612
Controller Firmware Download: (SYMsm Description: Download controller firmware issued) Logged when controller firmware download is started.					
Controller (0x1)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3013	Device: **0** = Download to drive started **1** = Download had completed Origin: Error value on completion of download **0** = Download Success **Other** = Error occurred, value of internal controller status
Drive Firmware Download Start: (SYMsm Description: Drive firmware download started) Logged when drive firmware download has started.					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3014	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Pass Through: (SYMsm Description: Drive pass-through issued) Currently Not Logged.					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3015	
Alternate Controller: (SYMsm Description: Alternate controller transition issued) Currently Not Logged.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x3016	
Set Pass Through: (SYMsm Description: Set pass-through issued) Currently Not Logged These log entries are made by the set pass through and save pass through command handlers respectively before the pass through command is sent to the drive. The following passed through commands are not logged: Test Unit Ready, Read Capacity, Inquiry, Mode Sense. All other commands are logged regardless of their success or failure.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3017	
Set Pass Command: (SYMsm Description: Set pass command issued) Currently Not Logged.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x3018	
Mode Select Active/Passive Mode: (SYMsm Description: Volume ownership changed due to failover) Logged when a Mode Select command to make the controller Active is received.					
System (0x0)	Critical (0x1)	Command (0x3)	Controller (0x8)	0x3019	
Drive Firmware Download Fail: (SYMsm Description: Drive firmware download failed) Logged when drive firmware download has failed.					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x301A	
Drive Firmware Download Complete: (SYMsm Description: Drive firmware download completed) Logged when drive firmware download has completed successfully.					
Drive (0x2)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x301B	
ESM Firmware Download Start: (SYMsm Description: ESM firmware download started) Logged when ESM firmware download has started.					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301C	Lun: Tray ID of tray containing ESM

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
ESM Firmware Download Fail: (SYMsm Description: ESM firmware download failed) Logged when ESM firmware download has failed.					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301D	Lun: Tray ID of tray containing ESM
ESM Firmware Download Complete: (SYMsm Description: ESM firmware download completed) Logged when ESM firmware download has successfully completed.					
Drive (0x2)	Informational (0x0)	Command (0x3)	ESM (0x7)	0x301E	Lun: Tray ID of tray containing ESM
PR Insuff Resources: (SYMsm Description: Unable to register a volume due to insufficient resources) Logged when a volume is unable to be registered due to insufficient resources.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x301F	

EEL Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
AEN Posted: (SYMsm Description: AEN posted for recently logged event) Logged when the controller posts an AEN.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x3101	Data Field Type: 0x0100 Data: Sense data of the AEN as defined in the Software Interface Specification.
EEL Deferred Error: (SYMsm Description: Deferred error (EEL)) Currently Not Logged					
System (0x0)	Informational (0x0)	Error (0x1)	Controller (0x8)	0x3102	
VKI Common Error: (SYMsm Description: VKI commom error) Logged when VKI_CMN_ERROR is called with the error level set to ERROR. Calls made with a level of CONTINUE or NOTE will not be logged					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x3200	Data Field Type: 0x0700
VKI Panic: (SYMsm Description: VKI panic) Logged when VKI_CMN_ERROR is called with the error level set to PANIC. Calls made with a level of CONTINUE or NOTE will not be logged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x3201	Data Field Type: 0x0700

RDAC, Quiescence and ICON Manager Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
SysWipe: (SYMsm Description: Sys wipe request sent to controller) Logged when a sys wipe request is sent to the controller. This routine is not called by the controller SW or FW currently. If logged it means the command was entered through the shell interface. If this entry is seen a corresponding entry of MEL_EV_ICON_SYS_WIPE_ALT should also be logged by the alternate controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4000	None
NVSRAM Clear: (SYMsm Description: NVSRAM clear request sent to alternate controller) Logged when an NVSRAM clear message is sent to the alternate controller. This is normally logged as part of a mode select command to the RDAC mode page 0x2C. The companion entry of MEL_EV_ICON_NV_CLR_ALT should also be seen in the event log along with this entry.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4001	None
SysWipe Alternate: (SYMsm Description: Sys wipe request received by alternate controller) Logged when a sys wipe request is received by the alternate controller. This is an unexpected log entry that is logged when the routine iconMgrSendSysWipe is executed from the shell of the alternate controller. This routine is not called by the controller SW. The companion entry of MEL_EV_ICON_SYS_WIPE should also be logged if this entry is seen.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4002	None
NVSRAM Clear Alternate: (SYMsm Description: NVSRAM clear request received by alternate controller) Logged when an NVSRAM clear message is received from the alternate controller. No additional data is logged. The companion entry of MEL_EV_ICON_NV_CLR should also be seen in the event log along with this entry.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4003	None
Quiesce Message Received: (SYMsm Description: Alternate controller quiescence message received) Logged when a quiescence manager message was received from the alternate controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4004	Id: Message that was received: **0** = Start controller level quiescence and return Done when completed. **1** = Stop controller level quiescence. **2** = The alternate controller has quiesced. **3** = Release the controller from quiescence.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Controller Quiesce Begin: (SYMsm Description: Controller quiescence started) Logged when a controller level quiescence was begun on the controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4005	Id: Value of the forceOption parameter that was passed to the routine.
Alternate Controller Quiesce Begin: (SYMsm Description: Alternate controller quiescence started) Logged when a controller level quiescence was begun on the alternate controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4006	Id: Value of the forceOption parameter that was passed to the routine.
Subsystem Quiesce Begin: (SYMsm Description: Subsystem quiescence started) Logged when a subsystem level quiescence was begun.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4007	Id: Value of the forceOption parameter that was passed to the routine.
Controller Quiesce Abort: (SYMsm Description: Controller quiescence halted) Logged when a controller level quiescence is aborted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4008	Id: Quiescence state of controller at beginning of the abort.
Controller Quiesce Release: (SYMsm Description: Controller quiescence released) Logged when a controller level quiescence is released.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4009	Id: Quiescence state of controller at beginning of release.
Alternate Controller Quiesce Release: (SYMsm Description: Alternate controller quiescence released) Logged when a controller level quiescence on alternate is released.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400A	Id: Quiescence state of alternate controller at beginning of release.
Reset All Channels: (SYMsm Description: All channel reset detected) Logged when the controller detects that the alternate controller has been removed or replaced.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400B	
Alternate Controller Reset Hold: (SYMsm Description: Controller placed offline) Logged when the controller successfully puts the alternate controller in the reset/hold state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400C	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Alternate Controller Reset Release: (SYMsm Description: Controller placed online) Logged when the controller successfully releases the alternate controller from the reset/failed state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400D	
Auto Volume Transfer: (SYMsm Description: Automatic volume transfer started) Logged when an Auto Volume Transfer is initiated.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400E	Lun: Number of Volumes being transferred Origin: 0 = Normal AVT 1 = Forced AVT (LUN will be zero)
Alternate controller has been reset: (SYMsm Description: Controller reset by its alternate) Logged when the alternate controller was reset. The controller number in the event reflects the controller that was held in reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x400F	None
Controller Reset: (SYMsm Description: Controller reset) Logged when the controller is going to reset itself through the controller firmware. This event is not logged when the controller is reset because of hardware errors (such as watchdog timeout conditions). The controller number reflects the controller number of the board that was reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x4010	None
Vol Xfer Alert: (SYMsm Description: Volume not on preferred path due to AVT/RDAC failover) Logged when a “volume not on preferred path” condition persists longer than the alert delay period.					
System (0x0)	Critical (0x1)	Error (0x1)	Controller (0x8)	0x4011	None

SYMbol Server Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Assign Volume Group Ownership: (SYMsm Description: Assign volume group ownership) Logged on entry to assignVolumeGroupOwnership_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5000	Data Field Type: 0x0603 & 0x0803
Create Hotspare: (SYMsm Description: Assign hot spare drive) Logged on entry to assignDriveAsHotSpares_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5001	Data Field Type: 0x0804 or 0x0805
Create Volume: (SYMsm Description: Create volume) Currently Not Logged					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5002	
Delete Hotspare: (SYMsm Description: De-assign hot spare drive) Logged on entry to deassignDriveAsHotSpares_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5003	Data Field Type: 0x0805
Delete Volume: (SYMsm Description: Delete volume) Logged on entry to deleteVolume_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5004	LUN: Volume be deleted
Set Controller Failed: (SYMsm Description: Place controller offline) Logged on entry to setControllerToFailed_1.					
System (0x0)	Critical (0x1)	Command (0x3)	Controller (0x8)	0x5005	Data Field Type: 0x0813
Set Drive Failed: (SYMsm Description: Fail drive) Logged on entry to setDriveToFailed_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x5006	None
Start Volume Format: (SYMsm Description: Initialize volume group or volume) Logged on entry to startVolumeFormat_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5007	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Initialize Drive: (SYMsm Description: Initialize drive) Logged on entry to initializeDrive_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x5008	None
Controller Firmware Start: (SYMsm Description: Controller firmware download started) Logged when a controller firmware download starts.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5009	
Load Drive Firmware: (SYMsm Description: Download drive firmware issued) Logged when a Download drive firmware is issued					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x500A	
Controller NVSRAM Start: (SYMsm Description: Controller NVSRAM download started) Logged when a controller NVSRAM download starts.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x500B	
Set Volume Group Offline: (SYMsm Description: Place volume group offline) Logged on entry to setVolumeGroupToOffline_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500C	Data Field Type: 0x0603
Set Volume Group Online: (SYMsm Description: Place volume group online) Logged on entry to setVolumeGroupToOnline_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500D	Data Field Type: 0x0603
Start Drive Reconstruction: (SYMsm Description: Reconstruct drive/volume) Logged on entry to startDriveReconstruction_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x500E	None
Start Volume Group Defragment: (SYMsm Description: Start volume group defragment) Logged on entry to startVolumeGroupDefrag_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x500F	Data Field Type: 0x0603

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Start Volume Group Expansion: (SYMsm Description: Add free capacity to volume group) Logged on entry to startVolumeGroupExpansion_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5010	Data Field Type: 0x0603 & 0x0809
Start Volume RAID Migration: (SYMsm Description: Change RAID level of volume group) Logged on entry to startVolumeRAIDMigration_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x5011	Data Field Type: 0x0603 & 0x080A
Start Volume Segment Sizing: (SYMsm Description: Change segment size of volume) Logged on entry to startVolumeSegmentSizing_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5012	Data Field Type: 0x0802
Set Controller To Passive: (SYMsm Description: Change controller to passive mode) Logged on entry to setControllerToPassive_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5013	Data Field Type: 0x0813
Set Controller To Active: (SYMsm Description: Change controller to active mode) Logged on entry to setControllerToActive_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5014	Data Field Type: 0x0813
Set Storage Array Cache Parameters: (SYMsm Description: Update cache parameters of Storage Array) Logged on entry to setSACacheParams_1. Instructs the SYMbol Server's controller to propagate a controller cache change to all controllers in the storage array.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5015	Data Field Type: 0x080B
Set Storage Array User Label: (SYMsm Description: Change name of Storage Array) Logged on entry to setSAUserLabel_1. Instructs the controller to change the shared storage array name.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5016	Data Field Type: 0x080C

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Set Controller Time: (SYMsm Description: Synchronize controller clock) Logged on entry to setControllerTime_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5017	Data Field Type: 0x080D
Set Volume Cache Parameters: (SYMsm Description: Change cache parameters of volume) Logged on entry to setVolumeCacheParams_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5018	Data Field Type: 0x080E
Set Volume Parameters: (SYMsm Description: Change parameters of volume) Logged on entry to setVolumeParams_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5019	Data Field Type: 0x080F
Set Volume User Label: (SYMsm Description: Change name of volume) Logged on entry to setVolumeUserLable_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x501A	Data Field Type: 0x0801
Set Controller To Optimal: (SYMsm Description: Place controller online) Logged on entry to setControllerToOptimal_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x501B	Data Field Type: 0x0813
Set Drive To Optimal: (SYMsm Description: Revive drive) Logged on entry to setDriveToOptimal_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Drive (0x1)	0x501C	None
Force Volume To Optimal: (SYMsm Description: Revive volume) Logged on entry to forceVolumeToOptimal_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume Group (0xE)	0x501D	None
Set Storage Array Tray Positions: (SYMsm Description: Change positions of trays in physical view) Logged on entry to setSATrayPositions_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x501E	Data Field Type: 0x0810
Set Volume Media Scan Parameters: (SYMsm Description: Change media scan (scrub) settings of volume) Logged on entry to setVolumeMediaScanParameters_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x501F	Data Field Type: 0x0811

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Set Storage Array Media Scan Rate: (SYMsm Description: Change media scan (scrub) settings of Storage Array) Logged on entry to setSAMediaScanRate_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5020	Data Field Type: 0x0812
Clear Storage Array Configuration: (SYMsm Description: Reset configuration of Storage Array) Logged on entry to clearSAConfiguration_1. Clears the entire array configuration, deleting all volumes and returning to a clean initial state.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5021	None
Auto Storage Array Configuration: (SYMsm Description: Automatic configuration on Storage Array) Logged on exit from to autoSAConfiguration_1.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5022	None
RPC Function Return Code: (SYMsm Description: Controller return status/function call for requested operation) Logged on the return from RPC function returning ReturnCode.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5023	Data Field Type: 0x0814
Write Download Checkpoint: (SYMsm Description: Internal download checkpoint) Logged whenever the download checkpoint is updated.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5024	Data Field Type: 0x0815
Controller Firmware Download Fail: (SYMsm Description: Controller firmware download failed) Logged when a controller firmware download fails.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5025	
Controller Firmware Download Complete: (SYMsm Description: Controller firmware download completed) Logged when a controller firmware download successfully completes.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5026	
Controller NVSRAM Download Fail: (SYMsm Description: Controller NVSRAM download failed) Logged when a controller NVSRAM download fails.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5027	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Controller NVSRAM Download Complete: (SYMsm Description: Controller NVSRAM download completed) Logged when a controller NVSRAM download successfully completes.					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5028	
Battery Update: (SYMsm Description: Reset controller battery age) Logged when the battery parameters are updated.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5029	Data Field Type: 0x0816
Assign Volume Ownership: (SYMsm Description: Assign volume ownership) Logged when volume ownership is modified.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502A	None
Volume Expand: (SYMsm Description: Increase volume capacity) Logged when volume capacity is increased					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502B	None
Snap Params Set: (SYMsm Description: Change parameters of snapshot repository volume) Logged when the snapshot parameters are changed.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502C	None
Recreate Snap: (SYMsm Description: Re-create snapshot volume) Logged when the snapshot is recreated (restarted).					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502D	None
Disable Snap: (SYMsm Description: Disable snapshot volume) Logged when the snapshot has been disabled (stopped).					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502E	None
Delete Ghost: (SYMsm Description: Delete missing volume) Logged when a missing volume is deleted.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x502F	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
RVM Activated (SYMsm Description: Activate remote volume mirroring) Logged when the Remote Volume Mirroring feature has been activated on the local array. Activation causes the controller host-ports to be configured for mirroring.					
System (0x0)	Informational (0x0)	Command (0x3)	Channel (0x6)	0x5030	None
RVM Deactivated: (SYMsm Description: Deactivate remote volume mirroring) Logged when the Remote Volume Mirroring feature has been deactivated on the local array. Deactivation restores normal host-port functionality.					
System (0x0)	Informational (0x0)	Command (0x3)	Channel (0x6)	0x5031	None
Mirror Sync Changed: (SYMsm Description: Change synchronization priority) Logged when the synchronization priority of a mirrored volume is changed.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5032	None
Mirror Start Sync: (SYMsm Description: Start mirror synchronization) Logged when a mirror relationship is created. The event is only propagated on the primary mirror storage array.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5033	None
Not Used				0x5034	
Not Used				0x5035	
Not Used				0x5036	
SYMbol Auth Fail Incorrect Password: (SYMsm Description: Incorrect password attempted) Logged when an authentication failure has occurred, but the lockout state has not yet been entered.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5037	None
SYMbol Auth Fail Cont Lockout: (SYMsm Description: Storage array 10-minute lockout; maximum incorrect passwords attempted) Logged when the lockout state has been entered.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x5038	None
SYMbol Vcopy Params Set: (SYMsm Description: Change parameters of volume copy pair) Logged when the parameters are changed on a volume copy pair.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5039	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
SYMbol Vcopy Start Copy: (SYMsm Description: Start volume copy operation) Logged when processing a user request (via SYMbol) to start a copy. This does not necessarily match the actual start of data movement because the copy may be queued.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503A	None
SYMbol Vcopy Stop Copy: (SYMsm Description: Stop volume copy operation) Logged when processing a user request (via SYMbol) to stop a copy.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503B	None
SYMbol Mirror Wrt Md Change: (SYMsm Description: Change mirror pair write mode) Logged when mirror pair write mode is changed.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503C	None
SYMbol Mirror Suspended: (SYMsm Description: Suspend mirror pair) Logged when mirror pair is suspended.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503D	None
SYMbol Mirror Resumed: (SYMsm Description: Resume mirror pair) Logged when mirror pair is resumed.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503E	None
SYMbol Mirror Set Auto Resync: (SYMsm Description: Resynchronization set for automatic) Logged when resynchronization is set for automatic.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x503F	None
SYMbol Cont Service Mode: (SYMsm Description: Place controller in service mode) Logged when the controller is placed in service mode.					
System (0x0)	Critical (0x1)	Command (0x3)	Controller (0x8)	0x5040	None
SYMbol Recover Volume: (SYMsm Description: Recover volume) Logged when the volume is recovered.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5041	None
SYMbol Mirror Suspend Group: (SYMsm Description: Write consistency group suspended) Logged when write consistency group is suspended.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5042	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
SYMbol Mirror Resume Group: (SYMsm Description: Write consistency group resumed) Logged when write consistency group is resumed					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5043	None
SYMbol Simplex Mode CHG: (SYMsm Description: Change to single controller mode) Logged when there is a change to the single controller mode					
System (0x0)	Informational (0x0)	Command (0x3)	Controller (0x8)	0x5044	None

Storage Partitions Manager Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Create Cluster: (SYMsm Description: Create host group) Logged on entry to spmCreateCluster.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5200	Data Field Type: 0x0900
Delete Cluster: (SYMsm Description: Delete host group) Logged on entry to spmDeleteCluster.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5201	Data Field Type: 0x0901
Rename Cluster: (SYMsm Description: Rename host group) Logged on entry to spmRenameCluster.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5202	Data Field Type: 0x0903
Create Host: (SYMsm Description: Create host) Logged on entry to spmCreateHost.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5203	Data Field Type: 0x0907
Delete Host: (SYMsm Description: Delete host) Logged on entry to spmDeleteHost.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5204	Data Field Type: 0x0901
Rename Host: (SYMsm Description: Rename host) Logged on entry to spmRenameHost.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5205	Data Field Type: 0x0903
Move Host: (SYMsm Description: Move host) Logged on entry to spmMoveHost.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5206	Data Field Type: 0x0902

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Create Host Port: (SYMsm Description: Create host port) Logged on entry to spmCreateHostPort.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5207	Data Field Type: 0x0904
Delete Host Port: (SYMsm Description: Delete host port) Logged on entry to spmDeleteHostPort.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5208	Data Field Type: 0x0901
Rename Host Port: (SYMsm Description: Rename host port) Logged on entry to spmRenameHostPort.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x5209	Data Field Type: 0x0905
Move Host Port: (SYMsm Description: Move host port) Logged on entry to spmMoveHostPort.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520A	Data Field Type: 0x0902
Set Host Port Type: (SYMsm Description: Set host port type) Logged on entry to spmSetHostPortType.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520B	Data Field Type: 0x0906
Create SAPort Group: (SYMsm Description: Create Storage Array port group) Logged on entry to spmCreateSAPortGroup.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520C	Data Field Type: 0x0900
Delete SAPort Group: (SYMsm Description: Delete Storage Array port group) Logged on entry to spmDeleteSAPortGroup.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520D	Data Field Type: 0x0900
Move SA Port: (SYMsm Description: Move Storage Array port) Logged on entry to spmMoveSAPort.					
System (0x0)	Informational (0x0)	Command (0x3)	Unknown (0x0)	0x520E	Data Field Type: 0x0902

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Create LUN Mapping: (SYMsm Description: Create volume-to-LUN mapping) Logged on entry to spmCreateLUNMapping.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x520F	Data Field Type: 0x0908
Delete LUN Mapping: (SYMsm Description: Delete volume-to-LUN mapping) Logged on entry to spmDeleteLUNMapping.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5210	Data Field Type: 0x0901
Move LUN Mapping: (SYMsm Description: Change volume-to-LUN mapping) Logged on entry to spmMoveLUNMapping.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x5211	Data Field Type: 0x0909
Write DACSTORE Error: (SYMsm Description: Error writing configuration) Logged when an error occurs when attempting to update the SPM DASCSTORE region.					
System (0x0)	Informational (0x0)	Error (0x1)	Unknown (0x0)	0x5212	Data Field Type: 0x090A
SPM Cleared (SYMsm Description: Premium feature not supported – storage partitions deleted) Logged if a user attempts to import a drive tray/volume group and the premium features are not supported.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5213	None

SAFE Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Feature Enabled: (SYMsm Description: Premium feature enabled) Logged when a feature is successfully enabled.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5400	Id: Feature Code
Feature Disabled: (SYMsm Description: Premium feature disabled) Logged when a feature is successfully disabled.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5401	Id: Feature Code
Non-Compliance: (SYMsm Description: Premium feature out of compliance) Logged when there are features enabled that have not been purchased.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5402	Id: Features not in compliance
Tier Non-Compliance: (SYMsm Description: Premium feature exceeds limit) Logged when the limits of a premium feature have been exceeded (e.g. 6 storage partitions mapped when 4 have been purchased).					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5403	Id: Features not in tier compliance
ID Changed: (SYMsm Description: Feature Enable Identifier changed) Logged when a new SAFE ID is successfully generated and stored.					
System (0x0)	Informational (0x0)	Notification (0x4)	Unknown (0x0)	0x5404	

Runtime Diagnostic Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Runtine Diagnostics OK: (SYMsm Description: Controller passed diagnostics) Logged when controller successfully passed runtime diagnostics.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5600	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Alternate controller runtime diagnostics OK: (SYMsm Description: This controller's alternate passed diagnostics.) Logged when alternate controller successfully passed diagnostics.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5601	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime diagnostics timeout: (SYMsm Description: This controller's alternate failed – timeout waiting for results) Logged when alternate controller failed due to timeout waiting for diagnostic results.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x5602	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Diagnostics in progress: (SYMsm Description: Diagnostics rejected - already in progress) Logged when Runtime Diagnostics request rejected because already in progress.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5603	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
No alternate present for diagnostic execution: (SYMsm Description: Diagnostics rejected – this controller's alternate is absent or failed) Logged when Runtime Diagnostics request rejected because the alternate controller is either absent, failed, or in passive mode.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5604	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
ICON error during runtime diagnostics: (SYMsm Description: Diagnostics rejected – error occurred when sending the Icon message) Logged when Runtime Diagnostics request failed because an error occurred when sending the ICON message.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5605	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Runtime diagnostic initialization error: (SYMsm Description: Diagnostics rejected - ctlrDiag task unable to queue DIAG_INIT_MSG message) Logged when Runtime Diagnostics request failed because ctlrDiag task was unable to queue the DIAG_INIT_MSG message.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5606	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – unknown return value: (SYMsm Description: Diagnostics returned unknown ReturnCode) Logged when Runtime Diagnostics status unknown because of unknown ReturnCode.					
System (0x0)	Informational (0x0)	Unknown (0x0)	Controller (0x8)	0x5607	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – bad test ID: (SYMsm Description: Diagnostics rejected - test ID is incorrect) Logged when Runtime Diagnostics request rejected because test ID is invalid.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5608	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – drive error: (SYMsm Description: Diagnostics unable to select a drive for I/O) Logged when Runtime Diagnostics unable to select a drive to use for I/O.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5609	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – UTM not enabled: (SYMsm Description: Diagnostics rejected – access volume (UTM)is not enabled) Logged when Runtime Diagnostics request rejected because UTM is not enabled.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x560A	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – lock error: (SYMsm Description: Diagnostics rejected - CtlrDiag task cannot obtain Mode Select lock) Logged when Runtime Diagnostics request failed because the ctlrDiag task was unable to obtain the Mode Select lock.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x560B	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Runtime Diagnostics error – lock error on alternate: (SYMsm Description: Diagnostics rejected – CtlrDiag task on controller's alternate cannot obtain Mode Select lock) Logged when Runtime Diagnostics request failed because the ctlrDiag task on the alternate controller was unable to obtain the Mode Select lock.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x560C	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Diagnostic read test failed: (SYMsm Description: Diagnostics read test failed on controller) Logged when Runtime Diagnostics Read test failed on this controller.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x560D	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Diagnostic read failure on alternate controller: (SYMsm Description: This controller's alternate failed diagnostics read test) Logged when Runtime Diagnostics Read test failed on the alternate controller.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x560E	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Diagnostic write test failed: (SYMsm Description: Diagnostics write test failed on controller) Logged when Runtime Diagnostics Write test failed on this controller.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x560F	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Diagnostic write test failed on alternate controller: (SYMsm Description: This controller's alternate failed diagnostics write test) Logged when Runtime Diagnostics Write test failed on the alternate controller.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x5610	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – loopback error: (SYMsm Description: Controller passed diagnostics, but loopback test identified an error on loop(s)) Logged when this controller passed diagnostics, but the loopback test identified an error on one or more of the loops.					

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5611	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – loopback error on alternate: (SYMsm Description: This controller's alternate passed diagnostics, but loopback test identified an error on loop(s)) Logged when the alternate controller passed diagnostics, but the loopback test identified an error on one or more of the loops.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5612	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – bad channel: (SYMsm Description: Diagnostics loopback test identified bad destination channel(s)) Logged when the specified destination channels were identified as bad during the Runtime Diagnostics Loopback Data test.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5613	Id: 1 if user initiated Data Field Type : 0x0A02 Data Field Value: Number of bad channels
Runtime Diagnostics error – Source link down: (SYMsm Description: A host-side port (link) has been detected as down) Logged when this controller passed diagnostics, but the specified source link was down.					
System (0x0)	Informational (0x0)	Notification (0x4)	Channel (0x6)	0x5614	Id: 1 if user initiated Data Field Type : 0x0A01 Data Field Value: Channel ID
Not Used				0x5615	
Runtime Diagnostics error – Configuration error: (SYMsm Description: Diagnostics rejected – configuration error on controller) Logged when configuration error on this controller for running diagnostics.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x5616	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Alternate controller configuration error: (SYMsm Description: Diagnostics rejected - configuration error on this controller's alternate) Logged when configuration error of the alternate controller for running diagnostics.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x5617	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Runtime Diagnostics error – No memory: (SYMsm Description: Diagnostics rejected - no cache memory on controller) Logged when there is no cache memory on controller for running diagnostics.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5618	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error –No memory on alternate controller: (SYMsm Description: Diagnostics rejected - no cache memory on this controller's alternate) Logged when there is no cache memory on the alternate controller for running diagnostics.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x5619	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Controller not quiesced: (SYMsm Description: Diagnostics rejected - data transfer on controller is not disabled (quiesced)) Logged when Runtime Diagnostics request rejected because controller is not quiesced.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561A	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics error – Alternate Controller not quiesced: (SYMsm Description: Diagnostics rejected – data transfer on this controller's alternate is not disabled (quiesced)) Logged when Runtime Diagnostics request rejected because the alternate controller is not quiesced.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561B	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics Mode Error: (SYMsm Description: Diagnostics rejected – both controllers must be in active mode) Logged when Runtime Diagnostics request rejected because both controllers must be in active mode.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561C	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics – Begin Initialization Controller: (SYMsm Description: Diagnostics initiated from this controller) Logged when Runtime Diagnostics is initiated from this controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561D	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Runtime Diagnostics – Begin Diagnostics Controller: (SYMsm Description: Running diagnostics on this controller) Logged when Runtime Diagnostics is started on this controller.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561E	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.
Runtime Diagnostics – Download in Progress: (SYMsm Description: Diagnostics rejected – download is in progress) Logged when Runtime Diagnostics request is rejected because download is in progress.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x561F	Id: 1 if user initiated Data Field Type : 0x0A00 Data Field Value: ID of test requested. 0 – all tests.

Stable Storage Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
SSTOR Database Creation: (SYMsm Description: Internal configuration database created) Logged when an internal configuration database is created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6000	None
SSTOR Database Merge: (SYMsm Description: Internal configuration database merged) Logged when an internal configuration database is merged.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6001	None
Not Used					
				0x6002	
SSTOR To Few Sundry: (SYMsm Description: Internal configuration database – not enough optimal drives available) Logged when there are not enough optimal drives available.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6003	None
SSTOR Re Synchronize: (SYMsm Description: Internal configuration database is being resynchronized) Logged when the internal configuration database is being resynchronized.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6004	None
SSTOR SS IO Failed: (SYMsm Description: Internal configuration database read or write operation failed) Logged when an internal configuration database read or write operation fails.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6005	None
SSTOR Merge Failed: (SYMsm Description: Internal configuration database – merge failed) Logged when a stable storage database merge operation fails.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6006	None

Hierarchical Config DB Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
DBM Config DB Cleared: (SYMsm Description: Internal configuration database cleared) Logged when an internal configuration database is cleared.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6100	None
DBM Config DB Full: (SYMsm Description: Internal configuration database full) Logged when an internal configuration database is full.					
System (0x0)	Critical (0x1)	Notification (0x4)	Controller (0x8)	0x6101	None
DBM Config DB Expanded: (SYMsm Description: Internal configuration database size increased) Logged when there is a drive mismatch on an internal configuration database.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6102	None
DBM HCK ALTCTL Reset: (SYMsm Description: This controller's alternate was reset) Logged when this controller's alternate is reset.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6103	None
DBM HCK ALTCTL Failed: (SYMsm Description: This controller's alternate was failed) Logged when this controller's alternate is failed.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6104	None
DBM Corrupt File SYS: (SYMsm Description: Internal configuration database – file system corrupted) Logged when the file system is corrupted on an internal configuration database.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6105	None
DBM Invalid File SYS Version: (SYMsm Description: Internal configuration database – incorrect file system version) Logged when an incorrect file system version is found in an internal configuration database.					
System (0x0)	Informational (0x0)	Notification (0x4)	Controller (0x8)	0x6106	None
DBM Hck Altctl Not Func: (SYMsm Description: This controller's alternate is non-functional and is being held in reset.) Logged when the controller's alternate is non-functional and is being held in reset.					
System (0x0)	Critical (0x1)	Failure (0x2)	Controller (0x8)	0x6107	None

Snapshot Copy Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
CCopy Repo Overwarn: (SYMsm Description: Snapshot repository volume capacity – threshold exceeded) Logged when the repository usage crosses over the warning threshold. This is an indication that something needs to be done to correct the dwindling free space in the repository before the snapshot fails.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x6200	None
CCopy Repo Full: (SYMsm Description: Snapshot repository volume capacity - full) Logged when the repository usage drops below the warning threshold. This could result from either a deletion of a point-in-time image or the capacity of the repository volume has been expanded or the warning threshold was changed.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x6201	None
CCopy Snap Failed: (SYMsm Description: Snapshot volume failed) Logged when a snapshot volume fails.					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x6202	None
CCopy Snap Created: (SYMsm Description: Snapshot volume created) Logged when a new snapshot volume is created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6203	None
CCopy Snap Deleted: (SYMsm Description: Snapshot volume deleted) Logged when a snapshot volume is deleted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6204	None

Metadata Manager Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Metadata Created: (SYMsm Description: Mirror repository volume created) Logged when a mirror repository volume is created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6300	None
Metadata Deleted: (SYMsm Description: Mirror repository volume deleted) Logged when a mirror repository volume is deleted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6301	None

Mirroring Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Mirror Dual Primary: (SYMsm Description: Dual primary volume conflict) Logged when there is a conflict over the primary volume. Since both sides of the mirrored pair are in the same Primary role, both storage arrays will report this MEL event.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x6400	None
Mirror Dual Secondary: (SYMsm Description: Dual secondary volume conflict) Logged when there is a conflict over the secondary volume. Since both sides of the mirrored pair are in the same Secondary role, both storage arrays will report this MEL event.					
System (0x0)	Critical (0x1)	Notification (0x4)	Volume (0xD)	0x6401	None
Mirror Unsynchronized: (SYMsm Description: Data on mirrored pair unsynchronized) Logged when the mirror state transitions to the unsynchronized state from either the synchronizing or optimal state.					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x6402	None
Mirror Synchronizing: (SYMsm Description: Data on mirrored pair synchronizing) Logged when a mirrored pair begins the synchronization process.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6403	None
Mirror Optimal: (SYMsm Description: Data on mirrored pair synchronized) Logged when a mirrored pair completes the background synchronization process and the mirrored pair transitions to the optimal state.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6404	None
Mirror Orphan Created: (SYMsm Description: Associated volume in mirrored pair not present) Logged when a failed or interrupted mirror creation or deletion request resulted in an orphaned mirror. In this case, one array has the mirror configuration information, but the remote array does not have the information.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x6405	None

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
Not Used				0x6406	None
Not Used				0x6407	None
Not Used				0x6408	None
Mirror Suspended: (SYMsm Description: Mirror relationship suspended) Logged when mirror relationship is suspended.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6409	None
Mirror Failed: (SYMsm Description: Data on mirrored pair unsynchronized) Logged when data on mirrored pair is unsynchronized.					
System (0x0)	Informational (0x0)	Failure (0x2)	Volume (0xD)	0x640A	None
Mirror Failed Suspended: (SYMsm Mirror relationship suspended) Logged when mirror relationship is suspended.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x640B	None
Mirror Set To Synchronous: (SYMsm Description: Mirror write mode set to synchronous) Logged when mirror write mode is set to synchronous.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x640C	None
Mirror Set To Asynchronous: (SYMsm Description: Mirror write mode set to asynchronous) Logged when mirror write mode is set to asynchronous.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x640D	None
Mirror Set To Consist Async: (SYMsm Description: Mirror write mode set to asynchronous, write-consistent) Logged when mirror write mode is set to asynchronous, write-consistent.					
System (0x0)	Informational (0x0)	Command (0x3)	Volume (0xD)	0x640E	None

Remote Volume Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
RMTVOL Created: (SYMsm Description: Remote volume created) Logged when a remote volume is created in conjunction with a remote mirror creation.					
System (0x0)	Informational (0x1)	Notification (0x4)	Volume (0xD)	0x6500	None
RMTVOL Deleted: (SYMsm Description: Remote volume deleted) Logged when a remote volume has been deleted in conjunction with a remote mirror deletion.					
System (0x0)	Informational (0x1)	Notification (0x4)	Volume (0xD)	0x6501	
RMTVOL Link Up: (SYMsm Description: Communication to remote volume – up) Logged when the link is back up.					
System (0x0)	Informational (0x1)	Notification (0x4)	Volume (0xD)	0x6502	
RMTVOL Link Down: (SYMsm Description: Communication to remote volume – down) Logged when the link is down.					
System (0x0)	Critical (0x0)	Failure (0x2)	Volume (0xD)	0x6503	
RMTVOL Node WWN Changed: (SYMsm Description: Remote storage array's world-wide name changed) Logged on the array that receives notification of its remote array's WWN change.					
System (0x0)	Informational (0x1)	Notification (0x4)	Volume (0xD)	0x6504	
RMTVOL Node WWN Changed Failed: (SYMsm Description: Failed to communicate storage array's world-wide name) This error occurs if an array detects during start-up processing that its WWN changed. When the firmware detects this name change, it attempts to notify any remote array that had previously been participating in a mirroring relationship.					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x6505	None

Volume Copy Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
VOLCOPY Failed: (SYMsm Description: Volume copy operation failed) Logged when a volume copy operation fails due to one of the following reasons: Read error on source volume, Write error on target volume, Configuration change resulting in a feature compatibility violation (e.g. Role Change of a Remote Mirror)					
System (0x0)	Critical (0x1)	Failure (0x2)	Volume (0xD)	0x6600	None
VOLCOPY Created: (SYMsm Description: Volume copy pair established) Logged when a volume copy is created.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6601	
VOLCOPY Deleted: (SYMsm Description: Volume copy pair removed) Logged when a volume copy is deleted.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6602	
VOLCOPY Started: (SYMsm Description: Volume copy operation in progress) Logged when the copy operation transitions to in progress, which may or may not be at the time the user requests the copy to start. For example, a copy operation that first transitions to the pending state (is queued due to lack of system resources at the time the copy start-request is processed) will generate Event 0x6604, followed later by Event 0x6603 when resources become available for the data movement to actually start.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6603	
VOLCOPY Queued: (SYMsm Description: Volume copy operation pending) Logged when a volume copy operation is queued.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6604	
VOLCOPY Halted: (SYMsm Description: Volume copy operation stopped) Logged upon transition to the halted state and will only occur as the result of a user request and should follow Event 0x503B.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6605	None
VOLCOPY Completed: (SYMsm Description: Volume copy operation completed) Logged as a result of a completed copy operation when the entire extent of the source volume has been copied to the target volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6606	None

Unreadable Sector Management Events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
USM BAD LBA Detected: (SYMsm Description: Unreadable sector(s) detected – data loss occurred) Logged when an unreadable sector is detected and data loss occurred.					
System (0x0)	Critical (0x1)	Error (0x1)	Volume (0xD)	0x6700	0x70b
USM Bad LBA Repaired: (SYMsm Description: Unreadable sector repaired) Logged when the unreadable sector is repaired.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6701	0x70b
USM Vol Clear Completed: (SYMsm Description: All unreadable sectors on the volume repaired – data unrecovered) Logged when all of the unreadable sectors on the volume have been repaired.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6702	None
USM Database Full: (SYMsm Description: Overflow in unreadable sector database) Logged when the database is full.					
System (0x0)	Critical (0x1)	Error (0x1)	Volume (0xD)	0x6703	0x70b
USM Bad LBAs Found: (SYMsm Description: Unreadable sectors found on volume) Logged when unreadable sectors are found on volume.					
System (0x0)	Informational (0x0)	Notification (0x4)	Volume (0xD)	0x6704	None
USM Import Failed: (SYMsm Description: Volume import failed - too many unreadable sectors) Logged when a volume import fails due to too many unreadable sectors.					
System (0x0)	Informational (0x0)	Notification (0x4)	VolumeGroup (0xE)	0x6705	None

Data Field Types

Name	Data Field Type	Data Description
Controller Sense Data	0x0100	Controller sense data follows
Transition (Currently not used)	0x0101	2 byte values follow: old value/state in byte 1
Channel ID (Currently not used)	0x0102	4 byte id follows channel & id or tray & slot
Controller Number (Currently not used)	0x0103	4 byte valu(e follows 0 even id 1 odd id controller /
Block Number (Currently not used)	0x0104	4 byte LBA follows
Host Number (Currently not used)	0x0105	4 byte host number follows
Software Revision Number (Currently not used)	0x0106	4 byte SW revision number follows
Error Number (Currently not used)	0x0107	4 byte error number follows - event/component specific
Parity Error (Currently not used)	0x0108	
Device Name (Currently not used)	0x0109	8 bytes - device name string
Number of Blocks (Currently not used)	0x010A	4 byte number of blocks
Unit Number	0x010B	4 byte unit or device number
Component Unique (Currently not used)	0x010C	4 bytes of component specific unique data
Drive Sense	0x010D	1st 18 bytes of drive sense data
Drive Inserted (Currently not used)	0x010E	Channel/Device number of inserted device
Drive Removed (Currently not used)	0x010F	Channel/Device number of removed device
Chip Status	0x0110	Value from chip being logged
ECC Parity Error	0x0111	14 Bytes of parity info **Type** (1 byte): 0x01: Spectra Double Bit ECC 0x02: Spectra Single Bit ECC 0x03: Processor Double Bit ECC 0x04: Processor Single Bit ECC **Syndrome** (1 byte): **Address** (4 bytes): Address of Error **Upper Word** (4 bytes): **Lower Word** (4 bytes):
FC Destination Drive Codes	0x0112	

Name	Data Field Type	Data Description
Chip Address	0x0201	4 bytes chip address
Register Value (Currently not used)	0x0202	4 byte register value
Tally Type (Currently not used)	0x0203	4 bytes tally type that exceeded threshold
Destination Device (Currently not used)	0x0204	
Chip Period (Currently not used)	0x0205	4 bytes - SCSI chip sync clock factor
No Memory	0x0206	4 bytes: 0 = Processor Memory 1 = RPA Memory
Bus Number (Currently not used)	0x0207	
Reassign Blocks Data	0x0208	Data: First eight device numbers and block addresses that were successfully reassigned by the controller. Data is pairs of device and block numbers each 4 bytes.
Piece Number (Currently not used)	0x0301	
Repair (Currently not used)	0x0302	
VDD Operation (Currently not used)	0x0303	1 byte VDD operation 0: Restore 1: Recovery 2: Repair 3: Interrupted Write 4: Extra Copy 5: Log Data 6: Stripe Write 7: New Data Write 8: New Parity Write 9: Write Cache
VDD Data, Parity or Repair Operation (Currently not used)	0x0304	1 byte 0: Data operation 1: Parity operation 2: Repair operation
VDD Algorithm (Currently not used)	0x0305	1 byte VDD algorithm in use

Name	Data Field Type	Data Description
EDC Error	0x0320	Used with events 0x2060, EDC Channel Error & 0x2061 EDC Volume Error 31 bytes: BYTE 1 ioType BYTE 2 Hw EDC Status BYTE 3 Sw EDC Status BYTE 4 Hw EDC Action BYTE 5 Primary Channel BYTE 6 Retry Channel BYTES 7 - 10 : Volume BYTES 11- 18 : LBA BYTES 19- 22 : Offset BYTES 23- 30 : Mem Address BYTE 31 EDC Occurrence
Configuration States (Currently not used)	0x0401	
LUN States (Currently not used)	0x0402	4 bytes - LUN state transition below
Controller State (Currently not used)	0x0403	4 bytes - Controller states
Controller Active-Active Mode	0x0404	**Primary controller state** (2 bytes) **Alternate controller state** (2 bytes) 0 = Passive Mode 1 = Active Mode
Controller Active-Passive Mode	0x0405	**Primary controller state** (2 bytes) **Alternate controller state** (2 bytes) 0 = Passive Mode 1 = Active Mode
User Data Length (Currently not used)	0x0501	A maximum of 64 bytes can be sent
User Data (Currently not used)	0x0502	
Configuration Data (Currently not used)	0x0601	
Drive Fault Data (Currently not used)	0x0602	
Drive Group Data	0x0603	Drive List
Fault Data (Currently not used)	0x0604	
Post Error (Currently not used)	0x0605	

Name	Data Field Type	Data Description
3rd Party ID (Currently not used)	0x0606	
Reconfiguration Data (Currently not used)	0x0607	
Mode Select Page Data	0x0608	Mode Select Page data in SCSI format. Length varies according to Mode Select Page
Reconstruction (Currently not used)	0x0609	
Mode Select Page 0x08 Data (Currently not used)	0x060A	
Mode Select Page 0x0A Data (Currently not used)	0x060B	
Mode Select Page 0x2A Data	0x060C	Data: Contains pairs of device and status numbers of device whose statuses were changed by the mode select command. A maximum of 40 pairs are logged using the following structure: **Device** (4 bytes) **Action** (1 byte)
Mode Select Page 0x2B Data (Currently not used)	0x060D	
Mode Select Page 0x2C Data (Currently not used)	0x060E	
Mode Select Page 0x2E Data (Currently not used)	0x060F	
Mode Select Time Data (Currently not used)	0x0610	4 bytes - new time value
Mode Select Page 0x3A Data (Currently not used)	0x0611	
VDD Information	0x0612	**Flags** (4 bytes): Beginning flags contents unspecified. **VpState** (4 bytes): State of the virtual piece **blockNum** (4 bytes): Beginning block number for the restore operation. **Cluster** (4 bytes): Beginning cluster number **Stripe** (4 bytes): Beginning stripe number **Offset** (4 bytes): Beginning offset within the stripe **Blocks** (4 bytes): Number of blocks to restore **remBlocks** (4 bytes): Number of remaining blocks to restore **dataDev** (4 bytes): Device number of the data drive not used for recover operations **parityDev** (4 bytes): Device number of the parity drive.
VDD Status	0x0613	**Flags** (4 bytes): buf flags **Error** (4 bytes): buf error **Value** (4 bytes): Block number if event type is 0x201F, exclusive operations boundary for other

Name	Data Field Type	Data Description
		event types
Pass Through Data	0x0614	**Direction of data transfer** (1 byte) **Pass through CDB** (16 bytes)
Write Buffer Data	0x0615	The data buffer contains a maximum of 64 bytes of data sent to the id
Download Destination (Currently not used)	0x0616	1 byte download device types
VDD Recovery Data	0x0617	Array of 6 byte entries (Maximum of 36 per MEL entry) indicating the LBA and Number of blocks being recovered. **LBA** (4 bytes) **Number of Blocks** (2 bytes)
Data Scrubbing End Tallies	0x0618	**Flags** (4 bytes): buf flags **Error** (4 bytes): buf error **Unrecovered** (1 byte): Number of Unrecovered errors found during scrub **Recovered** (1 byte): Number of recovered errors found during scrub **Mismatch** (1 byte): Number of data/parity mismatches found during scrub **Unfixable** (1 byte): Number of unfixable errors found during scrub
VDD Information Extended (Currently not used)	0x0650	
ASCII Text Data	0x0700	Data is variable length ASCII String
ACS Error	0x0701	4 bytes of ACS error data 1: Mirroring Error 2: Buffer Error 3: Image Error 4: CRC Error 5: Flash Error 6: ICON Error 7: Internal Error 8: Other Error
Enclosure ID (Currently not used)	0x0702	4 bytes sub enclosure id
AC Status (Currently not used)	0x0703	
Line State Change Data	0x0704	Byte 0: Unused Byte 1: Transition Data 0 = Good to bad transition 1 = Bad to good transition Byte 2: Line Number Byte 3: User Component Code
Enclosure Data	0x0705	Byte 0: Transition Data 0 = Good to bad transition 1 = Bad to good transition

Name	Data Field Type	Data Description
		Byte 1: FRU of device defined by sense data Byte 2: 1st Additional FRU byte Byte 3: 2nd Additional FRU byte
LBA Information	0x0706	**Starting LBA** (4 bytes) **Number of Block** (4 bytes)
EEL Information	0x0707	**Recovered:** (4 bytes) 0 = Unrecovered 1 = Recovered **Detection** (4 bytes): Detection point in code where logged **LBA** (4 bytes): LBA of error Number of Blocks (4 bytes): Number of blocks involved in the request **ASC** (4 bytes): Internal controller error code **Recovery** (4 bytes): EEL defined recovery actions **Flags** (4 bytes): EEL flags
Data Volume Label	0x708	MEL_DATA_VOL_LABEL length (4 bytes) label (60 bytes maximum) identifier (4 bytes)
Data Mirror Orphan	0x709	MEL_DATA_MIRROR_ORPHAN Used with Mirror Orphan Created event remoteMirrorArrayWwn (8 bytes) remoteMirrorVolWwn (16 bytes) localMirrorVolWwn (16 bytes)
Remote Volume WWN Changed	0x70A	MEL_DATA_RMTVOL_NODE_WWN_ CHANGED Used with RMTVOL Node WWN change & RMTVOL Node WWN change failed events BYTE localArrayWwn(8 bytes) BYTE remoteArrayOldWwn(8 bytes) BYTE remoteArrayNewWwn(8 bytes)
Unreadable Sector Data	0x70B	MEL_DATA_USM_UNREADABLE_SECTOR Used with USM BAD LBA Detected (0x6700), USM BAD LBA Repaired (0x6701), and USM Database Full (0x6703) events. Volume ID (16 bytes): Logical Volume WWN LBA (8 bytes): Volume Logical Block Address Device ID (8 bytes): Disk Drive Sector Address Device Sector (8 bytes): Disk Drive Sector Address Tray (4 bytes): Physical Tray Location Slot (4 bytes): Physical Slot Location
SYMbol Tray Number	0x0800	Tray location
Volume Label Update	0x0801	Volume Label Update Descriptor

Name	Data Field Type	Data Description
SYMbol Volume Segment Update	0x0802	Volume Segment Sizing Descriptor
SYMbol Group Ownership Update Descriptor	0x0803	Volume Group Ownership information
SYMbol Hotspare Count	0x0804	Number of Hot Spares (4 bytes)
SYMbol Drive Reference List	0x0805	Drive Reference List
SYMbol Volume Creation Descriptor (Currently not used)	0x0806	
SYMbol Controller Firmware Descriptor	0x0807	Firmware Update Descriptor
SYMbol Drive Firmware Descriptor (Currently not used)	0x0808	
SYMbol Group Expansion Descriptor	0x0809	Volume Group Expansion Descriptor
SYMbol Group Migration Descriptor	0x080A	Volume RAID Migration Descriptor
SYMbol Storage Array Cache Update Descriptor	0x080B	Storage Array Parameter Update Descriptor
SYMbol Storage Array User Label Update	0x080C	Storage Array User Assigned Label
SYMbol Time	0x080D	Controller A Time (8 bytes) Controller B Time (8 bytes)
SYMbol Volume Cache Descriptor	0x080E	Volume Cache Parameters Update Descriptor
SYMbol Volume Parameters Descriptor	0x080F	Volume Parameters Update Descriptor
SYMbol Tray Position List	0x0810	Tray Position List
SYMbol Volume Media Scan Descriptor	0x0811	Volume Media Scan Parameters Update Descriptor
SYMbol Storage Array Media Scan Rate	0x0812	Storage Array Media Scan Rate (4 bytes)
SYMbol Controller Number	0x0813	Controller Number (4 bytes) 0 = This controller 1 = Alternate controller
SYMbol Return Code	0x0814	**RPC Function** (4 bytes) See RPC Function Number table **Return Code** (4 bytes) See SYMbol Return code table
Download checkpoint data	0x0815	Checkpoint data
Battery Component Data	0x0816	**Battery Reset** (4 bytes) 0 – battery reset not requested

Name	Data Field Type	Data Description
		1 – battery reset requested **Component Location** (12 bytes) – A unique id that identifies the component to the controller firmware. Contents are not specified.
Snapshot parameters descriptor	0x0817	Snapshot Parameters Update Descriptor
Ghost WWN	0x0818	World Wide Name of the missing volume (16 bytes)
Mirror Sync Descriptor	0x0819	Mirror Synchronization Descriptor mirror reference (12 bytes) synchronization priority (1 byte)
Mirror Write Mode Descriptor	0x081A	Mirror Write Mode Descriptor
Mirror Auto Resynchronization Descriptor	0x081B	Mirror Auto Resynchronization Descriptor
RVM Array WWN	0x0820	World Wide Name of Remote Array length of world wide name (4 bytes) world wide name
Volume Copy Parameters Descriptor	0x0821	Volume Copy Parameters Descriptor
Consistency Group	0x0822	Consistency Group
Simplex Mode Enabled	0x0823	Simplex Mode Enabled
User Assigned Label	0x0900	
SYMbol Reference Data	0x0901	
SYMbol Reference Pair Data	0x0902	
SYMbol Reference Data with User Assigned Label	0x0903	
Host Port Creation Descriptor	0x0904	
Host Port Rename Descriptor	0x0905	
Host Port Type Update Descriptor	0x0906	
Host Creation Descriptor	0x0907	
LUN Mapping Creation Descriptor	0x0908	
LUN Mapping Update Descriptor	0x0909	
Error Return Code	0x090A	
Runtime Diagnostics Descriptor	0x0A00	Data field Value: 0 – all tests Else - ID of test requested.
Runtime Diagnostics Channel ID	0x0A01	Data is a byte indicating the channel number that failed.
Runtime Diagnostics Channel List	0x0A02	Data is a length and a byte array of the failed channels.

RPC Function Numbers

RPC Function Number		SYMbol Function
1	0x01	discoverControllers_1()
		This function is used to query a SYMbol server for all controllers that it knows about. The responder will also indicate in its response structure whether it is actually a net-attached controller, or is a host-based agent that is returning information about multiple attached controllers.
2	0x02	bindToController_1()
		This function is used to bind a new connection to a particular controller. If the server is actually a controller itself, the controller will just ensure that its CONTROLLER REF is the same as the one passed in as an argument. If the server is an agent, it will use the CONTROLLER REF argument to determine which locally-attached controller should be used for all further interactions over the RPC connection.
3	0x03	assignVolumeGroupOwnership_1()
		Instructs the SYMbol Server's controller to transfer ownership of a volume group and its associated volumes to another controller.
4	0x04	assignDrivesAsHotSpares_1()
		Instructs the SYMbol Server's controller to create a given number of hot spare drives out of the drives currently unassigned.
5	0x05	assignSpecificDrivesAsHotSpares_1()
		Instructs the SYMbol Server's controller to create hot spare drives out of the given drives.
6	0x06	getVolumeCandidates_1()
		Instructs the SYMbol Server's controller to return a list of volume candidates for the specified type of volume creation operation.
7	0x07	createVolume_1()
		Instructs the SYMbol Server's controller to create new volume using the specified parameters.
8	0x08	deassignDrivesAsHotSpares_1()
		Instructs the SYMbol Server's controller to delete a specified hot spare drive. After the deletion has occurred the drive is marked as unassigned.
9	0x09	deleteVolume_1()
		Instructs the SYMbol Server's controller to delete a specified volume from a volume group.
10	0x0A	SetControllerToFailed_1()
		Instructs the SYMbol Server's controller to fail the specified controller. Note that a controller is not allowed to fail itself.

RPC Function Number		SYMbol Function
11	0x0B	setDriveToFailed_1()
		Instructs the SYMbol Server's controller to mark the specified drive as failed.
12	0x0C	startVolumeFormat_1()
		Instructs the SYMbol Server's controller to initiate a format of the specified volume.
13	0x0D	initializeDrive_1()
		Acquaints a newly plugged in drive to a storage array by setting up appropriate structures on the disk.
14	0x0E	loadControllerFirmware_1()
		Downloads a portion of a new firmware image to the SYMbol Server's controller.
15	0x0F	loadControllerNVSRAM_1()
		Downloads an entire NVSRAM image to the SYMbol Server's controller. Note that the FirmwareUpdateDescriptor must contain the ENTIRE image of the NVSRAM; iterative download of multiple segments is not allowed when transferring NVSRAM.
16	0x10	resetMel_1()
		Clear all entries from the Major Events Log.
17	0x11	setVolumeGroupToOffline_1()
		Instructs the SYMbol Server's controller to place a volume group offline. Useful for pluggable volume groups.
18	0x12	setVolumeGroupToOnline_1()
		Returns an offline volume group to online operation.
19	0x13	startDriveReconstruction_1()
		Forces a volume reconstruction using the newly plugged in drive. The parameter is a reference to the new drive.
20	0x14	startVolumeGroupDefrag_1()
		Initiates a volume group defragmentation operation.
21	0x15	startVolumeGroupExpansion_1()
		Initiates a volume group expansion (DCE) operation.
22	0x16	startVolumeRAIDMigration_1()
		Initiates a volume RAID migration (DRM) operation.
23	0x17	startVolumeSegmentSizing_1()
		Initiates a volume segment sizing (DSS) operation.

RPC Function Number		SYMbol Function
24	0x18	setControllerToPassive_1()
		Instructs the SYMbol Server's controller to place the specified controller in passive mode.
25	0x19	setControllerToActive_1()
		Instructs the SYMbol Server's controller to place the specified controller in active mode.
26	0x1A	setSACacheParams_1()
		Instructs the SYMbol Server's controller to propagate a controller cache change to all controllers in the storage array.
27	0x1B	setSAUserLabel_1()
		Instructs the SYMbol Server's controller to change the shared SA name.
28	0x1C	setControllerTime_1()
		Sets the internal clock of the SYMbol Server's controller. The time should be expressed in seconds since midnight (GMT) on 1/1/1970.
29	0x1D	setVolumeCacheParams_1()
		Sets the volume cache properties of a volume indicated in the VolumeCacheParamsUpdate structure.
30	0x1E	setVolumeParams_1()
		Sets various volume parameters. Primarily used to fine tune a volume.
31	0x1F	setVolumeUserLabel_1()
		Sets the user assigned label for the volume specified in the VolumeLabelUpdate structure.
32	0x20	startSAIdentification_1()
		Causes the storage array to physically identify itself. The identification will continue until a stop command is issued. This function does not block.
33	0x21	startDriveIdentification_1()
		Causes the drives specified to physically identify themselves until a stop command is issued. This function does not block.
34	0x22	stopIdentification_1()
		Explicitly stops the physical identification of an SA unit.
35	0x23	SetHostInterfaceParams_1()
		Change the preferred ID used for the specified I/O interface.
36	0x24	setControllerToOptimal_1()
		Instructs the SYMbol Server's controller to attempt to revive the specified controller from the failed state.

RPC Function Number		SYMbol Function
37	0x25	setDriveToOptimal_1()
		Instructs the SYMbol Server's controller to attempt to revive the given drive. Success will be reported via a definition change event on the given drive.
38	0x26	forceVolumeToOptimal_1()
		Instructs the SYMbol Server's controller to attempt to revive the given volume group.
39	0x27	getControllerHostInterfaces_1()
		Obtains the most up-to-date information about the host-side I/O interfaces of the controller that responds to the request.
40	0x28	getObjectGraph_1()
		Gets a bundle of information consisting of all possible entities that comprise a storage array. Normally used by the management app to construct a representation of the storage array.
41	0x29	getVolumeActionProgress_1()
		Gets the completion percentage and the time to completion of a long running volume oriented operation. If no operation is running on the given volume then a -1 will be returned.
42	0x2A	getRecoveryFailureList_1()
		Gets a list of failure objects to assist in recovery. Each entry contains a recovery procedure key that can be used by the client as desired, and a SYMbol reference to the object associated with the failure.
43	0x2B	GetSAInfo_1()
		Gets information pertaining to the general characteristics of the storage array. Normally used simply to check the status and management version of each storage array at start up.
44	0x2C	getVolumePerformanceInfo_1()
		Samples the performance of several volumes and reports on their performance. The Nth VolumePerformance structure in the VolumePerformanceList should correspond to the Nth reference in the VolumeRefList.
45	0x2D	setSATrayPositions_1()
		Used to store the user selectable tray ordering data on the controller.
46	0x2E	setVolumeMediaScanParams_1()
		Sets the media scan parameters for the specified volume.
47	0x2F	setSAMediaScanPeriod_1()
		Sets the media scan period (in days) for the array. Each controller will scan volumes such that a complete scan completes every N days, as specified by the argument passed to this procedure.

RPC Function Number		SYMbol Function
48	0x30	getChangeInfo_1()
		Fetches an indication of the most recent state/configuration changes that occurred on the storage array. This function is used to initiate a (potentially) "hanging" poll for change notifications. The call "hangs", in the sense that the caller gives a maximum wait time. The controller can stall up to the given interval before returning the result to the caller.
49	0x31	clearSAConfiguration_1()
		Clears the entire array configuration, deleting all volumes and returning to a clean initial state. This is a highly destructive and dangerous operation!
50	0x32	autoSAConfiguration_1()
		Tells the controller to automatically configure the Storage Array.
51	0x33	getMelExtent_1()
		Retrieves the beginning and ending sequence numbers in the Mel.
52	0x34	getMelEntries_1()
		Retrieves a list of MelEntries starting with the beginning sequence number and ending with the ending sequence number.
53	0x35	getCriticalMelEntries_1()
		Retrieves a list of MelEntries within the specified extent that have a severity level of CRITICAL.
54	0x36	getControllerNVSRAM_1()
		Reads the specified regions of NVSRAM.
55	0x37	setControllerNVSRAM_1()
		Modifies a portion of the target controller's NVSRAM.
56	0x38	setSAPassword_1()
		Sets a new password value for the array.
57	0x39	pingController_1()
		Verifies that the controller is operating properly.
58	0x3A	startVolumeParityCheck_1()
		Initiates a parity check operation for the specified volume.
59	0x3B	getParityCheckProgress_1()
		Queries for the status of an in-progress parity check operation. The return value is one of the following: An integer in the range 0-100, indicating the percent complete for an operation that is still in progress, or a negative integer indicating either a successfully complete scan or a scan that was stopped because of an error condition.

RPC Function Number		SYMbol Function
60	0x3C	Not Used
61	0x3D	getLUNMappings_1()
		Retrieves the Storage Pools Manager's LUNMappings data which apply to a particular ref.
62	0x3E	createSAPortGroup_1()
		Creates a new SAPortGroup & returns its ref. If a group by that name already exists, returns its ref.
63	0x3F	deleteSAPortGroup_1()
		Removes all SAPorts from an SAPortGroup, and deletes the group.
64	0x40	moveSAPort_1()
		Removes the SA Port 'itemRef' from any SA Port Group that it might be in, & moves it to the group 'containerRef'. If this leaves the previous SAPortGroup empty, the previous SAPortGroup is deleted.
65	0x41	GetSAPort_1()
		Retrieves a storage array port.
66	0x42	CreateHost_1()
		Creates a new Host. If a Host already exists with 'label', returns a ref to it.
67	0x43	createCluster_1()
		Creates a new Host Group. If a Host Group already exists with 'label', returns a ref to it.
68	0x44	deleteCluster_1()
		Removes all Hosts from a Host Group, and deletes the Host Group.
69	0x45	renameCluster_1()
		Modifies a Host Group’s label.
70	0x46	DeleteHost_1()
		Removes all HostPorts from a Host, and deletes the Host. If this leaves the Host Group that the Host was in empty, the Host Group is deleted.
71	0x47	renameHost_1()
		Modifies a Host's label.
72	0x48	moveHost_1()
		Removes the Host 'itemRef' from any Host Group it might be in, & moves it to the Host Group 'containerRef'. If this leaves the previous Host Group empty, the previous Host Group is deleted.

RPC Function Number		SYMbol Function
73	0x49	createHostPort_1()
		Creates a new HostPort with the 'name' & 'label', & returns its ref. If a HostPort already exists with 'name' & 'label', returns its ref.
74	0x4A	deleteHostPort_1()
		Deletes a host port. If this leaves the Host that the HostPort was in empty, the Host is deleted. Then, if deleting the Host leaves the Host Group that the Host was in empty, the Host Group is deleted.
75	0x4B	RenameHostPort_1()
		Modifies a HostPort's name &/or label.
76	0x4C	MoveHostPort_1()
		Removes the HostPort 'itemRef' from any Host it might be in, & moves it to the Host 'containerRef'. If this leaves the previous Host empty, the Host is deleted. Then, if deleting the Host leaves the Host Group that the Host was in empty, the Host Group is deleted.
77	0x4D	CreateLUNMapping_1()
		Creates a LUN mapping.
78	0x4E	deleteLUNMapping_1()
		Deletes a LUN mapping.
79	0x4F	getUnlabedHostPorts_1()
		Get the volatile connections and host ports.
80	0x50	setHostPortType_1()
		Get the possible host port type labels.
81	0x51	moveLUNMapping_1()
		Move a LUN mapping.
82	0x52	enableFeature_1()
		Enable add-on(optional) features
83	0x53	disableFeature_1()
		Disable a single add-on(optional) feature
84	0x54	stateCapture_1()
		Capture diagnostic information
85	0x55	loadDriveFirmware()
		Downloads a portion of a new firmware image to a drive in the SYMbol Server.

RPC Function Number		SYMbol Function
86	0x56	loadESMFirmware()
		Downloads a portion of a new firmware image to an ESM card in the SYMbol Server.
87	0x57	getHostSpecificNVSRAM()
		Reads the Host Type Dependent regions of NVSRAM.
88	0x58	setHostSpecificNVSRAM()
		Modifies the Host Type Dependent regions of the target controller's NVSRAM.
89	0x59	setBatteryParams()
		Sets the battery properties for the given battery.
90	0x5A	assignVolumeOwnership()
		Instructs the SYMbol Server's controller to transfer ownership of a volume to another controller.
91	0x5B	IssueRuntimeDiagnostics()
		Issues Runtime Diagnostics.
92	0x5C	resetController()
		Requests a reboot of the given controller.
93	0x5D	quiesceController()
		Issues a quiesce command to the given controller.
94	0x5E	unquiesceController()
		Removes the given controller from a quiesced state.
95	0x5F	startVolumeExpansion()
		Initiates a Volume Expansion (DVE or DCE/DVE) operation.
96	0x60	createSnapshot()
		Creates a snapshot volume of a given base.
97	0x61	disableSnapshot()
		Disables (stops) a snapshot.
98	0x62	recreateSnapshot()
		Recreates (restarts) a snapshot.
99	0x63	setSnapshotParams()
		Modifies the parameters of a snapshot.
100	0x64	getRepositoryUtilization()
		Returns repository-utilization information for selected snapshots.

RPC Function Number		SYMbol Function
101	0x65	calculateDVECapacity()
		Calculates the volume's maximum capacity after a DVE operation.
102	0x66	getReadLinkStatus()
		Gets the Read Link Status information.
103	0x67	setRLSBaseline()
		Sets the Read Link Status baseline information.
104	0x68	getMetadataVolumeCapacity()
		Returns the amount of storage required for a metadata volume.
105	0x69	createMetadataVolume()
		Create a metadata volume.
106	0x6A	activateMirroring()
		Activate remote mirroring.
107	0x6B	deactivateMirroring()
		Deactivate remote mirroring.
108	0x6C	changeSynchronizationPriority()
		Change synchronization priority.
109	0x6D	getVolumeListForMirroring()
		Get a valid volume list for mirroring from the remote array.
110	0x6E	createMirror()
		Create a mirror.
111	0x6F	roleChange()
		Change a mirror's role.
112	0x70	removeMirror()
		Delete a mirror.
113	0x71	startSyncMirror()
		Start the synchronization process on a mirror.
114	0x72	startChannelIdentification()
		Identify all drive trays that are on a given loop (channel).
115	0x73	startTrayIdentification()
		Flash lights on tray so the user can locate the tray.

RPC Function Number		SYMbol Function
116	0x74	getDacstoreIncompatibleVolumes()
		Get a list of volumes encroaching the requested dacstore area. The argument represents the size of a dacsctore in bytes.
117	0x75	getControllerTime()
		Gets the internal clock time from the controllers. The time is expressed in seconds since midnight (GMT) on 1/1/1970.
118	0x76	establishVolumeCopy(VolumeCopyRef)
		Creates a volume copy.
119	0x77	removeVolumeCopy(VolumeCopyRef)
		Removes a volume copy.
120	0x78	setVolumeCopyParams(VolumeCopyParamsUpdateDescriptor)
		Modifies the parameters of a volume copy.
121	0x79	startVolumeCopy(VolumeCopyRef)
		Starts the copy operation.
122	0x7A	stopVolumeCopy(VolumeCopyRef)
		Stops the copy operation.
123	0x7B	getVolumeCopyTargetCandidates(AbstractVolRef)
		Returns a list of target candidates for creating a volume copy.
124	0x7C	getVolumeCopySourceCandidates(void)
		Returns a list of source candidates for creating a volume copy.
125	0x7D	setNetworkParameters(EthernetParamsUpdateDescriptor)
		Set network parameters on the specified controller.
126	0x7E	setRloginCapability(RloginUpdateDescriptor)
		Set remote login permission on the specified controller.
127	0x7F	setVolXferAlertDelayPeriod(unsigned int)
		Set the volume transfer alert notification delay period.
128	0x80	getPersistentRegistrations(void)
		Get the list of persistent registrations on the array.
129	0x81	getPersistent RegistrationsForVolume(AbstractVolRef)
		Get the persistent registrations for the specified volume. The list will contain no more than one PersistentRegistration element.
130	0x82	clearPersistentRegistrations(AbstractVolRefList)
		Clear the specified persistent registrations.
131	0x83	change MirrorWriteMode(MirrorWriteModeDescriptor)
		Change mirror write mode.

RPC Function Number		SYMbol Function
132	0x84	suspendMirror(MirrorProxyRef)
		Suspend communication between a mirror pair.
133	0x85	resumeMirror(MirrorProxyRef)
		Resume communication between a mirror pair.
134	0x86	setAutoResync(MirrorAutoResyncDescriptor)
		Setting the allowable option for auto resync.
135	0x87	activateStagedControllerFirmware(void)
		Activate staged controller firmware.
136	0x88	invalidateStagedControllerFirmware(void)
		Invalidate staged controller firmware.
137	0x89	getDriveLogData(DriveRef)
		Get a drive's log sense pages.
138	0x8A	getAutoConfigCandidates(AutoConfigTemplateList)
		Get automatic configuration candidates.
139	0x8B	createAutoConfig(AutoConfigCandidateList)
		Create automatic configuration.
140	0x8C	autoAssignHotSpares(void)
		Automatically assign hot spares.
141	0x8D	getHotSpareCoverage(void)
		Returns a list of all hot spare drives and the volume groups they cover.
142	0x8E	getHotSpareCandidates(PhysicalDriveType)
		Returns a list of hot spare candidates (unassigned drives) and the volume groups they potentially cover.
143	0x8F	readUnreadableSectorDatabase(void)
		Returns a list of the known unreadable sectors for the system.
144	0x90	clearUnreadableSectors(AbstractVolRef)
		Clears all the unreadable sectors for the given volume.
145	0x91	communicationCheck(RemoteCommunicationCheckDescriptor)
		Sends an RVM communication check command.
146	0x92	startDriveFirmwareDownload(DriveFirmwareDownload)
		Start the parallel drive firmware download process.
147	0x93	sendDriveFirmware(DriveFirmwareChunkDescriptor)
		Send chunks for the parallel drive firmware download process.

RPC Function Number		SYMbol Function
148	0x94	updateDriveFirmware(void)
		Begin drive download stage of parallel drive firmware download.
149	0x95	stopDriveFirmwareDownload(void)
		Stop parallel drive firmware download process.
150	0x96	getDriveFirmwareDownloadProgress(void)
		Get parallel drive firmware download process progress.
151	0x97	recoverVolume(RecoverVolumeDescriptor)
		Recover Volume (recreate volume without initialization).
152	0x98	setDriveChannelState(DriveChannelStateDescriptor)
		Set drive channel state to either degraded or optimal.
153	0x99	getDriveChannelStatistics(void)
		Get cumulative information about all drive channels.
154	0x9A	clearDriveChannelStatistics(void)
		Clear the drive channel cumulative statistical information.
155	0x9B	suspendConsistencyGroup(ConsistencyGroupRef)
		Suspend communication for all mirrors in a Write Consistency group with specified group number.
156	0x9C	resumeConsistencyGroup(ConsistencyGroupRef)
		Resume communication for all mirrors in a Write Consistency group with specified group number.

SYMbol Return Codes

Return Code		Definition/ SYMsm Description
0	0x00	RETCODE_UNINITIALIZED Value when an object has not been initialized
1	0x01	RETCODE_OK The operation completed successfully.
2	0x02	RETCODE_ERROR The operation cannot complete because either (1) the current state of a component does not allow the operation to be completed, (2) the operation has been disabled in NVSRAM (example, you are modifying media scan parameters when that option (offset 0x31, bit 5) is disabled), or (3) there is a problem with the storage array. Please check your storage array and its various components for possible problems and then retry the operation.
3	0x03	RETCODE_BUSY The operation cannot complete because a controller resource is being used by another process. If there are other array management operations in progress, wait for them to complete, and then retry the operation. If this message persists, turn the power to the controller tray off and then on.
4	0x04	RETCODE_ILLEGAL_PARAM The operation cannot complete because of an incorrect parameter in the command sent to the controller. Please retry the operation. If this message persists, contact your Technical Support Representative.
5	0x05	RETCODE_NO_HEAP An out of memory error occurred on one of the controllers in the storage array. Contact your Technical Support Representative about the memory requirements for this storage array.
6	0x06	RETCODE_DRIVE_NOT_EXIST The operation cannot complete because one or more specified drives do not exist. Please specify only drives currently installed in the Storage Array and then retry the operation.
7	0x07	RETCODE_DRIVE_NOT_UNASSIGNED The operation cannot complete because one or more specified drives do not have an unassigned status. Please specify only drives with an unassigned status and then retry the operation.
8	0x08	RETCODE_NO_SPARES_ASSIGNED None of the selected drives were assigned as hot spares. Possible causes include (1) the maximum number of hot spares have already been assigned or (2) the selected drives have capacities that are smaller than all other drives in the Storage Array. If you suspect the second cause, please use the Drive>>Properties option in the Array Management Window to obtain the selected drives' capacity.

Return Code		Definition/ SYMsm Description
9	0x09	RETCODE_SOME_SPARES_ASSIGNED Some but not all of the selected drives were assigned as hot spares. Check the Physical View in the Array Management Window to determine which drives were assigned. Possible causes include (1) the maximum number of hot spares have been assigned or (2) some of the selected drives have capacities that are smaller than all other drives in the Storage Array. If you suspect the second cause, please use the Drive>>Properties option in the Array Management Window to obtain the selected drives' capacity.
10	0x0A	RETCODE_VOLUME_NOT_EXIST The specified volume does not exist. The volume may have been deleted by a user on another management station accessing this Storage Array.
11	0x0B	RETCODE_VOLUME_RECONFIGURING The operation cannot complete because a volume is performing a modification operation. Please wait until the modification completes and then retry the operation. Use the Volume>>Properties option in the Array Management Window to check the progress.
12	0x0C	RETCODE_NOT_DUAL_ACTIVE The operation cannot complete because the controllers in the storage array must be Online.
13	0x0D	RETCODE_TRY_ALTERNATE This operation must be performed by the alternate controller.
14	0x0E	RETCODE_BACKGROUND An operation is running in the background.
15	0x0F	RETCODE_NOT_IMPLEMENTED This option is currently not implemented.
16	0x10	RETCODE_RESERVATION_CONFLICT The operation cannot complete because an application has reserved the selected volume. Please wait until the volume has been released and then retry the operation.
17	0x11	RETCODE_VOLUME_DEAD The operation cannot complete because either the volume remains failed or has transitioned to failed. Please use the Recovery Guru in the Array Management Window to resolve the problem.
18	0x12	RETCODE_INTERNAL_ERROR The operation cannot complete because of an internal target error. Please retry the operation. If this message persists, contact your Technical Support Representative.
19	0x13	RETCODE_INVALID_REQUEST The operation cannot complete because of a general configuration request error. Please retry the operation. If this message persists, contact your Technical Support Representative.

Return Code		Definition/ SYMsm Description
20	0x14	RETCODE_ICON_FAILURE The operation cannot complete because there is a communications failure between the controllers. Please turn the power to the controller tray off and then on and then retry the operation. If this message persists, contact your Technical Support Representative.
21	0x15	RETCODE_VOLUME_FORMATTING The operation cannot complete because a volume initialization is in progress. Please wait until the initialization completes and then retry the operation. Use the Volume>>Properties option in the Array Management Window to check the progress.
22	0x16	RETCODE_ALT_REMOVED The operation cannot complete because the other controller is not present. Please insert the other controller and retry the operation.
23	0x17	RETCODE_CACHE_SYNC_FAILURE The operation cannot complete because the cache between the controllers could not be synchronized. This normally occurs if the controller's alternate pair has not completed its start-of-day routine. Please wait at least two minutes and then retry the operation. If this message persists, contact your Technical Support Representative.
24	0x18	RETCODE_INVALID_FILE The download cannot complete because a file is not valid. Replace the file and retry the operation.
25	0x19	RETCODE_RECONFIG_SMALL_DACSTORE The modification operation cannot complete because the controller configuration area (DACStore) is too small. Contact your Technical Support Representative.
26	0x1A	RETCODE_RECONFIG_FAILURE The modification operation cannot complete because of the number of drives in the volume group and the segment size of the associated volumes. Reduce the segment size of all volumes in the volume group to 128 KB or below using the Volume>>Change>>Segment Size option. Then, retry the operation. If this message persists, contact your Technical Support Representative.
27	0x1B	RETCODE_NVRAM_ERROR Unable to read or write NVSRAM.
28	0x1C	RETCODE_FLASH_ERROR There was a failure in transferring the firmware to flash memory during a download operation. Please retry the operation.
29	0x1D	RETCODE_AUTH_FAIL_PARAM This operation cannot complete because there was a security authentication failure on a parameter in the command sent to the controller. Please retry the operation. If this message persists, contact your Technical Support Representative.
30	0x1E	RETCODE_AUTH_FAIL_PASSWORD The operation cannot complete because you did not provide a valid password.
31	0x1F	RETCODE_MEM_PARITY_ERROR There is a memory parity error on the controller.

Return Code		Definition/ SYMsm Description
32	0x20	RETCODE_INVALID_CONTROLLERREF The operation cannot complete because the controller specified in the request is not valid (unknown controller reference).
33	0x21	RETCODE_INVALID_VOLUMEGROUPREF The operation cannot complete because the volume group specified in the request is not valid (unknown volume group reference). The volume group may have been deleted or modified by a user on another management station accessing this Storage Array.
34	0x22	RETCODE_INVALID_VOLUMEREF The operation cannot complete because the volume specified in the request is not valid (unknown volume reference). The volume may have been deleted or modified by a user on another management station accessing this Storage Array.
35	0x23	RETCODE_INVALID_DRIVEREF The operation cannot complete because the drive specified in the request is not valid (unknown drive reference). The drive may have been used or modified by a user on another management station accessing this Storage Array.
36	0x24	RETCODE_INVALID_FREEEXTENTREF The operation cannot complete because the free capacity specified in the request is not valid (unknown free capacity reference). The free capacity may have been used or modified by a user on another management station accessing this Storage Array.
37	0x25	RETCODE_VOLUME_OFFLINE The operation cannot complete because the volume group is offline. Please place the volume group online by using the Advanced>>Maintenance>>Place Volume Group>>Online option in the Array Management Window.
38	0x26	RETCODE_VOLUME_NOT_OPTIMAL The operation cannot complete because some volumes are not optimal. Please correct the problem causing the non-optimal volumes using the Recovery Guru and then retry the operation.
39	0x27	RETCODE_MODESENSE_ERROR The operation cannot complete because state information could not be retrieved from one or more controllers in the Storage Array.
40	0x28	RETCODE_INVALID_SEGMENTSIZE The operation cannot complete for one of the following reasons: (1) The requested segment size is not valid, (2) The requested segment size is not allowed because it is more than twice or less than half the current segment size, or (3) The requested segment size is not allowed because this volume has an odd number of segments. If case (3) applies, you may only decrease the segment size for this volume to a smaller number.
41	0x29	RETCODE_INVALID_CACHEBLKSIZE The operation cannot complete because the cache block size requested is not valid.
42	0x2A	RETCODE_INVALID_FLUSH_THRESHOLD The operation cannot complete because the start cache flush value requested is not valid.

Return Code		Definition/ SYMsm Description
43	0x2B	RETCODE_INVALID_FLUSH_AMOUNT The operation cannot complete because the stop cache flush value requested is not valid.
44	0x2C	RETCODE_INVALID_LABEL The name you have provided cannot be used. The most likely cause is that the name is already used by another volume. Please provide another name.
45	0x2D	RETCODE_INVALID_CACHE_MODIFIER The operation cannot complete because the cache flush modifier requested is not valid.
46	0x2E	RETCODE_INVALID_READAHEAD The operation cannot complete because the cache read ahead requested is not valid.
47	0x2F	RETCODE_INVALID_RECONPRIORITY The operation cannot complete because the modification priority requested is not valid.
48	0x30	RETCODE_INVALID_SCANPERIOD The operation cannot complete because the media scan duration requested is not valid.
49	0x31	RETCODE_INVALID_TRAYPOS_LENGTH The number of trays requested has exceeded the maximum value.
50	0x32	RETCODE_INVALID_REGIONID The operation cannot complete because the requested NVSRAM region is not valid.
51	0x33	RETCODE_INVALID_FIBREID The operation cannot complete because the preferred loop ID requested is not valid. Please specify an ID between 0 and 127.
52	0x34	RETCODE_INVALID_ENCRYPTION The operation cannot complete because the encryption routine requested is not valid.
53	0x35	RETCODE_INVALID_RAIDLEVEL The operation cannot complete because of the current RAID level of the volume group. Remember that some operations cannot be performed on certain RAID levels because of redundancy or drive requirements.
54	0x36	RETCODE_INVALID_EXPANSION_LIST The operation cannot complete because the number of drives selected is not valid.
55	0x37	RETCODE_NO_SPARES_DEASSIGNED No hot spare drives were deassigned. Possible causes include (1) the drives are not hot spares, (2) the hot spares are removed, (3) the hot spares are failed, or (4) the hot spares are integrated into a volume group. Check these possible causes and then retry the operation.

Return Code		Definition/ SYMsm Description
56	0x38	RETCODE_SOME_SPARES_DEASSIGNED Not all of the requested hot spare drives were deassigned. Possible causes include (1) the drives are not hot spares, (2) the hot spares are removed, (3) the hot spares are failed, or (4) the hot spares are integrated into a volume group. Check these possible causes and then retry the operation.
57	0x39	RETCODE_PART_DUP_ID The operation cannot complete because the identifier or name you provided already exists. Please provide another identifier or name and then retry the operation.
58	0x3A	RETCODE_PART_LABEL_INVALID The operation cannot complete because the name you provided is not valid. Please provide a non-blank name and then retry the operation.
59	0x3B	RETCODE_PART_NODE_NONEXISTENT The operation cannot complete because the host group, host, or host port you have selected no longer exists. The object may have been deleted or modified by a user on another management station accessing this Storage Array. Please close and re-open the dialog box to refresh the information.
60	0x3C	RETCODE_PART_PORT_ID_INVALID The creation of the host port cannot complete because the host port identifier is not valid. Either the identifier is empty or has characters other than 0-9 and A-F. Please enter a valid host port identifier and then retry the operation.
61	0x3D	RETCODE_PART_VOLUME_NONEXISTENT The creation of a new volume-to-LUN mapping cannot complete because the volume you have selected no longer exists. The volume may have been deleted or modified by a user on another management station accessing this Storage Array. Please close and open the dialog box to refresh the information.
62	0x3E	RETCODE_PART_LUN_COLLISION The operation cannot complete because the logical unit number (LUN) is already in use. Please enter another LUN.
63	0x3F	RETCODE_PART_VOL_MAPPING_EXISTS The operation cannot complete because the volume you have selected already has a volume-to-LUN mapping. The mapping may have defined by a user on another management station accessing this Storage Array. Please close and re-open the dialog box to refresh the information.
64	0x40	RETCODE_PART_MAPPING_NONEXISTENT The operation cannot complete because the volume-to-LUN mapping you have selected no longer exists. The mapping may have been deleted by a user on another management station accessing this Storage Array. Please close and re-open the dialog box to refresh the information.
65	0x41	RETCODE_PART_NO_HOSTPORTS The operation cannot complete because the host group or host has no host ports. Please define a host port for the host group or host and then retry the operation.
66	0x42	RETCODE_IMAGE_TRANSFERRED The image was successfully transferred.

Return Code		Definition/ SYMsm Description
67	0x43	RETCODE_FILE_TOO_LARGE The download cannot complete because a file is not valid. Replace the file and retry the operation.
68	0x44	RETCODE_INVALID_OFFSET A problem has occurred during the download. Please retry the operation.
69	0x45	RETCODE_OVERRUN The download cannot complete because a file is not valid. Replace the file and retry the operation.
70	0x46	RETCODE_INVALID_CHUNKSIZE A problem has occurred during the download. Please retry the operation.
71	0x47	RETCODE_INVALID_TOTALSIZE The download cannot complete because a file is not valid. Replace the file and retry the operation.
72	0x48	RETCODE_DOWNLOAD_NOT_PERMITTED Unable to perform the requested download because the NVSRAM option to support this download type is disabled. Contact your Technical Support Representative.
73	0x49	RETCODE_SPAWN_ERROR A resource allocation error (unable to spawn a task) occurred on one of the controllers in the Storage Array.
74	0x4A	RETCODE_VOLTRANSFER_ERROR The operation cannot complete because the controller was unable to transfer the volumes to its alternate controller. Please check the alternate controller for problems and then retry the operation.
75	0x4B	RETCODE_INVALID_DLSTATE The operation cannot complete because the controller pair is in Service mode. Please set the status of the controller in Service mode to Online and then retry the operation.
76	0x4C	RETCODE_CACHECONFIG_ERROR The operation cannot complete because of an incorrect controller configuration. Possible causes include (1) the controller pair is in an Active/Passive mode, or (2) controller cache synchronization failed. Please use the Controller>>Change Mode option in the Array Management Window to change the passive controller to active and then retry the operation. If this message persists, contact your Technical Support Representative.
77	0x4D	RETCODE_DOWNLOAD_IN_PROGRESS The operation cannot complete because a download is already in progress. Please wait for the download to complete and, if necessary, retry the operation.
78	0x4E	RETCODE_DRIVE_NOT_OPTIMAL The operation cannot complete because a drive in the volume group is not optimal. Please correct the problem causing the non-optimal drive using the Recovery Guru and then retry the operation.

Return Code		Definition/ SYMsm Description
79	0x4F	RETCODE_DRIVE_REMOVED The operation cannot complete because a drive in the volume group is removed. Please insert a drive and then retry the operation.
80	0x50	RETCODE_DUPLICATE_DRIVES The operation cannot complete because the selected drive is already part of the volume group. Please select another drive and retry the operation.
81	0x51	RETCODE_NUMDRIVES_ADDITIONAL The operation cannot complete because the number of drives selected exceeds the maximum additional drives allowed. Please select a smaller number of drives and then retry the operation.
82	0x52	RETCODE_NUMDRIVES_GROUP The operation cannot complete because either (1) the number of drives selected is not valid for the RAID level of the volume group or (2) the number of drives in the volume group is not valid for the proposed RAID level.
83	0x53	RETCODE_DRIVE_TOO_SMALL The operation cannot complete because at least one of the drives selected has a capacity that is not large enough to hold the existing data of the volume group. Please select another drive and retry the operation.
84	0x54	RETCODE_CAPACITY_CONSTRAINED The operation cannot complete because there is no free capacity or not enough free capacity on the volume group to accommodate the new RAID level.
85	0x55	RETCODE_MAX_VOLUMES_EXCEEDED The operation cannot complete because the maximum number of volumes for this Storage Array has been reached.
86	0x56	RETCODE_PART_IS_UTM_LUN The operation cannot complete because the logical unit number (LUN) is already in use by the Access Volume. Please select another LUN.
87	0x57	RETCODE_SOME_SPARES_TOO_SMALL One or more drives were assigned as hot spares. However, some of the drives do not have a capacity large enough to cover all of the drives in the Storage Array. If a drive fails that has a capacity larger than these hot spares drive(s), it will not be covered by these drives. Check the capacity of the newly-assigned hot spare drives by using the Drive>>Properties option in the Array Management Window. You may want to deassign the smaller hot spare drives.
88	0x58	RETCODE_SPARES_SMALL_UNASSIGNED Not all of the drives that you attempted to assign as hot spares were assigned. In addition, one or more drives that were assigned as hot spares do not have a capacity large enough to cover all of the drives in the Storage Array. If a drive fails that has a capacity larger than these hot spares drive(s), it will not be covered by these drives. Check the capacity of the newly-assigned hot spare drives by using the Drive>>Properties option in the Array Management Window. You may want to deassign the smaller hot spare drives.

Return Code		Definition/ SYMsm Description
89	0x59	RETCODE_TOO_MANY_PARTITIONS Cannot create or change a volume-to-LUN mapping because either you have not enabled the Storage Partitioning feature or the Storage Array has reached its maximum number of allowable partitions. Storage Partitioning is a Premium Feature that must be specifically enabled through the user interface. Use the Storage Array>>Premium Features option to enable the feature. If you have not previously obtained a Feature Key File for Storage Partitioning, contact your storage supplier.
90	0x5A	RETCODE_PARITY_SCAN_IN_PROGRESS A redundancy check is already in progress. Either a redundancy check is currently being performed or it was cancelled but the time-out period (1 to 2 minutes) has not been reached. Please wait until the check has completed or timed out and then retry the operation.
91	0x5B	RETCODE_INVALID_SAFE_ID The Feature Enable Identifier contained in the Feature Key File you have selected does not match the identifier for this Storage Array. Please select another Feature Key File or obtain a Feature Key File using the correct identifier. You can determine the Feature Enable Identifier for this Storage Array by selecting the Storage Array>>Premimum Feature>>List option.
92	0x5C	RETCODE_INVALID_SAFE_KEY The Feature Key File you have selected is not valid. The security (digest) information contained in the file does not match what was expected from the controller. Please contact your Technical Support Representative.
93	0x5D	RETCODE_INVALID_SAFE_CAPABILITY The Premium Feature you are attempting to enable with this Feature Key File is not supported on the current configuration of this Storage Array. Please determine the configuration (such as appropriate level of firmware and hardware) necessary to support this feature. Contact your Technical Support Representative if necessary.
94	0x5E	RETCODE_INVALID_SAFE_VERSION The Feature Key File you have selected is not valid. The version information contained in the file does not match what was expected from the controller. Please contact your Technical Support Representative.
95	0x5F	RETCODE_PARTITIONS_DISABLED Cannot create an unmapped volume, since storage partitions are disabled.
96	0x60	RETCODE_DRIVE_DOWNLOAD_FAILED A firmware download to a drive failed.
97	0x61	RETCODE_ESM_DOWNLOAD_FAILED A firmware download to an ESM failed. If your storage array is not optimal, please correct any problems using the Recovery Guru in the Array Management Window and then retry the download operation.
98	0x62	RETCODE_ESM_PARTIAL_UPDATE The firmware versions on the ESM cards do not match. Please retry the download operation.

Return Code		Definition/ SYMsm Description
99	0x63	RETCODE_UTM_CONFLICT The operation could not complete because the NVSRAM offset 0x32 is attempting to enable a logical unit number (LUN) for an access volume that conflicts with a LUN for a volume that already exists on the Storage Array. If you are downloading a new NVSRAM file, you will need to obtain a new file with the offset set to a LUN that does not conflict. If you are setting this NVSRAM offset using the Script Editor "set controller nvsramByte" command, you must choose a different LUN that does not conflict.
100	0x64	RETCODE_NO_VOLUMES A volume must exist to perform the operation.
101	0x65	RETCODE_AUTO_FAIL_READPASSWORD The operation cannot complete because either there is a problem communicating with any of the drives in the Storage Array or there are currently no drives connected. Please correct the problem and then retry the operation.
102	0x66	RETCODE_PART_CRTE_FAIL_TBL_FULL The operation cannot complete because the maximum number of host-groups, hosts, and host-ports have been created for this Storage Array.
103	0x67	RETCODE_ATTEMPT_TO_SET_LOCAL The operation cannot complete because you are attempting to modify host-dependent values for region ID 0xF1. You must change host-dependent values in one of the host index areas.
104	0x68	RETCODE_INVALID_HOST_TYPE_INDEX The operation cannot complete because the host index must be between 0 and 15.
105	0x69	RETCODE_FAIL_VOLUME_VISIBLE The operation cannot complete because the volume you are trying to map is already accessible by a host group or host in this partition.
106	0x6A	RETCODE_NO_DELETE_UTM_IN_USE The operation cannot complete because you are attempting to delete the access volume-to-LUN mapping that you are currently using to communicate with this Storage Array.
107	0x6B	RETCODE_INVALID_LUN The operation cannot complete because the logical unit number (LUN) is not valid.
108	0x6C	RETCODE_UTM_TOO_MANY_MAPS The operation cannot complete because the logical unit number you are attempting to map to this access volume is outside the allowable range. Please select one of the logical unit numbers (LUN) that have already been mapped to one of the other access volumes.
109	0x6D	RETCODE_DIAG_READ_FAILURE Diagnostics Read test failed. The controller has been placed offline. Use the Recovery Guru to replace the faulty controller. For information on read test failures, refer to online Help.

Return Code		Definition/ SYMsm Description
110	0x6E	RETCODE_DIAG_SRC_LINK_DOWN The Diagnostics passed, but I/Os were performed internally because the test was unable to communicate on the host/source links. For information on host/source link communication errors, refer to online Help.
111	0x6F	RETCODE_DIAG_WRITE_FAILURE Diagnostics Write test failed. The controller has been placed offline. Use the Recovery Guru to replace the faulty controller. For information on write test failures, refer to online Help.
112	0x70	RETCODE_DIAG_LOOPBACK_ERROR The Diagnostics passed, but the loopback test identified an error on one or more of the loops. For information on loop errors, refer to online Help.
113	0x71	RETCODE_DIAG_TIMEOUT The diagnostics operation failed because the controller did not respond within the allotted time. The controller has been placed offline. Use the Recovery Guru to recover from the offline controller.
114	0x72	RETCODE_DIAG_IN_PROGRESS The diagnostics request failed because an internal controller or user initiated diagnostics is already in progress.
115	0x73	RETCODE_DIAG_NO_ALT The diagnostics request failed because the operation requires two Online controllers.
116	0x74	RETCODE_DIAG_ICON_SEND_ERR The diagnostics failed because of an ICON communication error between controllers.
117	0x75	RETCODE_DIAG_INIT_ERR The diagnostics request failed because of an internal initialization error.
118	0x76	RETCODE_DIAG_MODE_ERR Diagnostics cannot run because both controllers are not in Online mode.
119	0x77	RETCODE_DIAG_INVALID_TEST_ID The diagnostics request failed because the controller does not support one or more selected diagnostic tests.
120	0x78	RETCODE_DIAG_DRIVE_ERR The diagnostics request failed because the controller was unable to obtain the location (drive number) of the diagnostics data repository.
121	0x79	RETCODE_DIAG_LOCK_ERR The diagnostics request failed because the controller was unable to obtain a mode select lock.
122	0x7A	RETCODE_DIAG_CONFIG_ERR The diagnostics request failed because a diagnostic volume cannot be created.
123	0x7B	RETCODE_DIAG_NO_CACHE_MEM The diagnostics request failed because there was not enough memory available to run the operation.

Return Code		Definition/ SYMsm Description
124	0x7C	RETCODE_DIAG_NOT_QUIESCED The diagnostics request failed because the operation cannot disable data transfer.
125	0x7D	RETCODE_DIAG_UTM_NOT_ENABLED The diagnostics request failed because an Access Volume is not defined.
126	0x7E	RETCODE_INVALID_MODE_SWITCH The controller mode switch to passive failed because the controller has Auto-Volume Transfer mode enabled. For more information about AVT, see "Learn about Auto-Volume Transfer and Multi-Path Drivers" in the Learn More section of the online help.
127	0x7F	RETCODE_INVALID_PORTNAME The operation cannot complete because the I/O interface specified in the request is not valid (unknown port name).
128	0x80	RETCODE_DUPLICATE_VOL_MAPPING The operation cannot complete because the volume-to-LUN mapping has already been assigned to this storage partition (host group or host). A storage partition cannot have duplicate volume-to-LUN mappings.
129	0x81	RETCODE_MAX_SNAPS_PER_BASE_EXCEEDED The operation cannot complete because the maximum number of snapshot volumes have been created for this base volume.
130	0x82	RETCODE_MAX_SNAPS_EXCEEDED The operation cannot complete because the maximum number of snapshot volumes have been created for this Storage Array.
131	0x83	RETCODE_INVALID_BASEVOL The operation cannot complete because of one of the following reasons: (1) you attempted to create a snapshot volume from a snapshot repository volume, another snapshot volume, a mirror repository volume, a secondary volume in a Remote Volume Mirror pair, or a target volume in a Volume Copy pair. (2) the base volume contains unreadable sectors. Check the Recovery Guru for an unreadable sectors problem and follow the recommended procedure.
132	0x84	RETCODE_SNAP_NOT_AVAILABLE The operation cannot complete because the snapshot volume's associated base volume or repository volume is missing.
133	0x85	RETCODE_NOT_DISABLED The re-create operation cannot complete because the snapshot volume must be in the disabled state.
134	0x86	RETCODE_SNAPSHOT_FEATURE_DISABLED The operation cannot complete because the Snapshot Volume Premium Feature is disabled or unauthorized.
135	0x87	RETCODE_REPOSITORY_OFFLINE The operation cannot complete because the snapshot volume's associated repository volume is in an offline state.

Return Code		Definition/ SYMsm Description
136	0x88	RETCODE_REPOSITORY_RECONFIGURING The delete operation cannot complete because the snapshot volume's associated repository volume is currently performing a modification operation. Please wait until the modification completes and then retry the operation. Use the Volume>>Properties option in the Array Management Window to check the progress.
137	0x89	RETCODE_ROLLBACK_IN_PROGRESS The delete operation cannot complete because there is a rollback operation in progress.
138	0x8A	RETCODE_NUM_VOLUMES_GROUP The operation cannot complete because the maximum number of volumes has been created on this volume group.
139	0x8B	RETCODE_GHOST_VOLUME The operation cannot complete because the volume on which you are attempting to perform the operation is missing. The only action that can be performed on a missing volume is deletion.
140	0x8C	RETCODE_REPOSITORY_MISSING The delete operation cannot complete because the snapshot volume's associated repository volume is missing.
141	0x8D	RETCODE_INVALID_REPOSITORY_LABEL The operation cannot complete because the name you provided for the snapshot repository volume already exists. Please provide another name and then retry the operation.
142	0x8E	RETCODE_INVALID_SNAP_LABEL The operation cannot complete because the name you provided for the snapshot volume already exists. Please provide another name and then retry the operation.
143	0x8F	RETCODE_INVALID_ROLLBACK_PRIORITY The operation cannot complete because the rollback priority you specified is not between 0 and 4. Please specify a value in this range and then retry the operation.
144	0x90	RETCODE_INVALID_WARN_THRESHOLD The operation cannot complete because the warning threshold you specified is not between 0 and 100. Please specify a value in this range and then retry the operation.
145	0x91	RETCODE_CANNOT_MAP_VOLUME The operation cannot complete because the volume you specified is a snapshot repository volume. You cannot map a logical unit number (LUN) or host to a snapshot repository volume.
146	0x92	RETCODE_CANNOT_FORMAT_VOLUME The initialization operation cannot complete because the volume you specified is either a snapshot volume, a standard volume that has associated snapshot volumes, a repository volume (snapshot or mirror), a mirror volume (primary or secondary), a read-only target volume, or a volume that is a source or a target in a copy operation that is currently Pending, In Progress, or Failed. You cannot initialize these types of volumes.

Return Code		Definition/ SYMsm Description
147	0x93	RETCODE_DST_NOT_FIBRE The operation cannot complete because the drive-side interface is SCSI not Fibre Channel.
148	0x94	RETCODE_REPOSITORY_TOO_SMALL The operation cannot complete because the capacity you specified for the snapshot repository volume is less than the minimum size required.
149	0x95	RETCODE_RESPOSITORY_FAILED The operation cannot complete because the snapshot repository volume is failed. Please use the Recovery Guru in the Array Management Window to resolve the problem.
150	0x96	RETCODE_BASE_VOLUME_FAILED The operation cannot complete because the base volume associated with this snapshot failed. Please use the Recovery Guru in the Array Management Window to resolve the problem.
151	0x97	RETCODE_BASE_VOLUME_OFFLINE The operation cannot complete because the base volume associated with this snapshot is offline. Please use the Recovery Guru in the Array Management Window to resolve the problem.
152	0x98	RETCODE_BASE_VOLUME_FORMATTING The create snapshot operation cannot complete because a base volume initialization is in progress. Please wait until the initialization completes and then retry the operation. Use the Volume>>Properties option in the Array Management Window to check the progress.
153	0x99	RETCODE_METADATA_VOL_NONEXISTENT The operation cannot complete because the command to create the mirror repository volumes was unsuccessful. Please retry the operation.
154	0x9A	RETCODE_RVM_FEATURE_DISABLED The operation cannot complete because the RVM feature is disabled.
155	0x9B	RETCODE_MIRRORS_PRESENT The operation cannot complete because there are mirrors (Primary or Secondary) present on the array.
156	0x9C	RETCODE_RVM_FEATURE_DEACTIVATED The operation cannot complete because the RVM feature has not been activated.
157	0x9D	RETCODE_MAX_MIRRORS_EXCEEDED The operation cannot complete because the maximum number of mirror volumes have been created on the local storage array.
158	0x9E	RETCODE_INVALID_MIRROR_CANDIDATE_VOL The operation cannot complete because the base volume for a potential Mirror was invalid.
159	0x9F	RETCODE_INVALID_MIRRORVOL The operation cannot complete because the selected volume is not a mirror volume.

Return Code		Definition/ SYMsm Description
160	0xA0	RETCODE_METADATA_ALREADY_EXISTS The operation cannot complete because Mirror Repository Volume(s) already exist. Please Deactivate Mirroring.
161	0xA1	RETCODE_METADATA_MISSING The operation cannot complete because there are missing children for the Mirror Repository Volume.
162	0xA2	RETCODE_METADATA_OFFLINE The operation cannot complete because there are offline children for the Mirror Repository Volume.
163	0xA3	RETCODE_METADATA_RECONFIGURING The operation cannot complete because there are reconfiguring children for the Mirror Repository Volume.
164	0xA4	RETCODE_LOCAL_ROLE_CHANGE_FAILED The operation cannot complete because the role of the local volume was unable to be changed. Please retry the operation. If the operation still cannot complete, please use the Recovery Guru to correct this condition or contact your Technical Support Representative.
165	0xA5	RETCODE_REMOTE_ROLE_CHANGE_FAILED Not Used
166	0xA6	RETCODE_LOCAL_ROLE_CHANGE_SUCCESSFUL Not Used
167	0xA7	RETCODE_ONLY_LOCAL_MIRROR_DELETED The mirror relationship was successfully removed from the local volume, but a communication error prevented the mirror relationship from being removed from the associated remote volume in the mirrored pair. Please open an Array Management Window for Remote Storage Array {1}, select Remote Volume {2} and remove the mirror relationship to correct this condition.
168	0xA8	RETCODE_NO_VALID_MIRROR_CANDIDATE The operation cannot complete because there are no Mirror Candidates on the remote storage array.
169	0xA9	RETCODE_REMOTE_MAX_MIRRORS_EXCEEDED The operation cannot complete because the maximum number of mirror volumes has been created on the remote storage array.
170	0xAA	RETCODE_REMOTE_RVM_FEATURE_DISABLED The operation cannot complete because the RVM feature is disabled on the remote storage array.
171	0xAB	RETCODE_REMOTE_METADATA_VOL_NONEXISTENT The operation cannot complete because the metadata volume is not present on the remote storage array.
172	0xAC	RETCODE_NOT_REGISTERED The operation cannot complete because of an internal error. Please contact your Technical Support Representative.

Return Code		Definition/ SYMsm Description
173	0xAD	RETCODE_REMOTE_INVALID_CFG_GEN The operation cannot complete because the configuration number on the remote storage array is invalid.
174	0xAE	RETCODE_LOCAL_ROLE_CHANGED_NOT_FORCED The local primary volume was successfully demoted to a secondary role, but the command to promote the remote secondary volume to a primary role did not complete successfully. Please use the Recovery Guru to correct this condition.
175	0xAF	RETCODE_REMOTE_ROLE_CHANGED_LOCAL_FAILED The remote primary volume was successfully demoted to a secondary role, but the command to promote the local secondary volume to a primary role did not complete successfully. Please use the Recovery Guru to correct this condition.
176	0xB0	RETCODE_RVM_SPM_ERROR The operation cannot complete because the local storage array was unable to create/delete storage partition mappings for the remote volume or the remote storage array was unable to create/delete storage partition mappings for the local volume. Please retry the operation.
177	0xB1	RETCODE_REMOTE_AUTH_FAIL_PASSWORD The operation cannot complete because the authentication failed on the remote storage array.
178	0xB2	RETCODE_RVM_VERSION_MISMATCH The selected remote storage array does not support the version of Remote Volume Mirroring currently running on this storage array. Please upgrade the remote storage array's management software or select another storage array.
179	0xB3	RETCODE_RVM_REMOTE_ARRAY_ERROR The operation cannot complete due to an unknown failure at the remote storage array. Please retry the operation at a later time.
180	0xB4	RETCODE_RVM_COMMUNICATION_ERROR Could not communicate with the remote storage array to complete this request. Possible causes include network or connection problems, or no power to the storage array. Check these possible causes and then retry the operation.
181	0xB5	RETCODE_RVM_FIBRE_ERROR The operation cannot complete because host port 2 was unable to be reserved for mirror data transmissions. Please be sure that host port 2 is not in exclusive use by a host and then retry the operation.
182	0xB6	RETCODE_MIRROR_VOL_NOT_PRIMARY The operation cannot complete because the local volume is not a primary volume.
183	0xB7	RETCODE_SEC_NOT_PROMOTEABLE The operation cannot complete because the selected volume is not in a synchronized mirror state. Please wait until the mirrored pair is synchronized and then retry the operation.

Return Code		Definition/ SYMsm Description
184	0xB8	RETCODE_PRI_NOT_DEMOTEABLE The operation cannot complete because the selected volume is not in a synchronized mirror state. Please wait until the mirrored pair is synchronized and then retry the operation.
185	0xB9	RETCODE_METADATA_CHILD_DELETION The operation cannot complete because the selected volume is a mirror repository volume. To delete a mirror repository volume, deactivate the Remote Volume Mirroring premium feature.
186	0xBA	RETCODE_RMTVOL_ORPHAN_DELETION The operation cannot complete because the selected volume is in a mirror relationship. Please remove the mirror relationship and then retry the operation.
187	0xBB	RETCODE_RVM_ACTIVATE_DISALLOWED The operation cannot complete because the Remote Volume Mirroring premium feature is not supported on this controller platform.
188	0xBC	RETCODE_INVALID_TRAYREF The operation cannot complete because the Tray ID number entered is invalid. Please enter a valid Tray ID number and retry the operation. If you are unsure of the Tray ID number, please use the Drive>>Locate>>Drive Tray option in the Array Management Window to locate the drive tray.
189	0xBD	RETCODE_PARTIAL_DELETION The operation cannot complete because a selected volume is the last one belonging to its controller owner and could not be successfully deleted. Please use the Volume>>Delete option in the Array Management Window to manually delete the volume.
190	0xBE	RETCODE_DEFAULT_UTM_COLLISION The operation cannot complete because the logical unit number (LUN) is already in use by the Access Volume. Please select another LUN. Note: This is only returned through the command line interface.
191	0xBF	RETCODE_INVALID_COPY_PRIORITY The operation cannot complete because the copy priority entered was not valid. Please enter a valid priority and retry the operation. Valid copy priorities include Lowest, Low, Medium, High and Highest.
192	0xC0	RETCODE_INVALID_VOLUMECOPYREF The operation cannot complete because the volumes entered are not a valid copy pair. Please enter a valid copy pair and retry the operation.
193	0xC1	RETCODE_COPY_CHANGE_FAILED The attempt to change the parameters of the selected copy pair cannot complete because of an internal controller error. Please retry the operation.
194	0xC2	RETCODE_COPY_ACTIVE The operation cannot complete because the selected copy pair is currently in a Pending, In Progress, or Failed state. Please (1) wait for the copy operation to complete if it is Pending or In Progress, or (2) use the Copy>>Stop option in the Copy Manager to clear the Failed state. Then, retry the operation.

Return Code		Definition/ SYMsm Description
195	0xC3	RETCODE_COPY_INACTIVE The operation cannot complete because the selected copy pair is currently in a Stopped or Completed State.
196	0xC4	RETCODE_COPY_INCOMPATIBLE_SOURCE The operation cannot complete because the volume entered is not a valid source volume candidate. Possible causes include: the volume is a secondary volume in a mirrored pair, a mirror repository volume, a snapshot repository volume, or is a target volume in a copy pair that is currently Pending, In Progress, or Failed. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
197	0xC5	RETCODE_COPY_INCOMPATIBLE_TARGET The operation cannot complete because the volume entered is not a valid target volume candidate. Possible causes include: the volume is a secondary volume in a mirrored pair, a mirror repository volume, a snapshot repository volume, a snapshot volume, a base volume of an active snapshot volume, a source volume in a copy pair that is currently Pending, In Progress, or Failed, or is the same volume that you entered as the source volume for this copy pair. Please select a different target volume and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
198	0xC6	RETCODE_COPY_GHOST_SOURCE The operation cannot complete because the source volume entered is missing. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
199	0xC7	RETCODE_COPY_GHOST_TARGET The operation cannot complete because the target volume entered is missing. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
200	0xC8	RETCODE_COPY_INVALID_SOURCE_REF The operation cannot complete because the source volume entered does not exist. The source volume may have been deleted by a user on another storage management station accessing this storage array.
201	0xC9	RETCODE_COPY_INVALID_TARGET_REF The operation cannot complete because the target volume entered does not exist. The target volume may have been deleted by a user on another storage management station accessing this storage array.

Return Code		Definition/ SYMsm Description
202	0xCA	RETCODE_COPY_INVALID_SOURCE_STATE The operation cannot complete because the source volume entered is not in an Optimal or Degraded state. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
203	0xCB	RETCODE_COPY_INVALID_TARGET_STATE The operation cannot complete because the target volume entered is not in an Optimal state. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
204	0xCC	RETCODE_COPY_SOURCE_RECONFIG The operation cannot complete because the source volume entered is currently undergoing a reconfiguration operation. Please wait until the reconfiguration operation completes and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
205	0xCD	RETCODE_COPY_TARGET_RECONFIG The operation cannot complete because the target volume entered is currently undergoing a reconfiguration operation. Please wait until the reconfiguration operation completes and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
206	0xCE	RETCODE_COPY_TARGET_TOO_SMALL The operation cannot complete because the target volume must be of equal or larger capacity than the source volume. Please select a different target volume or increase the capacity of the target volume entered and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
207	0xCF	RETCODE_COPY_TARGET_LIMIT The operation cannot complete because the target volume entered is already a target volume for another source volume. Please select a different target volume or remove the copy pair where this target volume currently resides by selecting the Copy>>Remove Copy Pairs option in the Copy Manager. Then retry the operation.
208	0xD0	RETCODE_MAX_VOLUME_COPYS_EXCEEDED The operation cannot complete because the maximum number of copy pairs have been created for this storage array.
209	0xD1	RETCODE_COPY_SOURCE_RESERVATION The operation cannot complete because the source volume entered has a SCSI-2 or persistent reservation placed on it. Please release the reservation at the host and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.

Return Code		Definition/ SYMsm Description
210	0xD2	RETCODE_COPY_TARGET_RESERVATION The operation cannot complete because the target volume entered has a SCSI-2 or persistent reservation placed on it. Please release the reservation at the host and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
211	0xD3	RETCODE_COPY_SOURCE_FORMAT The operation cannot complete because the source volume entered is currently initializing. Please wait for the initialization to complete and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
212	0xD4	RETCODE_COPY_TARGET_FORMAT The operation cannot complete because the target volume entered is currently initializing. Please wait for the initialization to complete and then retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
213	0xD5	RETCODE_COPY_START_FAILED The attempt to start the copy operation failed because of an internal controller error. Please retry the operation. NOTE: If you received this error after attempting a Re-Copy operation, even though the Re-Copy command failed, any changes you made to the Copy Priority as a result of that command were successfully completed.
214	0xD6	RETCODE_COPY_STOP_FAILED The attempt to stop the copy operation failed because of an internal controller error. Please retry the operation.
215	0xD7	RETCODE_VOLCOPY_FEATURE_DISABLED The operation cannot complete because the Volume Copy premium feature is disabled.
216	0xD8	RETCODE_WRITE_LOCK The operation cannot complete because either the volume entered is a read-only target volume or it is a mirror secondary volume. Please either disable read-only using the Change>>Target Volume Permissions>>Disable Read-Only option in the Copy Manager or remove the mirror relationship using the Volume>>Remote Volume Mirroring>>Remove Mirror Relationship option in the Array Management Window and then retry the operation.
217	0xD9	RETCODE_CANNOT_RECONFIGURE The reconfiguration operation cannot complete because of one of the following reasons: (1) the volume contains unreadable sectors. Check the Recovery Guru for an unreadable sectors problem and follow the recommended procedure. (2) the volume, or another volume that resides in the same volume group, is a source or target volume in a copy pair that is currently in a Pending, In Progress or Failed state. Please either wait for the copy operation to complete if it is Pending or In Progress, or use the Copy>>Stop option in the Copy Manager to clear the Failed state. Then, retry the reconfiguration operation.

Return Code		Definition/ SYMsm Description
218	0xDA	RETCODE_AUTH_FAIL_CONT_LOCKOUT The operation cannot complete because the storage array is currently in a locked out mode. This mode occurs when too many incorrect passwords have been attempted over a 10-minute interval. This could be a result of an unauthorized attempt to access the storage array. The storage array will remain in the locked out mode for 10 minutes. During the lockout period, any operations that require a password will fail. Please wait and then retry the operation.
219	0xDB	RETCODE_PR_RESERVATION_CONFLICT The operation cannot complete because the volume has a persistent reservation placed on it. Please release the reservation at the host and then retry the operation. If you still have problems, contact your Technical Support Representative about using the Advanced>>Maintenance>>Persistent Reservations option.
220	0xDC	RETCODE_REG_DELETE_FAILED The operation cannot complete because a volume registration could not be cleared. Please retry the operation. If this message persists, contact your Technical Support Representative.
221	0xDD	RETCODE_BATTERY_NOT_IN_CONFIG The operation cannot complete because an NVSRAM configuration setting indicates that batteries should not be part of this storage array. However, if you have batteries in this storage array, contact your Technical Support Representative to fix the NVSRAM setting to match your configuration. If you were attempting to reset the battery age, wait until the battery becomes fully charged and then try the operation again.
222	0xDE	RETCODE_BATTERY_MISSING The operation cannot complete because the battery was removed.
223	0xDF	RETCODE_NO_CHANNEL The operation cannot complete because the drive channel specified does not have a minihub or the cable is improperly connected. Please specify a different drive channel.
224	0xE0	RETCODE_RVM_OPER_NOT_ALLOWED_ON_SEC The operation cannot complete because the selected volume is a secondary volume. Please select a primary volume and then retry the operation.
225	0xE1	RETCODE_DATA_REDUNDANCY_REQUIRED Unable to change the volume group to RAID 0 because it contains the mirror repository volumes. Mirror repository volumes must be either RAID 1,3, or 5 to ensure data redundancy on these volumes.
226	0xE2	RETCODE_COPY_SOURCE_ZERO_CAPACITY The operation cannot complete because the source volume entered is also a primary volume in a mirrored pair, and there is currently an error preventing mirror communication with the remote storage array. This error may be intermittent. Please retry the operation. If the operation still cannot complete, please use the Recovery Guru to correct the mirror communication error and then retry the operation.

Return Code		Definition/ SYMsm Description
227	0xE3	RETCODE_INV_HOSTLUN_DEFINE_MAPPING The operation cannot complete because you attempted a volume-to-LUN mapping with a LUN greater than 31 and at least one host type defined for the selected host/host ports is limited to accessing volumes with LUNs 0 to 31. Please retry the operation using LUN 0 to 31.
228	0xE4	RETCODE_INV_HOSTLUN_MOVE_MAPPING The operation cannot complete because you attempted to do one of the following operations. (1) change a volume-to-LUN mapping with a LUN greater than 31 and at least one host type defined for the selected host/host ports is limited to accessing volumes with LUNs 0 to 31. (2) move a volume-to-LUN mapping to a host that contains at least one defined host type that is limited to accessing volumes with LUNs 0 to 31. Please retry the operation and use LUN 0 to 31 or select a different host.
229	0xE5	RETCODE_INV_HOSTLUN_DEFINE_HOSTYPE The operation cannot complete because you attempted to define or change a host type to one that can only access volumes with LUNs 0 to 31 and there is already at least one volume mapped to the selected host or host port using a LUN greater than 31. Please either select a host type that can access LUNs greater than 31 or change the existing volume mappings to LUNs 0 to 31, and then retry the operation.
230	0xE6	RETCODE_INV_HOSTLUN_MOVE_HOSTPORT The operation cannot complete because you attempted to move a host or host port to an existing partition that has at least one volume defined with a LUN greater than 31 and the defined host type is limited to accessing volumes with LUNs 0 to 31. Please either change the host type of the host port to one that can access LUNs greater than 31 or change the existing volume mappings for that partition to LUNs 0 to 31, and then retry the operation. IMPORTANT: If you want to change the host type of the host port, you must first change it on the existing host using the Mappings>>Change>>Host Port option and then move it to the new partition using the Mappings>>Move option.
231	0xE7	RETCODE_FW_INCOMPATIBLE The operation cannot complete because you attempted to download incompatible firmware. Contact your Technical Support Representative for downgrade and compatible firmware support information.
232	0xE8	RETCODE_MIRROR_ALREADY_SUSPENDED The operation cannot complete because you attempted to suspend an already suspended mirror.
233	0xE9	RETCODE_INSUFF_LOCAL_MIR_REP_RESOURCES The operation cannot complete because the existing mirror repositories are not large enough to accommodate more mirrors. Please upgrade the mirror repositories and retry the operation.
234	0xEA	RETCODE_INSUFF_REMT_MIR_REP_RESOURCES The operation cannot complete because the remote array's mirror repositories are not large enough to accommodate more mirrors. Please upgrade the remote array's mirror repositories and retry the operation.

Return Code		Definition/ SYMsm Description
235	0xEB	RETCODE_GHOST_HAS_UNREADABLE_SECTORS Unable to delete the following missing volumes because they currently have unreadable sectors. You must clear the unreadable sectors on these volumes using the Advanced>>Recovery>>Unreadable Sectors option before deleting them. Contact your technical support representative for assistance.
236	0xEC	RETCODE_RVM_COMM_STAT_RECOVERED_TIMEOUT The communication test passed. Some pings timed out, but their retries succeeded.
237	0xED	RETCODE_RVM_COMM_STAT_RECOVERED_DELAY The communication test passed, although some pings had delayed response.
238	0xEE	RETCODE_RVM_COMM_STAT_NOT_READY The operation failed because the communication test could not start.
239	0xEF	RETCODE_RVM_COMM_STAT_TIMEOUT The operation failed because a command to the remote volume timed out.
240	0xF0	RETCODE_RVM_COMM_STAT_CHANNEL_FAILURE The operation failed because the channel to the remote array or volume is failed.
241	0xF1	RETCODE_RVM_COMM_STAT_NETWORK_FAILURE The operation failed because the RVM network could not be accessed.
242	0xF2	RETCODE_RVM_COMM_STAT_DEVICE_MISSING The operation failed because the remote volume was not found.
243	0xF3	RETCODE_RVM_COMM_STAT_LOGIN_REJECTED The operation failed because the remote volume did not permit login.
244	0xF4	RETCODE_RVM_COMM_STAT_LOGIN_FAILURE The operation failed because the remote volume login failed.
245	0xF5	RETCODE_RVM_COMM_INV_NUM_SAMPLES_REQD The operation failed because the number of sample times exceeds the maximum.
246	0xF6	RETCODE_RVM_QUIESCENCE_IN_PROGRESS The operation failed because a quiescence or suspension is in progress.
247	0xF7	RETCODE_RVM_INVALID_REMOTEVOL The operation failed because the volume reference is not of a RemoteVolume object.
248	0xF8	RETCODE_SOD_IN_PROGRESS The drive firmware download operation failed because one or both of the controllers are currently performing a start-of-day operation. Please wait until the start-of-day operation completes, and then retry the drive firmware download operation.
249	0xF9	RETCODE_INVALID_DRIVES The drive firmware download operation failed because one or more of the drives you selected has a Bypassed or Offline status and is inaccessible. Please make sure the drives you selected do not have a status of Bypassed or Offline, and then retry the operation.

Return Code		Definition/ SYMsm Description
250	0xFA	RETCODE_PDFD_INVALID_SETID The operation cannot complete because a download set identifier was incorrect.
251	0xFB	RETCODE_PDFD_INVALID_SETSIZE The operation cannot complete because the number of download sets exceeds the maximum allowed.
252	0xFC	RETCODE_PDFD_MISSING_DATA The operation cannot complete because not all the data for all download sets was received.
253	0xFD	RETCODE_PDFD_QUIESCENCE_FAILED The operation cannot complete because request to quiesce the system failed.
254	0xFE	RETCODE_PDFD_VALIDATION_ERROR The operation cannot complete because file validation failed.
255	0xFF	RETCODE_PDFD_DOWNLOAD_HALTED The operation cannot complete because the drive firmware download was halted by the user.
256	0x100	RETCODE_PDFD_ALL_FAILED The drive firmware download operation failed for all drives.
257	0x101	RETCODE_PDFD_PARTIAL_OK The drive firmware download operation completed. The operation failed for some drives.
258	0x102	RETCODE_PDFD_OBSOLETE This type of drive firmware download operation is no longer supported.
259	0x103	RETCODE_USM_CLEAR_FAILED Unable to clear the unreadable sectors on the drives associated with the selected volumes. There was a problem writing a known data pattern to these drives. Please retry the operation. If this message persists, contact your Technical Support Representative.
260	0x104	RETCODE_CONTROLLER_IN_SERVICE_MODE The operation cannot complete because the controller was placed in Service Mode at the request of a Technical Support Representative. A possible reason for this is that a problem with the storage array required diagnostic tests on this controller. Check to make sure the problem has been resolved. To place the controller Online, highlight the affected controller in the Array Management Window and then select Advanced>>Recovery>>Place Controller>>Online.
261	0x105	RETCODE_INVALID_DRIVE Invalid Drive
262	0x106	RETCODE_DATABASE_ERROR Dbm database error
263	0x107	RETCODE_BACKGROUND_AUTOCFG AutoConfig started as a background task

Return Code		Definition/ SYMsm Description
264	0x108	RETCODE_AUTOCFG_INPROGRESS An automatic configuration is already in progress. Please wait until the active request finishes before submitting another automatic configuration. The time it takes to complete the request depends on the number of volumes being created. A large configuration will take a long time to complete. Check the Event Log to determine the success or failure of the automatic creation.
265	0x109	RETCODE_UNSUPPORTED_LHA_SATA_ESM A firmware download to an ESM failed. The failure occurred because the ESM firmware you were attempting to download is not compatible with the version of controller firmware you have on the storage array. Please contact your Technical Support Representative to resolve this problem.

Event Decoding Examples

It is recommended that event logs be decoded using an automated method. This utility will convert an event log file saved by the event viewer into a file that is suitable for input to Excel or a similar spreadsheet application.

An example AWK script for processing events follows:

```
# melxls <filename>
# This script contains parsing for 2 mel formats, the orginal (short) format
and the
# expanded format that is present in Sonoran 2 and later releases.
#
# This script:
#       Parses symSM7-generated MEL data file.
#       Generates a tab-delimited file with one record per MEL entry, suitable
#       for use as an Excel spreadsheet.
#
# The output file is the input file name with a .xls extension.
# This file may be opened by Excel directly, & Excel will convert it to the
# regular Excel format.
#
# NOTE: Be sure the input file has unix EOLs. The dos2unix utility may be used
# to convert them to unix.
#
# The raw data is formatted as follows:
#      Orginal format                   Sonoran 2 format
#
#      bytes  0 -  7  seq#              bytes   0 -   3 signature
#      bytes  8 - 11  event#                    bytes   4 -   7 log version #
#      bytes 12 - 15  timestamp         bytes   8 -  15 seq#
#      bytes 16 - 19  device                    bytes  16 -  19 event#
#      bytes 20 - 23  id                        bytes  20 -  23 timestamp
#      bytes 24 - 25  origin                    bytes  24 -  27 device
#      bytes 26 - 27  lunNum                    bytes  28 -  31 id
#      byte  28       controllerNum             bytes  32 -  33 origin
#      byte  29       numDataFields             bytes  36 -  39 lunNum
#      byte  30       dataFieldsLen             bytes  40 -  43 controllerNum
#      byte  31       filler                    bytes  44 -  47 category
#      remainder event specific data            bytes  48 -  51 component type
#                                       bytes  52 - 119 component location
#                                       bytes 120 - 123 location valid
#                                       byte  124   numDataFields
#                                       byte  125   dataFieldsLen
#                                       remainder event specific data
#
################################################################################

BEGIN {
       FS=":"
       OFS="\t"
       tm = "Date/Time"
       seq = "Seq#"
       ev = "Event#"
       cat = "Category"
       pri = "Priority"
       desc = "Description"
       esc = "Code"
       type = "Type"
       loc = "Location"
       firstTime = 1
```

```
      v1Header =
"Seq#\tEvent#\tTimestamp\tDevice\tId\tOrigin\tlunNum\tctlr\tndf\tdfl\tfill\tdat
a..."
      v2Header =
"Hdr\tver#\tSeq#\tEvent#\tTimestamp\tDevice\tId\tOrigin\tlunNum\tctlr\tcat\tcmp
Typ\tcmpLoc\tlocVal\tndf\tdfl\tpad\tdata..."
}

$1 == "Date/Time" {
      if (firstTime)
            saved = tm "\t" seq "\t" ev "\t" cat "\t" pri "\t" desc "\t" esc
"\t" type "\t" loc
      else
            print tm, seq, ev, cat, pri, desc, esc, type, loc, data
      tm = $2 ":" $3 ":" $4
      data = ""
}

$1 == "Sequence number" { seq = substr($2,2)}
$1 == "Event type" { ev = substr($2,2) }
$1 == "Category" { cat = substr($2,2) }
$1 == "Priority" { pri = substr($2,2) }
$1 == "Description" { desc = substr($2,2) }
$1 == "Event specific codes" { esc = substr($2,2) }
$1 == "Component type" { type = substr($2,2) }
$1 == "Component location" { loc = substr($2,2) }
$1 == "Raw data" {
      j = 0
      FS=" "
      getline
      rev2 = match($0,"4d 45 4c 48")
      if (firstTime)
      {
            if (rev2){   print saved, v2Header}
            else{        print saved, v1Header}
            firstTime = 0
      }
      do {
            for ( i=1; i<=NF; i++)
            {
                  sep = " "
                  if (rev2 == 0)
                  {
                        if (j==8  || j==12 || j==16 || j==20 || j==24
||j==26) sep = "\t"
                        if (j==28 || j==29 || j==30 || j==31 || j==32) sep =
"\t"
                  }
                  else
                  {
                        if (j ==  4 || j==  8 || j== 16 || j== 20 || j== 24
|| j==28) sep = "\t"
                        if (j == 32 || j== 36 || j== 40 || j== 44 || j== 48
|| j==52) sep = "\t"
                        if (j ==120 || j==124 || j==125 || j==126 || j==128)
sep = "\t"
                  }
                  data = data sep $i
                  j++
            }
            getline
      } while (NF != 0)
      FS=":"
}
END {print tm, seq, ev, cat, pri, desc, esc, type, loc, data}
```

The following example demonstrates manual decoding of events.

Example: AEN Event

Event as saved from the event viewer.

Date/Time: 9/13/01 5:05:56 PM
Sequence number: 17870
Event type: 3101
Event category: Internal
Priority: Informational
Description: AEN posted for recently logged event
Event specific codes: 6/a0/0
Component type: Controller
Component location: Controller in slot B

Raw data:
4d 45 4c 48 02 00 00 00 ce 45 00 00 00 00 00 00
01 31 48 00 c4 2d a1 3b 00 00 00 00 00 00 00 00
00 00 00 00 1e 00 00 00 01 00 00 00 04 00 00 00
08 00 00 00 08 00 00 00 ff ff ff ff 01 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 01 00 00 00 04 80 00 00
20 00 00 01 70 00 06 00 00 00 00 98 00 00 00 00
a0 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00
00 00 00 00 20 00 00 81 00 00 80 00 00 08 2c 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 54
39 33 35 31 30 32 36 34 20 00 00 81 20 20 20 20
20 20 95 00 00 00 00 1e 01 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 10 00 00 81
00 00 00 00 00 05 00 00 00 00 00 00 00 00 00 00

signature	4d 45 4c 48 internal controller firmware event signature.
version	02 00 00 00 = 2
sequence number	ce 45 00 00 00 00 00 00 = 0x45ce = 17870
event number	01 31 48 00 = 0x00483101
timestamp	c4 2d a1 3b = 0x3ba12dc4
device	00 00 00 00
id	00 00 00 00
origin	00 00
reserved1	00 00
lun	1e 00 00 00 =0x1e
controller num	01 00 00 00 = 1 b controller
category	04 00 00 00 = 4
component type	08 00 00 00
component location	08 00 00 00 ff ff ff ff 01 00 00 00 internal controller representation of component location field above usually not decodable by hand 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
location valid	01 00 00 00 = 1
numDataFields	04 4 event specific data fields
DataFieldsLength	80 00 00 = 128 bytes long

1st data field	20 00 00 01, 32 bytes long field type 0x100 sense data 70 00 06 00 00 00 00 98 00 00 00 00 a0 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00
2nd data field	20 00 00 81, 32 bytes long field type continuation of sense data 0x100 00 00 80 00 00 08 2c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 54 39 33 35 31 30 32 36 34
3rd data field	20 00 00 81 32 bytes long field type continuation of sense data 0x100 20 20 20 20 20 20 95 00 00 00 00 1e 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
4th data field	10 00 00 81, 16 bytes long field type continuation of sense data 0x100 00 00 00 00 00 05 00 00 00 00 00 00 00 00 00 00

Appendix. Accessibility

This section provides information about alternate keyboard navigation, which is a DS4000 Storage Manager accessibility feature. Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

By using the alternate keyboard operations that are described in this section, you can use keys or key combinations to perform Storage Manager tasks and initiate many menu actions that can also be done with a mouse.

Note: In addition to the keyboard operations that are described in this section, the DS4000 Storage Manager 9.14 software installation package for Windows includes a screen reader software interface. To enable the screen reader, select Custom Installation when using the installation wizard to install Storage Manager 9.14 on a Windows host/management station. Then, in the Select Product Features window, select Java Access Bridge in addition to the other required host software components.

Table 35 defines the keyboard operations that enable you to navigate, select, or activate user interface components. The following terms are used in the table:

- *Navigate* means to move the input focus from one user interface component to another.
- *Select* means to choose one or more components, typically for a subsequent action.
- *Activate* means to carry out the action of a particular component.

Note: In general, navigation between components requires the following keys:

- **Tab** - Moves keyboard focus to the next component or to the first member of the next group of components
- **Shift-Tab** - Moves keyboard focus to the previous component or to the first component in the previous group of components
- **Arrow keys** - Move keyboard focus within the individual components of a group of components

Table 35. DS4000 Storage Manager alternate keyboard operations

Short cut	Action
F1	Open the Help.
F10	Move keyboard focus to main menu bar and post first menu; use the arrow keys to navigate through the available options.
Alt+F4	Close the management window.
Alt+F6	Move keyboard focus between dialogs (non-modal) and between management windows.

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Table 35. DS4000 Storage Manager alternate keyboard operations (continued)

Short cut	Action
Alt+ underlined letter	Access menu items, buttons, and other interface components by using the keys associated with the underlined letters. For the menu options, select the Alt + underlined letter combination to access a main menu, and then select the underlined letter to access the individual menu item. For other interface components, use the Alt + underlined letter combination.
Ctrl+F1	Display or conceal a tool tip when keyboard focus is on the toolbar.
Spacebar	Select an item or activate a hyperlink.
Ctrl+Spacebar (Contiguous/Non-contiguous) AMW Logical/Physical View	Select multiple drives in the Physical View. To select multiple drives, select one drive by pressing Spacebar, and then press Tab to switch focus to the next drive you want to select; press Ctrl+Spacebar to select the drive. If you press Spacebar alone when multiple drives are selected then all selections are removed. Use the Ctrl+Spacebar combination to deselect a drive when multiple drives are selected. This behavior is the same for contiguous and non-contiguous selection of drives.
End, Page Down	Move keyboard focus to the last item in the list.
Esc	Close the current dialog (does not require keyboard focus).
Home, Page Up	Move keyboard focus to the first item in the list.
Shift+Tab	Move keyboard focus through components in the reverse direction.
Ctrl+Tab	Move keyboard focus from a table to the next user interface component.
Tab	Navigate keyboard focus between components or select a hyperlink.
Down arrow	Move keyboard focus down one item in the list.
Left arrow	Move keyboard focus to the left.
Right arrow	Move keyboard focus to the right.
Up arrow	Move keyboard focus up one item in the list.

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Glossary

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- *IBM Glossary of Computing Terms*. New York: McGraw-Hill, 1994.

The following cross-reference conventions are used in this glossary:

See Refers you to (a) a term that is the expanded form of an abbreviation or acronym, or (b) a synonym or more preferred term.

See also Refers you to a related term.

Abstract Windowing Toolkit (AWT). A Java graphical user interface (GUI).

accelerated graphics port (AGP). A bus specification that gives low-cost 3D graphics cards faster access to main memory on personal computers than the usual peripheral component interconnect (PCI) bus. AGP reduces the overall cost of creating high-end graphics subsystems by using existing system memory.

access volume. A special logical drive that allows the host-agent to communicate with the controllers in the storage subsystem.

adapter. A printed circuit assembly that transmits user data input/output (I/O) between the internal bus of the host system and the external fibre-channel (FC) link and vice versa. Also called an I/O adapter, host adapter, or FC adapter.

advanced technology (AT) bus architecture. A bus standard for IBM compatibles. It extends the XT bus architecture to 16 bits and also allows for bus mastering, although only the first 16 MB of main memory are available for direct access.

agent. A server program that receives virtual connections from the network manager (the client program) in a Simple Network Management Protocol-Transmission Control Protocol/Internet Protocol (SNMP-TCP/IP) network-managing environment.

AGP. See *accelerated graphics port*.

AL_PA. See *arbitrated loop physical address*.

arbitrated loop. One of three existing fibre-channel topologies, in which 2 - 126 ports are interconnected serially in a single loop circuit. Access to the Fibre Channel-Arbitrated Loop (FC-AL) is controlled by an arbitration scheme. The FC-AL topology supports all classes of service and guarantees in-order delivery of FC frames when the originator and responder are on the same FC-AL. The default topology for the disk array is arbitrated loop. An arbitrated loop is sometimes referred to as a Stealth Mode.

arbitrated loop physical address (AL_PA). An 8-bit value that is used to uniquely identify an individual port within a loop. A loop can have one or more AL_PAs.

array. A collection of fibre-channel or SATA hard drives that are logically grouped together. All the drives in the array are assigned the same RAID level. An array is sometimes referred to as a "RAID set." See also *redundant array of independent disks (RAID)*, *RAID level*.

asynchronous write mode. In remote mirroring, an option that allows the primary controller to return a write I/O request completion to the host server before data has been successfully written by the secondary controller. See also *synchronous write mode*, *remote mirroring*, *Global Copy*,*Global Mirroring*.

AT. See *advanced technology (AT) bus architecture*.

ATA. See *AT-attached*.

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AT-attached. Peripheral devices that are compatible with the original IBM AT computer standard in which signals on a 40-pin AT-attached (ATA) ribbon cable followed the timings and constraints of the Industry Standard Architecture (ISA) system bus on the IBM PC AT computer. Equivalent to integrated drive electronics (IDE).

auto-volume transfer/auto-disk transfer (AVT/ADT). A function that provides automatic failover in case of controller failure on a storage subsystem.

AVT/ADT. See *auto-volume transfer/auto-disk transfer*.

AWT. See *Abstract Windowing Toolkit*.

basic input/output system (BIOS). The personal computer code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

BIOS. See *basic input/output system*.

BOOTP. See *bootstrap protocol*.

bootstrap protocol (BOOTP). In Transmission Control Protocol/Internet Protocol (TCP/IP) networking, an alternative protocol by which a diskless machine can obtain its Internet Protocol (IP) address and such configuration information as IP addresses of various servers from a BOOTP server.

bridge. A storage area network (SAN) device that provides physical and transport conversion, such as fibre channel to small computer system interface (SCSI) bridge.

bridge group. A bridge and the collection of devices connected to it.

broadcast. The simultaneous transmission of data to more than one destination.

cathode ray tube (CRT). A display device in which controlled electron beams are used to display alphanumeric or graphical data on an electroluminescent screen.

client. A computer system or process that requests a service of another computer system or process that is typically referred to as a server. Multiple clients can share access to a common server.

command. A statement used to initiate an action or start a service. A command consists of the command name abbreviation, and its parameters and flags if applicable. A command can be issued by typing it on a command line or selecting it from a menu.

community string. The name of a community contained in each Simple Network Management Protocol (SNMP) message.

concurrent download. A method of downloading and installing firmware that does not require the user to stop I/O to the controllers during the process.

CRC. See *cyclic redundancy check*.

CRT. See *cathode ray tube*.

CRU. See *customer replaceable unit*.

customer replaceable unit (CRU). An assembly or part that a customer can replace in its entirety when any of its components fail. Contrast with *field replaceable unit (FRU)*.

cyclic redundancy check (CRC). (1) A redundancy check in which the check key is generated by a cyclic algorithm. (2) An error detection technique performed at both the sending and receiving stations.

dac. See *disk array controller*.

dar. See *disk array router*.

DASD. See *direct access storage device*.

data striping. See *striping*.

default host group. A logical collection of discovered host ports, defined host computers, and defined host groups in the storage-partition topology that fulfill the following requirements:

- Are not involved in specific logical drive-to-LUN mappings
- Share access to logical drives with default logical drive-to-LUN mappings

device type. Identifier used to place devices in the physical map, such as the switch, hub, or storage.

DHCP. See *Dynamic Host Configuration Protocol*.

direct access storage device (DASD). A device in which access time is effectively independent of the location of the data. Information is entered and retrieved without reference to previously accessed data. (For example, a disk drive is a DASD, in contrast with a tape drive, which stores data as a linear sequence.) DASDs include both fixed and removable storage devices.

direct memory access (DMA). The transfer of data between memory and an input/output (I/O) device without processor intervention.

disk array controller (dac). A disk array controller device that represents the two controllers of an array. See also *disk array router*.

disk array router (dar). A disk array router that represents an entire array, including current and deferred paths to all logical unit numbers (LUNs) (hdisks on AIX). See also *disk array controller*.

DMA. See *direct memory access*.

domain. The most significant byte in the node port (N_port) identifier for the fibre-channel (FC) device. It is not used in the fibre channel-small computer system interface (FC-SCSI) hardware path ID. It is required to be the same for all SCSI targets logically connected to an FC adapter.

DRAM. See *dynamic random access memory*.

Dynamic Host Configuration Protocol (DHCP). A protocol defined by the Internet Engineering Task Force that is used for dynamically assigning Internet Protocol (IP) addresses to computers in a network.

dynamic random access memory (DRAM). A storage in which the cells require repetitive application of control signals to retain stored data.

ECC. See *error correction coding*.

EEPROM. See *electrically erasable programmable read-only memory*.

EISA. See *Extended Industry Standard Architecture*.

electrically erasable programmable read-only memory (EEPROM). A type of memory chip which can retain its contents without consistent electrical power. Unlike the PROM which can be programmed only once, the EEPROM can be erased electrically. Because it can only be reprogrammed a limited number of times before it wears out, it is appropriate for storing small amounts of data that are changed infrequently.

electrostatic discharge (ESD). The flow of current that results when objects that have a static charge come into close enough proximity to discharge.

environmental service module (ESM) canister. A component in a storage expansion enclosure that monitors the environmental condition of the components in that enclosure. Not all storage subsystems have ESM canisters.

E_port. See *expansion port*.

error correction coding (ECC). A method for encoding data so that transmission errors can be detected and corrected by examining the data on the receiving end. Most ECCs are characterized by the maximum number of errors they can detect and correct.

ESD. See *electrostatic discharge*.

ESM canister. See *environmental service module canister*.

EXP. See *storage expansion enclosure*.

expansion port (E_port). A port that connects the switches for two fabrics.

Extended Industry Standard Architecture (EISA). A bus standard for IBM compatibles that extends the Industry Standard Architecture (ISA) bus architecture to 32 bits and allows more than one central processing unit (CPU) to share the bus. See also *Industry Standard Architecture*.

fabric. A Fibre Channel entity which interconnects and facilitates logins of N_ports attached to it. The fabric is responsible for routing frames between source and destination N_ports using address information in the frame header. A fabric can be as simple as a point-to-point channel between two N-ports, or as complex as a frame-routing switch that provides multiple and redundant internal pathways within the fabric between F_ports.

fabric port (F_port). In a fabric, an access point for connecting a user's N_port. An F_port facilitates N_port logins to the fabric from nodes connected to the fabric. An F_port is addressable by the N_port connected to it. See also *fabric*.

FAStT MSJ. See *FAStT Management Suite Java*.

FAStT Management Suite Java (FAStT MSJ). A diagnostic and configuration utility that can be used on Linux, Microsoft Windows, and Novell NetWare host systems. In Linux, it is also used with the QLRemote agent to define preferred and non-preferred paths for logical drives.

FC. See *fibre channel*.

FC-AL. See *arbitrated loop*.

feature enable identifier. A unique identifier for the storage subsystem, which is used in the process of generating a premium feature key. See also *premium feature key*.

fibre channel (FC). A set of standards for a serial input/output (I/O) bus capable of transferring data between two ports at up to 100 Mbps, with standards proposals to go to higher speeds. FC supports point-to-point, arbitrated loop, and switched topologies.

Fibre Channel-Arbitrated Loop (FC-AL). See *arbitrated loop*.

Fibre Channel Protocol (FCP) for small computer system interface (SCSI). A high-level fibre-channel mapping layer (FC-4) that uses lower-level fibre-channel (FC-PH) services to transmit SCSI commands, data, and status information between a SCSI initiator and a SCSI target across the FC link by using FC frame and sequence formats.

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 might contain other field replaceable units. Contrast with *customer replaceable unit (CRU)*.

FlashCopy. A premium feature for DS4000 that can make an instantaneous copy of the data in a volume.

F_port. See *fabric port*.

FRU. See *field replaceable unit*.

GBIC. See *gigabit interface converter*

gigabit interface converter (GBIC). A transceiver that performs serial, optical-to-electrical, and electrical-to-optical signal conversions for high-speed networking. A GBIC can be hot swapped. See also *small form-factor pluggable*.

Global Copy. Refers to a remote logical drive mirror pair that is set up using asynchronous write mode without the write consistency group option. This is also referred to as "Asynchronous Mirroring without Consistency Group." Global Copy does not ensure that write requests to multiple primary logical drives are carried out in the same order on the secondary logical drives as they are on the primary logical drives. If it is critical that writes to the primary logical drives are carried out in the same order in the appropriate secondary logical drives, Global Mirroring should be used instead of Global Copy. See also *asynchronous write mode*, *Global Mirroring*, *remote mirroring*, *Metro Mirroring*.

Global Mirroring. Refers to a remote logical drive mirror pair that is set up using asynchronous write mode with the write consistency group option. This is also referred to as "Asynchronous Mirroring with Consistency Group." Global Mirroring ensures that write requests to multiple primary logical drives are carried out in the same order on the secondary logical drives as they are on the primary logical drives, preventing data on the secondary logical drives from becoming inconsistent with the data on the primary logical drives. See also *asynchronous write mode*, *Global Copy*, *remote mirroring*, *Metro Mirroring*.

graphical user interface (GUI). A type of computer interface that presents a visual metaphor of a real-world scene, often of a desktop, by combining high-resolution graphics, pointing devices, menu bars and other menus, overlapping windows, icons, and the object-action relationship.

GUI. See *graphical user interface.*

HBA. See *host bus adapter*.

hdisk. An AIX term representing a logical unit number (LUN) on an array.

host. A system that is directly attached to the storage subsystem through a fibre-channel input/output (I/O) path. This system is used to serve data (typically in the form of files) from the storage subsystem. A system can be both a storage management station and a host simultaneously.

host bus adapter (HBA). An interface between the fibre-channel network and a workstation or server.

host computer. See *host*.

host group. An entity in the storage partition topology that defines a logical collection of host computers that require shared access to one or more logical drives.

host port. Ports that physically reside on the host adapters and are automatically discovered by the DS4000 Storage Manager software. To give a host computer access to a partition, its associated host ports must be defined.

hot swap. To replace a hardware component without turning off the system.

hub. In a network, a point at which circuits are either connected or switched. For example, in a star network, the hub is the central node; in a star/ring network, it is the location of wiring concentrators.

IBMSAN driver. The device driver that is used in a Novell NetWare environment to provide multipath input/output (I/O) support to the storage controller.

IC. See *integrated circuit*.

IDE. See *integrated drive electronics*.

in-band. Transmission of management protocol over the fibre-channel transport.

Industry Standard Architecture (ISA). Unofficial name for the bus architecture of the IBM PC/XT personal computer. This bus design included expansion slots for plugging in various adapter boards. Early versions had an 8-bit data path, later expanded to 16 bits. The "Extended Industry Standard Architecture" (EISA) further expanded the data path to 32 bits. See also *Extended Industry Standard Architecture*.

initial program load (IPL). The initialization procedure that causes an operating system to commence operation. Also referred to as a system restart, system startup, and boot.

integrated circuit (IC). A microelectronic semiconductor device that consists of many interconnected transistors and other components. ICs are constructed on a small rectangle cut from a silicon crystal or other semiconductor material. The small size of these circuits allows high speed, low power dissipation, and reduced manufacturing cost compared with board-level integration. Also known as a *chip*.

integrated drive electronics (IDE). A disk drive interface based on the 16-bit IBM personal computer Industry Standard Architecture (ISA) in which the controller electronics reside on the drive itself,

eliminating the need for a separate adapter card. Also known as an Advanced Technology Attachment Interface (ATA).

Internet Protocol (IP). A protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network.

Internet Protocol (IP) address. The unique 32-bit address that specifies the location of each device or workstation on the Internet. For example, 9.67.97.103 is an IP address.

interrupt request (IRQ). A type of input found on many processors that causes the processor to suspend normal processing temporarily and start running an interrupt handler routine. Some processors have several interrupt request inputs that allow different priority interrupts.

IP. See *Internet Protocol*.

IPL. See *initial program load*.

IRQ. See *interrupt request*.

ISA. See *Industry Standard Architecture*.

Java Runtime Environment (JRE). A subset of the Java Development Kit (JDK) for end users and developers who want to redistribute the Java Runtime Environment (JRE). The JRE consists of the Java virtual machine, the Java Core Classes, and supporting files.

JRE. See *Java Runtime Environment*.

label. A discovered or user entered property value that is displayed underneath each device in the Physical and Data Path maps.

LAN. See *local area network*.

LBA. See *logical block address*.

local area network (LAN). A computer network located on a user's premises within a limited geographic area.

logical block address (LBA). The address of a logical block. Logical block addresses are typically used in hosts' I/O commands. The SCSI disk command protocol, for example, uses logical block addresses.

logical partition (LPAR). (1) A subset of a single system that contains resources (processors, memory, and input/output devices). A logical partition operates as an independent system. If hardware requirements are met, multiple logical partitions can exist within a system. (2) A fixed-size portion of a logical volume. A logical partition is the same size as the physical partitions in its volume group. Unless the logical volume of which it is a part is mirrored, each logical partition corresponds to, and its contents are stored on, a single physical partition. (3) One to three physical partitions (copies). The number of logical partitions within a logical volume is variable.

logical unit number (LUN). An identifier used on a small computer system interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

loop address. The unique ID of a node in fibre-channel loop topology sometimes referred to as a loop ID.

loop group. A collection of storage area network (SAN) devices that are interconnected serially in a single loop circuit.

loop port. A node port (N_port) or fabric port (F_port) that supports arbitrated loop functions associated with an arbitrated loop topology.

LPAR. See *logical partition*.

LUN. See *logical unit number*.

MAC. See *medium access control*.

management information base (MIB). The information that is on an agent. It is an abstraction of configuration and status information.

man pages. In UNIX-based operating systems, online documentation for operating system commands, subroutines, system calls, file formats, special files, stand-alone utilities, and miscellaneous facilities. Invoked by the **man** command.

MCA. See *micro channel architecture*.

media scan. A media scan is a background process that runs on all logical drives in the storage subsystem for which it has been enabled, providing error detection on the drive media. The media scan process scans all logical drive data to verify that it can be accessed, and optionally scans the logical drive redundancy information.

medium access control (MAC). In local area networks (LANs), the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

Metro Mirroring. This term is used to refer to a remote logical drive mirror pair which is set up with synchronous write mode. See also *remote mirroring*, *Global Mirroring*.

MIB. See *management information base*.

micro channel architecture (MCA). Hardware that is used for PS/2 Model 50 computers and above to

provide better growth potential and performance characteristics when compared with the original personal computer design.

Microsoft Cluster Server (MSCS). MSCS, a feature of Windows NT Server (Enterprise Edition), supports the connection of two servers into a cluster for higher availability and easier manageability. MSCS can automatically detect and recover from server or application failures. It can also be used to balance server workload and provide for planned maintenance.

mini hub. An interface card or port device that receives short-wave fiber channel GBICs or SFPs. These devices enable redundant fibre channel connections from the host computers, either directly or through a fibre channel switch or managed hub, over optical fiber cables to the DS4000 Storage Server controllers. Each DS4000 controller is responsible for two mini hubs. Each mini hub has two ports. Four host ports (two on each controller) provide a cluster solution without use of a switch. Two host-side mini hubs are shipped as standard. See also *host port, gigabit interface converter (GBIC), small form-factor pluggable (SFP).*

mirroring. A fault-tolerance technique in which information on a hard disk is duplicated on additional hard disks. See also *remote mirroring*.

model. The model identification that is assigned to a device by its manufacturer.

MSCS. See *Microsoft Cluster Server*.

network management station (NMS). In the Simple Network Management Protocol (SNMP), a station that runs management application programs that monitor and control network elements.

NMI. See *non-maskable interrupt*.

NMS. See *network management station*.

non-maskable interrupt (NMI). A hardware interrupt that another service request cannot overrule (mask). An NMI bypasses and takes priority over interrupt requests generated by software, the keyboard, and other such devices and is issued to the microprocessor only in disastrous circumstances, such as severe memory errors or impending power failures.

node. A physical device that allows for the transmission of data within a network.

node port (N_port). A fibre-channel defined hardware entity that performs data communications over the fibre-channel link. It is identifiable by a unique worldwide name. It can act as an originator or a responder.

nonvolatile storage (NVS). A storage device whose contents are not lost when power is cut off.

N_port. See *node port*.

NVS. See *nonvolatile storage*.

NVSRAM. Nonvolatile storage random access memory. See *nonvolatile storage*.

Object Data Manager (ODM). An AIX proprietary storage mechanism for ASCII stanza files that are edited as part of configuring a drive into the kernel.

ODM. See *Object Data Manager*.

out-of-band. Transmission of management protocols outside of the fibre-channel network, typically over Ethernet.

partitioning. See *storage partition*.

parity check. (1) A test to determine whether the number of ones (or zeros) in an array of binary digits is odd or even. (2) A mathematical operation on the numerical representation of the information communicated between two pieces. For example, if parity is odd, any character represented by an even number has a bit added to it, making it odd, and an information receiver checks that each unit of information has an odd value.

PCI local bus. See *peripheral component interconnect local bus*.

PDF. See *portable document format*.

performance events. Events related to thresholds set on storage area network (SAN) performance.

peripheral component interconnect local bus (PCI local bus). A local bus for PCs, from Intel, that provides a high-speed data path between the CPU and up to 10 peripherals (video, disk, network, and so on). The PCI bus coexists in the PC with the Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA) bus. ISA and EISA boards plug into an IA or EISA slot, while high-speed PCI controllers plug into a PCI slot. See also *Industry Standard Architecture*, *Extended Industry Standard Architecture*.

polling delay. The time in seconds between successive discovery processes during which discovery is inactive.

port. A part of the system unit or remote controller to which cables for external devices (such as display stations, terminals, printers, switches, or external storage units) are attached. The port is an access point for data entry or exit. A device can contain one or more ports.

portable document format (PDF). A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with

the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

premium feature key. A file that the storage subsystem controller uses to enable an authorized premium feature. The file contains the feature enable identifier of the storage subsystem for which the premium feature is authorized, and data about the premium feature. See also *feature enable identifier*.

private loop. A freestanding arbitrated loop with no fabric attachment. See also *arbitrated loop*.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

PTF. See *program temporary fix*.

RAID. See *redundant array of independent disks (RAID)*.

RAID level. An array's RAID level is a number that refers to the method used to achieve redundancy and fault tolerance in the array. See also *array, redundant array of independent disks (RAID)*.

RAID set. See *array*.

RAM. See *random-access memory*.

random-access memory (RAM). A temporary storage location in which the central processing unit (CPU) stores and executes its processes. Contrast with *DASD*.

RDAC. See *redundant disk array controller*.

read-only memory (ROM). Memory in which stored data cannot be changed by the user except under special conditions.

recoverable virtual shared disk (RVSD). A virtual shared disk on a server node configured to provide continuous access to data and file systems in a cluster.

redundant array of independent disks (RAID). A collection of disk drives (*array*) that appears as a single volume to the server, which is fault tolerant through an assigned method of data striping, mirroring, or parity checking. Each array is assigned a RAID level, which is a specific number that refers to the method used to achieve redundancy and fault tolerance. See also *array, parity check, mirroring, RAID level, striping*.

redundant disk array controller (RDAC). (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

remote mirroring. Online, real-time replication of data between storage subsystems that are maintained on separate media. The Enhanced Remote Mirror Option is a DS4000 premium feature that provides support for remote mirroring. See also *Global Mirroring*, *Metro Mirroring*.

ROM. See *read-only memory*.

router. A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses.

RVSD. See *recoverable virtual shared disk*.

SAI. See *Storage Array Identifier*.

SA Identifier. See *Storage Array Identifier*.

SAN. See *storage area network*.

SATA. See *serial ATA*.

scope. Defines a group of controllers by their Internet Protocol (IP) addresses. A scope must be created and defined so that dynamic IP addresses can be assigned to controllers on the network.

SCSI. See *small computer system interface*.

segmented loop port (SL_port). A port that allows division of a fibre-channel private loop into multiple segments. Each segment can pass frames around as an independent loop and can connect through the fabric to other segments of the same loop.

sense data. (1) Data sent with a negative response, indicating the reason for the response. (2) Data describing an I/O error. Sense data is presented to a host system in response to a sense request command.

serial ATA. The standard for a high-speed alternative to small computer system interface (SCSI) hard drives. The SATA-1 standard is equivalent in performance to a 10 000 RPM SCSI drive.

serial storage architecture (SSA). An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with small computer system interface (SCSI) devices, allows full-duplex packet multiplexed serial data transfers at rates of 20 Mbps in each direction.

server. A functional hardware and software unit that delivers shared resources to workstation client units on a computer network.

server/device events. Events that occur on the server or a designated device that meet criteria that the user sets.

SFP. See *small form-factor pluggable*.

Simple Network Management Protocol (SNMP). 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).

SL_port. See *segmented loop port*.

SMagent. The DS4000 Storage Manager optional Java-based host-agent software, which can be used on Microsoft Windows, Novell NetWare, HP-UX, and Solaris host systems to manage storage subsystems through the host fibre-channel connection.

SMclient. The DS4000 Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and storage expansion enclosures in a DS4000 storage subsystem. SMclient can be used on a host system or on a storage management station.

SMruntime. A Java compiler for the SMclient.

SMutil. The DS4000 Storage Manager utility software that is used on Microsoft Windows, HP-UX, and Solaris host systems to register and map new logical drives to the operating system. In Microsoft Windows, it also contains a utility to flush the cached data of the operating system for a particular drive before creating a FlashCopy.

small computer system interface (SCSI). A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

small form-factor pluggable (SFP). An optical transceiver that is used to convert signals between optical fiber cables and switches. An SFP is smaller than a gigabit interface converter (GBIC). See also *gigabit interface converter*.

SNMP. See *Simple Network Management Protocol* and *SNMPv1*.

SNMP trap event. (1) (2) An event notification sent by the SNMP agent that identifies conditions, such as thresholds, that exceed a predetermined value. See also *Simple Network Management Protocol*.

SNMPv1. The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

SRAM. See *static random access memory*.

SSA. See *serial storage architecture*.

static random access memory (SRAM). Random access memory based on the logic circuit know as flip-flop. It is called static because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly refreshed. It is however, still volatile, meaning that it can lose its contents when the power is turned off.

storage area network (SAN). A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services. See also *fabric*.

Storage Array Identifier (SAI or SA Identifier). The Storage Array Identifier is the identification value used by the DS4000 Storage Manager host software (SMClient) to uniquely identify each managed storage server. The DS4000 Storage Manager SMClient program maintains Storage Array Identifier records of previously-discovered storage servers in the host resident file, which allows it to retain discovery information in a persistent fashion.

storage expansion enclosure (EXP). A feature that can be connected to a system unit to provide additional storage and processing capacity.

storage management station. A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel input/output (I/O) path.

storage partition. Storage subsystem logical drives that are visible to a host computer or are shared among host computers that are part of a host group.

storage partition topology. In the DS4000 Storage Manager client, the Topology view of the Mappings window displays the default host group, the defined host group, the host computer, and host-port nodes. The host port, host computer, and host group topological elements must be defined to grant access to host computers and host groups using logical drive-to-LUN mappings.

striping. Splitting data to be written into equal blocks and writing blocks simultaneously to separate disk drives. Striping maximizes performance to the disks. Reading the data back is also scheduled in parallel, with a block being read concurrently from each disk then reassembled at the host.

subnet. An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

sweep method. A method of sending Simple Network Management Protocol (SNMP) requests for information to all the devices on a subnet by sending the request to every device in the network.

switch. A fibre-channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

switch group. A switch and the collection of devices connected to it that are not in other groups.

switch zoning. See *zoning*.

synchronous write mode. In remote mirroring, an option that requires the primary controller to wait for the acknowledgment of a write operation from the secondary controller before returning a write I/O request completion to the host. See also *asynchronous write mode*, *remote mirroring*, *Metro Mirroring*.

system name. Device name assigned by the vendor's third-party software.

TCP. See *Transmission Control Protocol*.

TCP/IP. See *Transmission Control Protocol/Internet Protocol*.

terminate and stay resident program (TSR program). A program that installs part of itself as an extension of DOS when it is executed.

topology. The physical or logical arrangement of devices on a network. The three fibre-channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

TL_port. See *translated loop port*.

transceiver. A device that is used to transmit and receive data. Transceiver is an abbreviation of transmitter-receiver.

translated loop port (TL_port). A port that connects to a private loop and allows connectivity between the private loop devices and off loop devices (devices not connected to that particular TL_port).

Transmission Control Protocol (TCP). A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packed-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

trap. In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

trap recipient. Receiver of a forwarded Simple Network Management Protocol (SNMP) trap. Specifically, a trap receiver is defined by an Internet Protocol (IP) address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

TSR program. See *terminate and stay resident program*.

uninterruptible power supply. A source of power from a battery that is installed between a computer system and its power source. The uninterruptible power supply keeps the system running if a commercial power failure occurs, until an orderly shutdown of the system can be performed.

user action events. Actions that the user takes, such as changes in the storage area network (SAN), changed settings, and so on.

worldwide port name (WWPN). A unique identifier for a switch on local and global networks.

worldwide name (WWN). A globally unique 64-bit identifier assigned to each Fibre Channel port.

WORM. See *write-once read-many*.

write-once read many (WORM). Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered.

WWN. See *worldwide name*.

zoning. (1) In Fibre Channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones. (2) A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.

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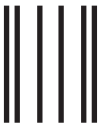

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