IBM TotalStorage FAStT

Problem Determination Guide

GC26-7642-00

IBM TotalStorage FAStT

Problem Determination Guide

GC26-7642-00

Note

Before using this information and the product it supports, be sure to read the general information in “Notices” on page 421.

First Edition (June 2004)

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

Contents

Figures

Tables

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.

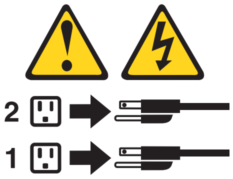
Läs säkerhetsinformationen innan du installerar den här produkten.

Caution notice

The following Caution notice is printed in English throughout this document. For a translation of this notice, see *IBM Safety Information*.

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.



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™ FAStT product line. Use this document for the following tasks:

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

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 FAStT 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 FAStT Hardware Maintenance Manual* and the *IBM TotalStorage FAStT Problem Determination Guide* are published as separate documents. In addition, the hardware maintenance information for new IBM FAStT 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 9 provides a series of flowcharts that help you to isolate and resolve hardware issues.

Chapter 4, "Introduction to FAStT MSJ," on page 55 introduces the IBM Fibre Array Storage Technology Management Suite Java (FAStT MSJ).

Chapter 5, "Introduction to SANavigator," on page 103 provides an overview of the functions of SANavigator.

Chapter 6, "PD hints: Common path/single path configurations," on page 135 provides problem determination hints for common path or single path configurations.

Chapter 7, "PD hints: RAID controller errors in the Windows NT event log," on page 137 provides problem determination hints for event log errors stemming from the RAID controller.

Chapter 8, “PD hints: Configuration types,” on page 151 provides the various configuration types that can be encountered.

Chapter 9, “PD hints: Passive RAID controller,” on page 157 provides instructions on how to isolate problems that occur in a passive RAID controller.

Chapter 10, “PD hints: Performing sendEcho tests,” on page 161 contains information on how to perform loopback tests.

Chapter 11, “PD hints: Tool hints,” on page 165 contains information on generalized tool usage.

Chapter 12, “PD hints: Drive side hints and RLS diagnostics,” on page 193 contains problem determination information for the drive or device side as well as read link status diagnostics.

Chapter 13, “PD hints: Hubs and switches,” on page 219 provides information on hub and switch problem determination.

Chapter 14, “PD hints: Wrap plug tests,” on page 225 provides information about tests that you can perform with wrap plugs.

Chapter 15, “Heterogeneous configurations,” on page 229 contains information on heterogeneous configurations.

Chapter 16, “Using IBM Fast!UTIL,” on page 233 provides detailed configuration information for advanced users who want to customize the configuration of the IBM fibre-channel PCI adapter (FRU 01K7354), the IBM FAStT host adapter (FRU 09N7292), and the IBM FAStT FC2-133 Adapter (FRU 24P0962).

Chapter 17, “Frequently asked questions about FAStT Storage Manager,” on page 241 contains frequently asked questions about FAStT Storage Manager.

Chapter 18, “pSeries supplemental problem determination information,” on page 251 discusses Fibre Channel specific problems and information that might be necessary to resolve them.

Chapter 19, MEL data format,″ on page 281 discusses MEL data format.

FAStT installation process overview

The following flow chart gives an overview of the FAStT hardware and the FAStT 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.

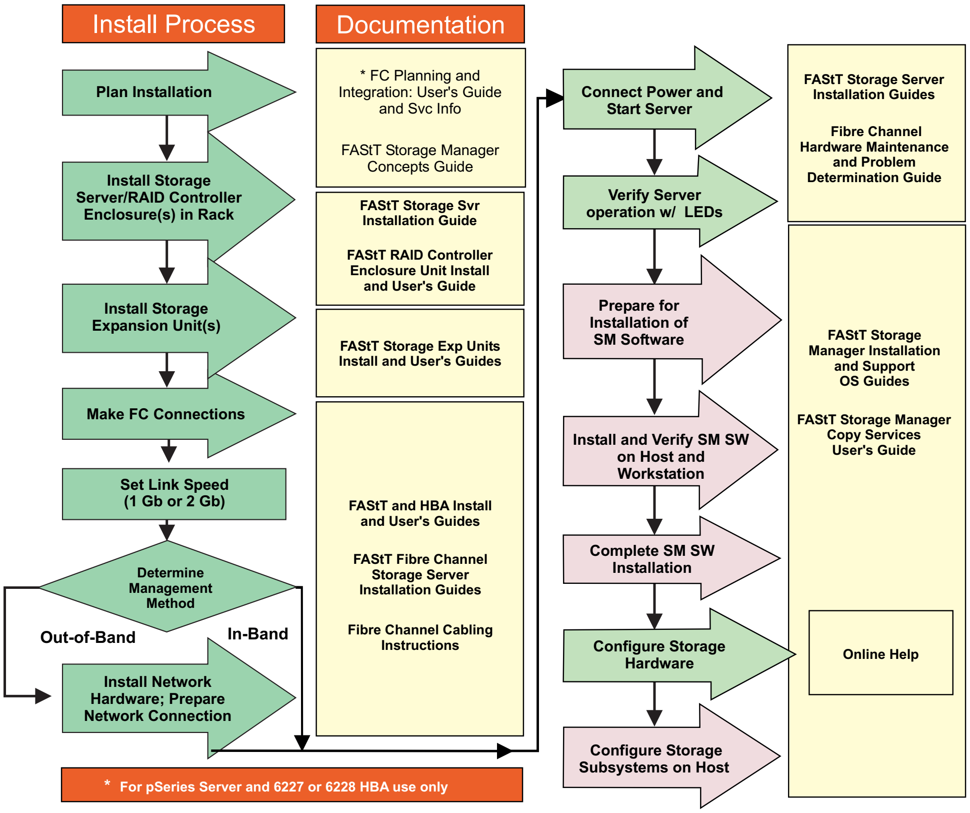

Install Process
Documentation
Plan Installation
Install Storage Server/RAID Controller Enclosure(s) in Rack
Install Storage Expansion Unit(s)
Make FC Connections
Set Link Speed (1 Gb or 2 Gb)
Determine Management Method
Out-of-Band
In-Band
Install Network Hardware; Prepare Network Connection
* FC Planning and Integration: User's Guide and Svc Info
FAStT Storage Manager Concepts Guide
FAStT Storage Svr Installation Guide
FAStT RAID Controller Enclosure Unit Install and User's Guide
FAStT Storage Exp Units Install and User's Guides
FAStT and HBA Install and User's Guides
FAStT Fibre Channel Storage Server Installation Guides
Fibre Channel Cabling Instructions
* For pSeries Server and 6227 or 6228 HBA use only
Connect Power and Start Server
Verify Server operation w/ LEDs
Prepare for Installation of SM Software
Install and Verify SM SW on Host and Workstation
Complete SM SW Installation
Configure Storage Hardware
Configure Storage Subsystems on Host
FAStT Storage Server Installation Guides
Fibre Channel Hardware Maintenance and Problem Determination Guide
FAStT Storage Manager Installation and Support OS Guides
FAStT Storage Manager Copy Services User's Guide
Online Help

Figure 1. Installation process flow by current publications

FAStT Storage Server publications

The following tables present an overview of the FAStT900, FAStT700, FAStT600 and FAStT100 Fibre Channel Storage Server product libraries, as well as other related documents. Each table lists documents that are included in the libraries and what common tasks they address. Click on active links in the tables to access those documents currently available on the Internet. You can access documentation for the other FAStT products at the following Web site:

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

FAStT900 Fibre Channel Storage Server library

Table 1 associates each document in the FAStT900 Fibre Channel Storage Server library with its related common user tasks.

Table 1. TotalStorage FAStT900 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 FAStT900 Installation and Support Guide, GC26-7530	✓	✓		✓		

Table 1. TotalStorage FAStT900 Fibre Channel Storage Server document titles by user tasks (continued)

Title	**User Tasks**					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT900 Fibre Channel Cabling Instructions, 24P8135	✓	✓				
IBM TotalStorage FAStT900 Storage Server User's Guide, GC26-7534				✓	✓	✓
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM TotalStorage FAStT900 Rack Mounting Instructions, 19K0900	✓	✓				
IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✓	✓			✓	✓
IBM FAStT Management Suite Java User's Guide, 32P0081					✓	✓
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual, GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT700 Fibre Channel Storage Server library

Table 2 associates each document in the FAStT700 Fibre Channel Storage Server library with its related common user tasks.

Table 2. TotalStorage FAStT700 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 FAStT700 Installation and Support Guide, 32P0171	✓	✓		✓		
IBM FAStT700 Fibre Channel Cabling Instructions, 32P0343	✓	✓				
IBM FAStT700 Fibre Channel Storage Server User's Guide, 32P0341				✓	✓	✓
IBM FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FAStT Management Suite Java User's Guide, 32P0081					✓	✓
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual, GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT600 Fibre Channel Storage Server library

Table 3 associates each document in the FAStT600 Fibre Channel Storage Server library with its related common user tasks.

Table 3. TotalStorage FAStT600 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 FAStT600 Fibre Channel Storage Server Installation and User's Guide, GC26-7531	✓	✓		✓		
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual, GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAStT600 Rack Mounting Instructions, 24P8125	✓	✓				
IBM TotalStorage FAStT600 Cabling Instructions, 24P8126	✓	✓				

FAStT100 Storage Server library

Table 4 associates each document in the FAStT100 Storage Server library with its related common user tasks.

Table 4. TotalStorage FAStT100 Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM TotalStorage FAStT100 Storage Server Installation, User's, and Maintenance Guide, GC26-7641	✓	✓		✓		✓

Table 4. TotalStorage FAStT100 Storage Server document titles by user tasks (continued)

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT100 Fibre Channel Cabling Instructions, 248973	✓	✓				
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual, GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT-related hardware publications

Table 5 associates each of the following documents related to FAStT operations with its related common user tasks.

Table 5. TotalStorage FAStT related document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM Safety Information, P48P9741					✓	
IBM TotalStorage FAStT EXP100 Storage Expansion Unit Release Notes, GC26–7619	✓	✓				
IBM TotalStorage FAStT EXP100 Storage Expansion Unit Installation and Users Guide, GC26–7601	✓	✓		✓	✓	✓
Fibre Channel Solutions - IBM FAStT EXP500 Installation and User's Guide, 59p5637	✓	✓		✓	✓	✓
IBM EXP700 Storage Expansion Unit Installation and User's Guide, 32P0178	✓	✓		✓	✓	✓
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✓				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

FAStT Storage Manager Version 8.4 publications

Table 6 on page xxix associates each document in the FAStT Storage Manager library with its related common user tasks.

Table 6. TotalStorage FAStT Storage Manager Version 8.4 titles by user tasks

Title	**User Tasks**					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT Storage Manager 8.4x Installation and Support Guide for Intel-based Operating System Environments, GC26-7621	✓		✓	✓		
IBM TotalStorage FAStT Storage Manager 8.4x Installation and Support Guide for AIX®, UNIX, and Solaris, GC26-7622	✓		✓	✓		
IBM TotalStorage FAStT Storage Manager Copy Services User's Guide, GC26-7561	✓		✓	✓	✓	
IBM FAStT Storage Manager Script Commands (see product CD)				✓		
IBM TotalStorage FAStT Fibre Channel Hard Drive and Storage Expansion Enclosure Installation and Migration Guide, GC26-7639	✓	✓		✓		
IBM TotalStorage FAStT Storage Manager Concepts Guide, GC26-7560	✓	✓	✓	✓	✓	✓

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 IBM Support Web site:
  www.ibm.com/storage/techsup.htm
- 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 your 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 for using 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 FAStT information, go to the following Web site:
  www.ibm.com/storage/techsup.htm

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 the IBM IntelliStation information, go to the following Web site:
  www.ibm.com/pc/intellistation/
- For the latest information about operating system and HBA support, clustering support, SAN fabric support, and FAStT Storage Manager feature support, see the TotalStorage FAStT Interoperability Matrix at the following Web site:

  www.storage.ibm.com/disk/FAStT/pdf/0217-03.pdf

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.

See the *IBM TotalStorage FAStT Hardware Maintenance Manual* for environmental specifications of the various FAStT storage server models.

How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this document, you can submit them in one of the following ways:

- E-mail

  Submit your comments electronically to:

  starpubs@us.ibm.com

  Be sure to include the name and order number of the document and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.
- Mail or fax

  Fill out the Readers' Comments form (RCF) at the back of this document and return it by mail or fax (1-408-256-0488) or give it to an IBM representative. If the RCF has been removed, you can address your comments to:

  International Business Machines Corporation
  Information Development
  Department GZW
  9000 South Rita Road
  Tucson, Arizona 85744–0001
  U.S.A

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

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 FAStT 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

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 9.

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 9 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 has now been integrated in the Fast!UTIL utility that can be invoked during system POST. Depending on the BIOS level or the type of adapter, the Alt+Q or Ctrl+Q key sequence starts the Fast!UTIL utility. (For more information on Fast!UTIL, see Chapter 16, “Using IBM Fast!UTIL,” on page 233.) The Loopback Data Test is a menu item in the utility. The Loopback Data Test can also be run from the FAStT MSJ diagnostics. (For more information on FAStT MSJ, see Chapter 4, “Introduction to FAStT MSJ,” on page 55.)

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 FAStT700 storage server and the IBM FAStT 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 FAStT700 storage server)
  - 05N6766 (coupler packaged with FAStT700 storage server)

Note: Many illustrations in this document depict the SC wrap plug. Substitute the LC wrap plug for the FAStT700 storage server (1742) and the IBM FAStT FC-2 HBA (2300).

SANavigator

SANavigator is a SAN discovery tool that displays link, device, and interconnecting problems. It monitors the health of the SAN and identifies problem areas. It provides a topological view of the SAN, displaying the devices, the interconnection, and the switch and controller port assignments. The SAN discovery is accomplished out-of-band through the network and (optionally) in-band through the Fibre medium. The HBA API library (supplied) is required for in-band management.

Install SANavigator to help you monitor your SAN and diagnose problems. See Chapter 5, “Introduction to SANavigator,” on page 103 for further details.

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 55 for further details on FAStT MSJ.

IBM FAStT Storage Manager 7.2 and 8.xx

The newest versions of FAStT Storage Manager (versions 7.2 and 8.xx) enable you to monitor events and manage storage in a heterogeneous environment. These new diagnostic and storage management capabilities fulfill the requirements of a true SAN, but also increase complexity and the potential for problems. Chapter 15, “Heterogeneous configurations,” on page 229 shows examples of heterogeneous configurations and the associated profiles from the FAStT 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 FAStT 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. Previous versions of the IBM FAStT Storage Manager software did not have the Event Monitor and required that the Enterprise Management window be open in order to monitor the storage subsystems and receive alerts. The Event Monitor is a separate program bundled with the FAStT Storage Manager client software; it is a background task that runs independently of the Enterprise Management window.

In addition to these enhancements, controller run-time diagnostics have been implemented for Storage Controllers types 3526, 3542, 3552, and 1742. The FAStT Storage Manager version 8.xx also implements Read Link Status (RLS), which enables diagnostics to aid in troubleshooting drive-side problems. FAStT 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 55.
- If SANavigator is not installed, install it to assist you in isolating problems. For more information, see Chapter 5, “Introduction to SANavigator,” on page 103. After SANavigator is installed, export the SAN to capture its current state. This will be useful in later diagnoses.

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 6, “Specific problem areas” on page 6, 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/

SANavigator automatically links to the xSeries Fibre Channel Solutions Web site. Right-click the desired device (a host bus adapter or a controller) and select IBM Solutions 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 11.
- **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 12.
- **Startup long delay**

  If at startup you experience a long delay (more than 10 minutes), go to “Boot-up Delay PD map” on page 13.
- **Systems Management or FAStT 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 14.

Specific problem areas

- **FAStT Storage Manager**

  See “Systems Management PD map” on page 14.

  See also Chapter 17, “Frequently asked questions about FAStT Storage Manager,” on page 241.
- **Port configuration (Linux)**

  See “Linux Port Configuration PD map 1” on page 41.
- **Windows NT Event Log**

  See Chapter 7, “PD hints: RAID controller errors in the Windows NT event log,” on page 137.
- **Indicator lights on devices**

  See “Indicator lights and problem indications” on page 202.
- **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 13, “PD hints: Hubs and switches,” on page 219.
- **Cluster Administrator**
- **IBM pSeries servers with 6228 HBAs**

  “pSeries PD map” on page 44

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 10.

  In order to break larger configurations into manageable units for debugging, see Chapter 8, “PD hints: Configuration types,” on page 151.
- **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 17.
- **Fibre Path PD**

If you determine that a problem exists within the Fibre Path, go to “Fibre Path PD map 1” on page 20.

- **Device PD**

  If you determine that a problem exists within a device, go to “Device PD map 1” on page 26.

- **SANavigator PD**

  If SANavigator is installed (as is strongly suggested), go to “Diagnosing with SANavigator PD map 1” on page 28.

Chapter 3. Problem determination maps

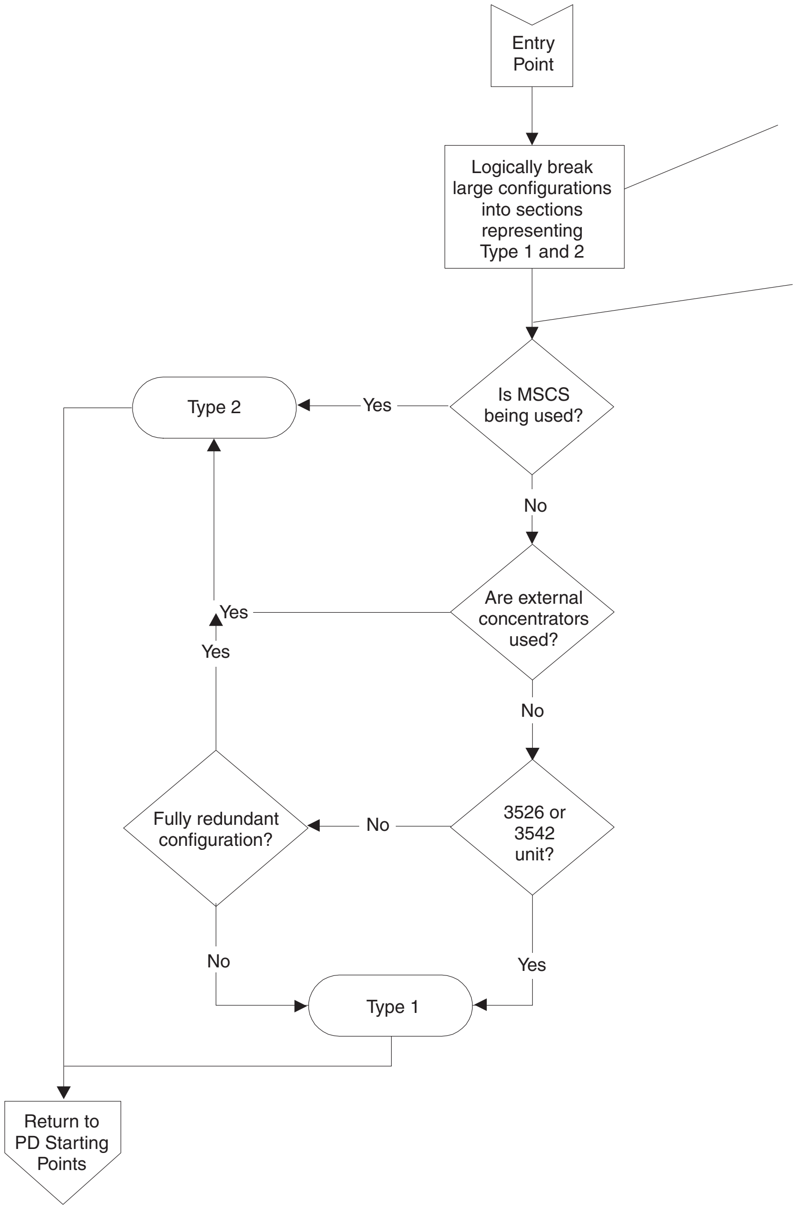
This chapter contains a series of PD maps that guide you through problem isolation and resolution. Before you use any of the following PD maps, you should have reviewed the information in Chapter 2, “Problem determination starting points,” on page 3.

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.

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


Entry Point
Logically break large configurations into sections representing Type 1 and 2
Is MSCS being used?
Yes
Type 2
No
Are external concentrators used?
Yes
Yes
No
3526 or 3542 unit?
No
Fully redundant configuration?
No
Yes
Type 1
Return to PD Starting Points

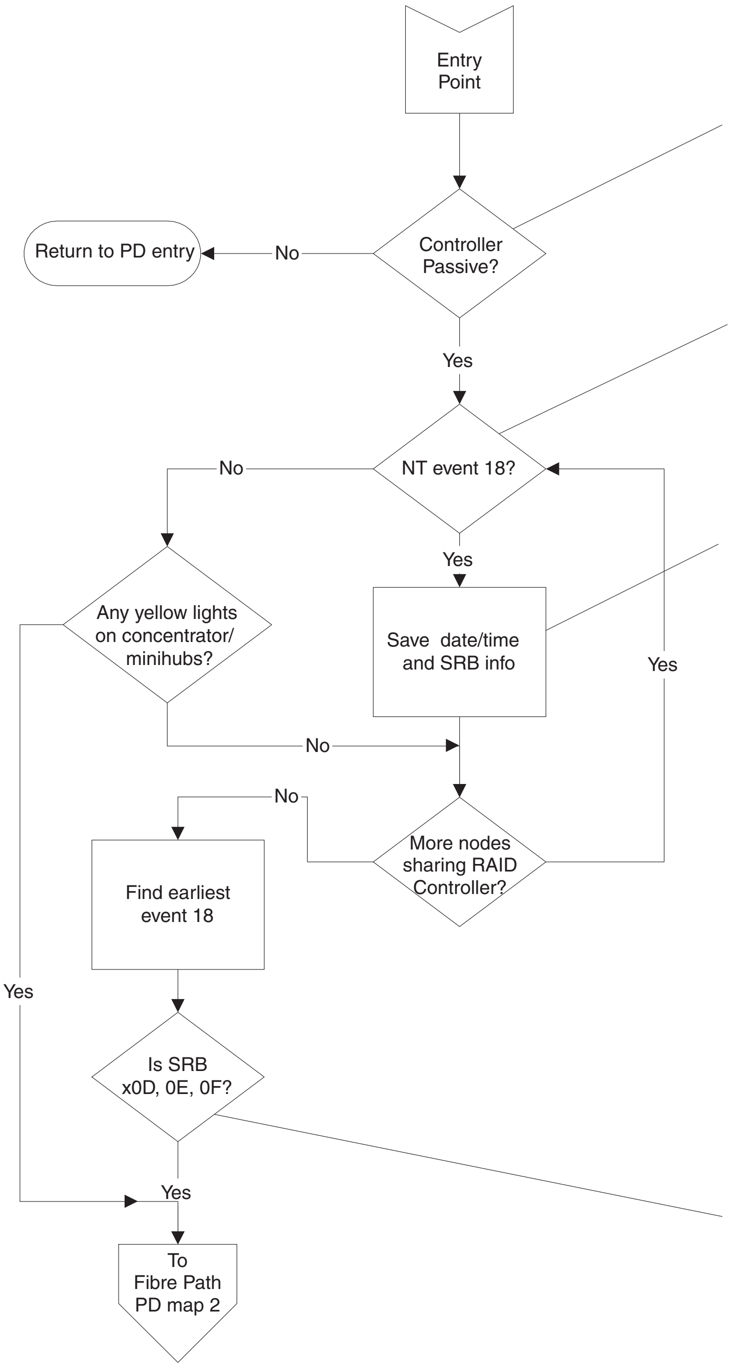
Additional information: See Chapter 8, “PD hints: Configuration types,” on page 151.

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 6; “Cluster Resource PD map” on page 12.


Controller Passive PD map

Additional information: See Chapter 9, “PD hints: Passive RAID controller,” on page 157.

Additional information: Use MEL information to find the approximate fail time in the Windows NT Event Log. See ″MEL data format″ on page 281.

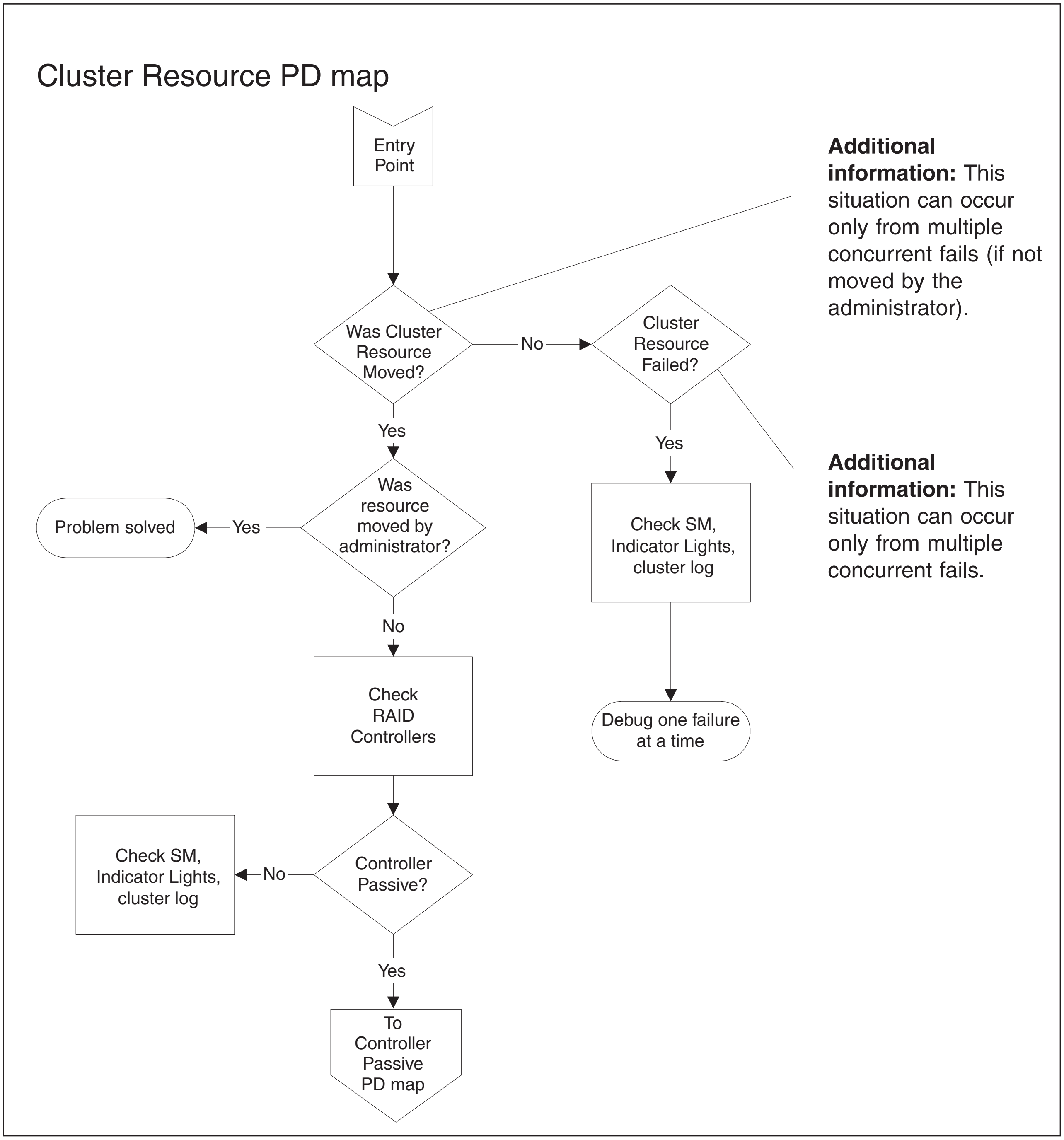
Additional information: See Chapter 7, “PD hints: RAID controller errors in the Windows NT event log,” on page 137.

Additional information: See Chapter 7, “PD hints: RAID controller errors in the Windows NT event log,” on page 137.

To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 21.

Cluster Resource PD map

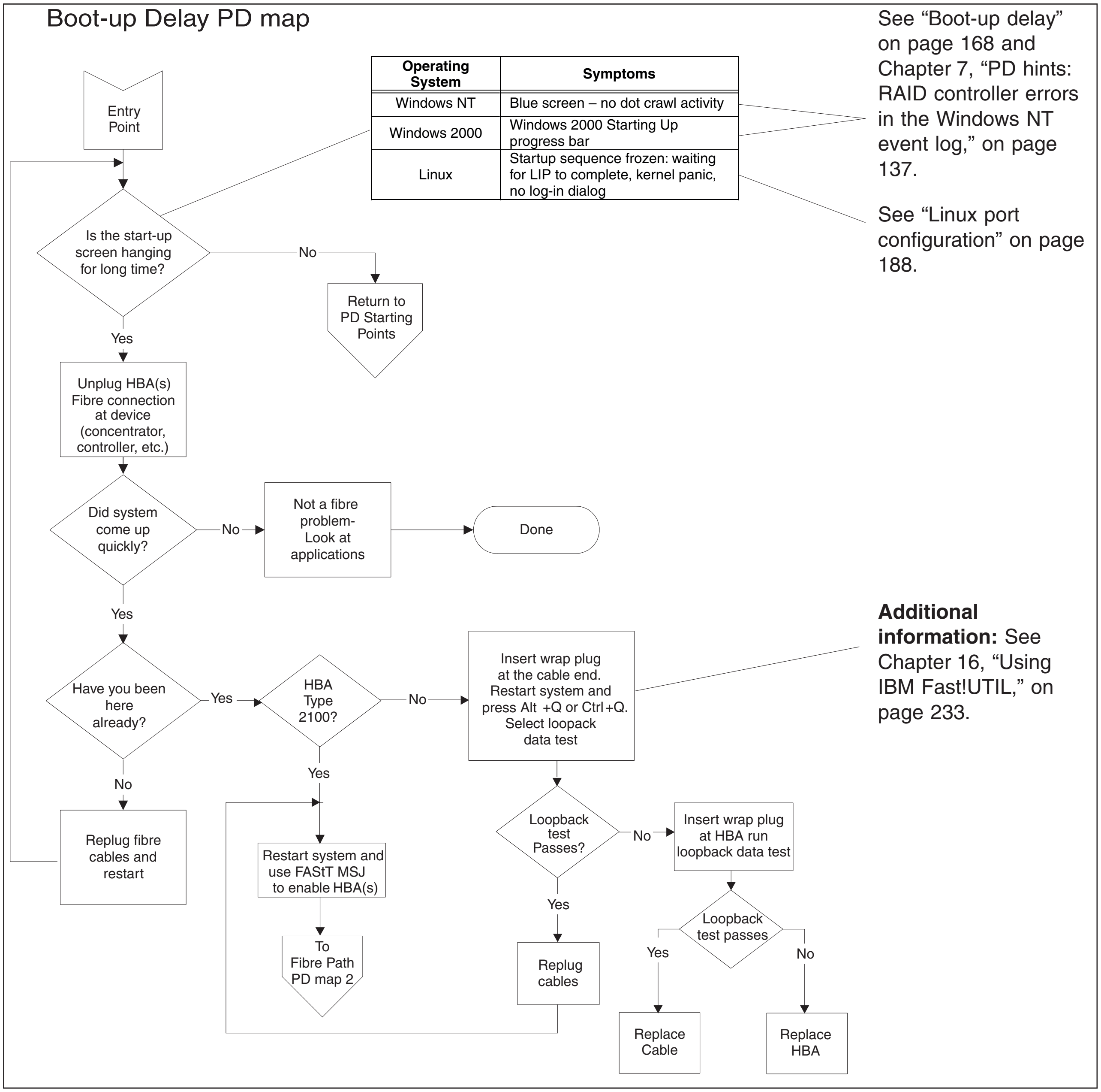
From: “General symptoms” on page 6.


Cluster Resource PD map
Entry Point
Was Cluster Resource Moved?
No
Cluster Resource Failed?
Yes
Yes
Was resource moved by administrator?
Yes
Problem solved
No
Check RAID Controllers
Check SM, Indicator Lights, cluster log
Debug one failure at a time
Controller Passive?
No
Check SM, Indicator Lights, cluster log
Yes
To Controller Passive PD map
Additional information: This situation can occur only from multiple concurrent fails (if not moved by the administrator).
Additional information: This situation can occur only from multiple concurrent fails.

To see the Controller Passive PD map, go to “RAID Controller Passive PD map” on page 11.

Boot-up Delay PD map

From: “General symptoms” on page 6.


Boot-up Delay PD map

Operating System	Symptoms
Windows NT	Blue screen – no dot crawl activity
Windows 2000	Windows 2000 Starting Up progress bar
Linux	Startup sequence frozen: waiting for LIP to complete, kernel panic, no log-in dialog

See “Boot-up delay” on page 168 and Chapter 7, “PD hints: RAID controller errors in the Windows NT event log,” on page 137.

See “Linux port configuration” on page 188.

Additional information: See Chapter 16, “Using IBM Fast!UTIL,” on page 233.

Entry Point
Is the start-up screen hanging for long time?
No
Return to PD Starting Points
Yes
Unplug HBA(s) Fibre connection at device (concentrator, controller, etc.)
Did system come up quickly?
No
Not a fibre problem- Look at applications
Done
Yes
Have you been here already?
Yes
HBA Type 2100?
No
Insert wrap plug at the cable end. Restart system and press Alt +Q or Ctrl+Q. Select loopback data test
No
Replug fibre cables and restart
Yes
Restart system and use FAStT MSJ to enable HBA(s)
To Fibre Path PD map 2
Loopback test Passes?
No
Insert wrap plug at HBA run loopback data test
Yes
Replug cables
Loopback test passes
Yes
No
Replace Cable
Replace HBA

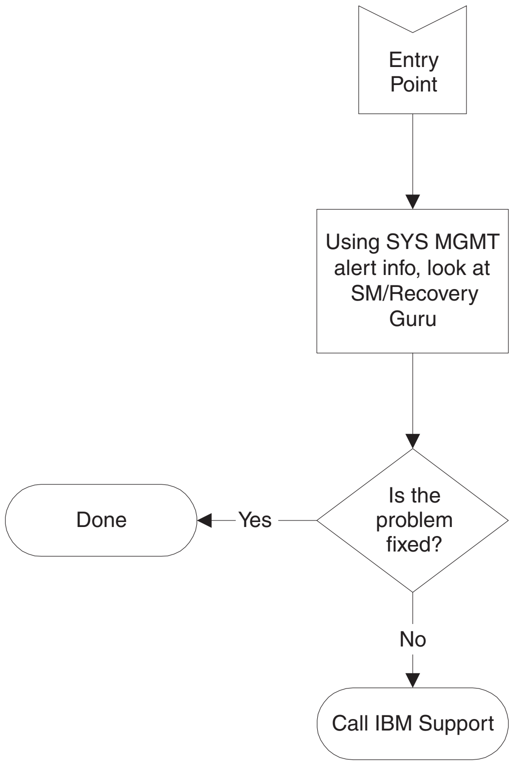
To return to the options for PD entry, go to page 3.

To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 21.

Systems Management PD map

From: “General symptoms” on page 6.

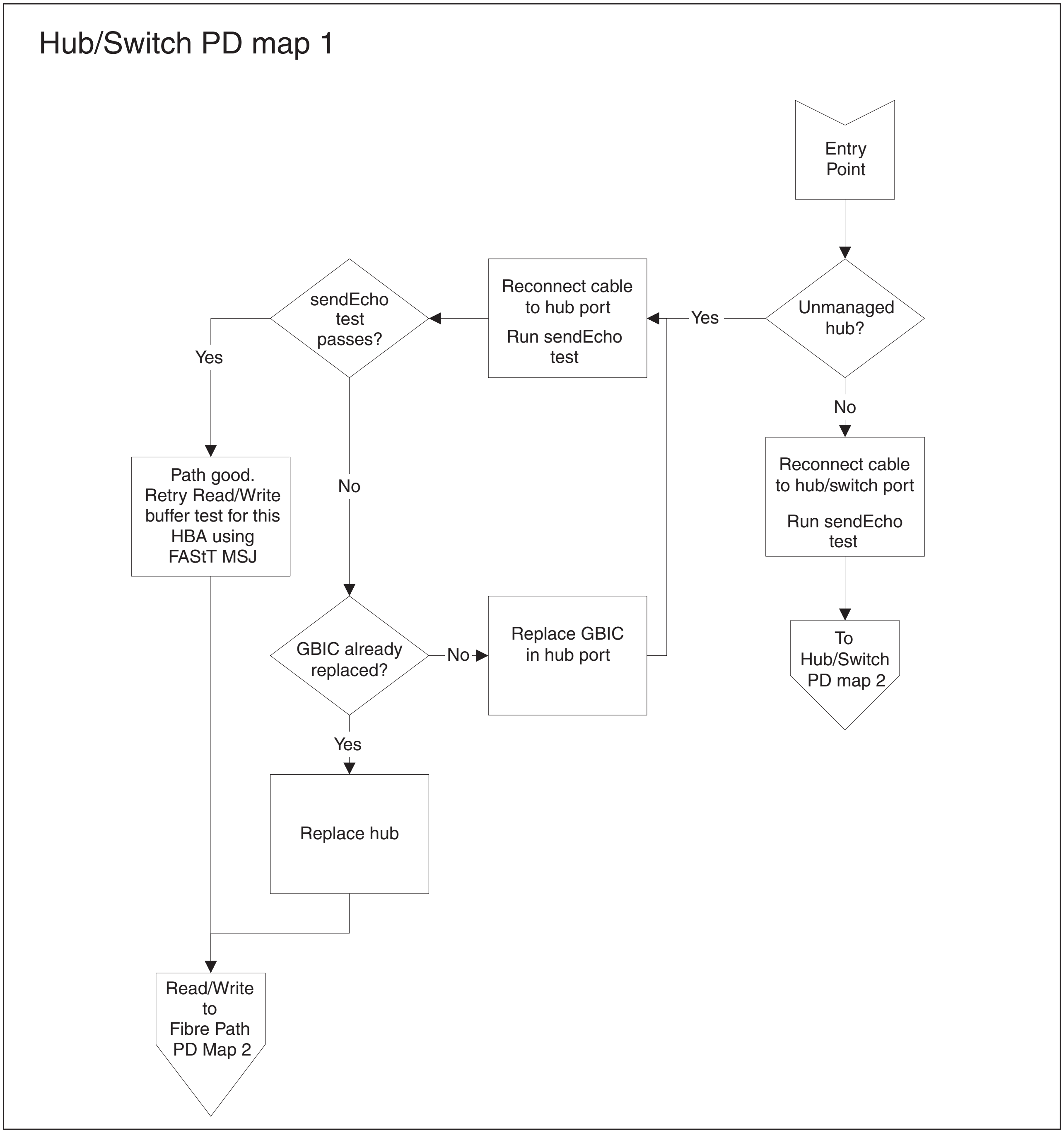
Systems Management



Additional information: See Chapter 17, “Frequently asked questions about FAStT Storage Manager,” on page 241.

Hub/Switch PD map 1

From: “PD maps and diagrams” on page 6; “Single Path Fail PD map 2” on page 23.



For information about sendEcho tests, see Chapter 10, “PD hints: Performing sendEcho tests,” on page 161.

For information about Read/Write Buffer tests, see Chapter 4, “Introduction to FAStT MSJ,” on page 55.

To see Hub/Switch PD map 2, go to “Hub/Switch PD map 2” on page 17.

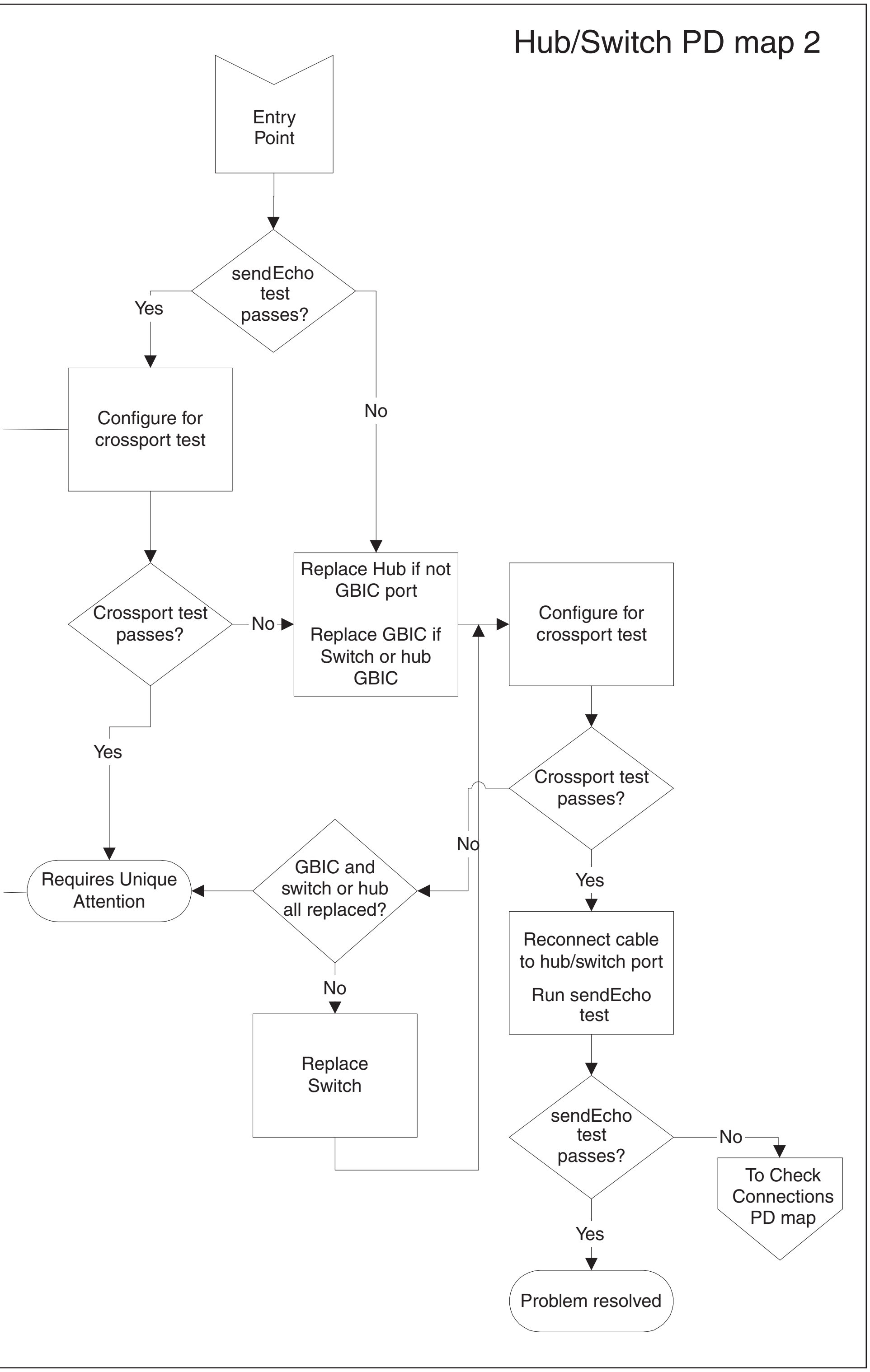
To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 21.

Hub/Switch PD map 2

From: “Hub/Switch PD map 1” on page 15.

Additional information: See Chapter 13, “PD hints: Hubs and switches,” on page 219.

Additional information: See Chapter 13, “PD hints: Hubs and switches,” on page 219.

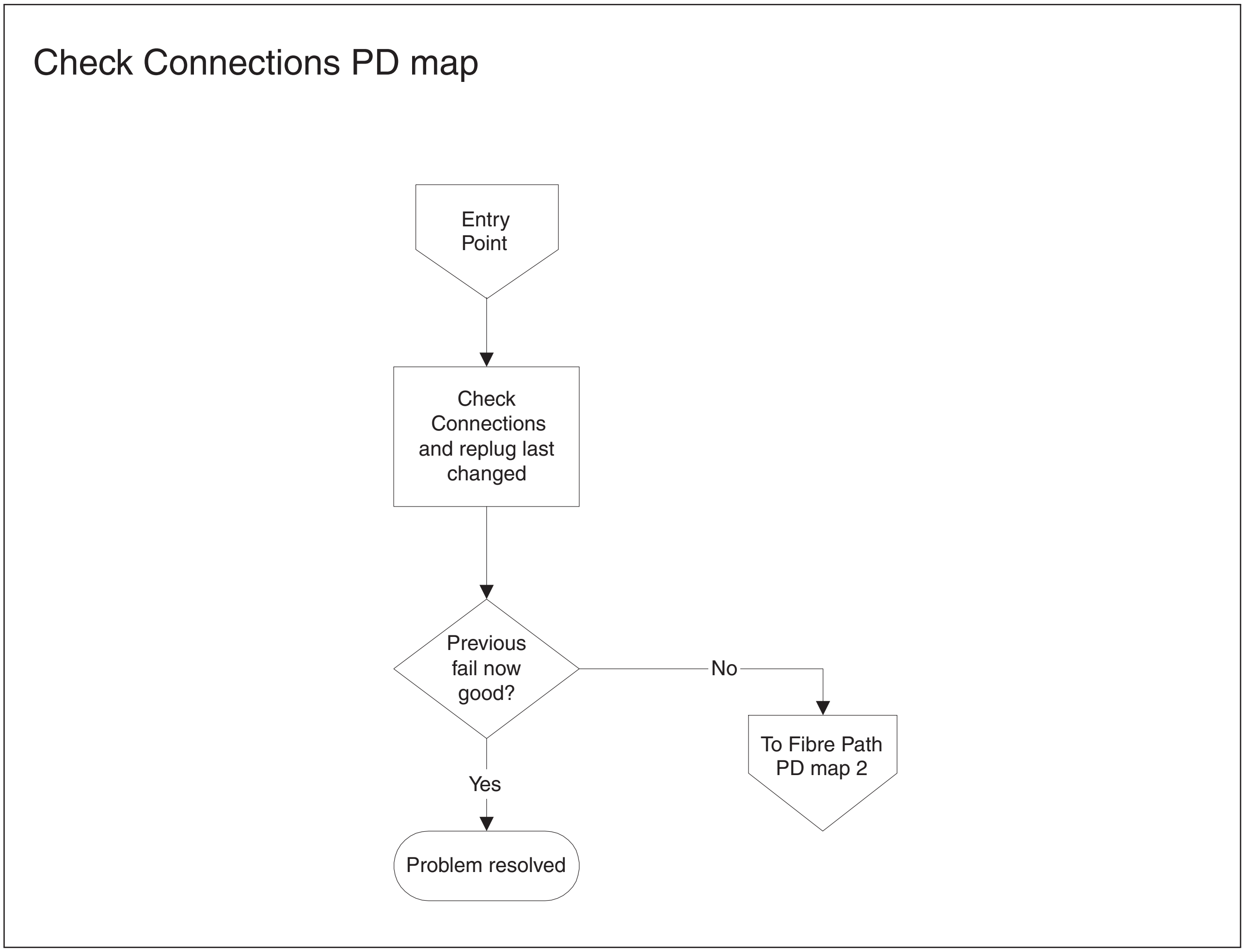

Hub/Switch PD map 2
Entry Point
sendEcho test passes?
Yes
No
Configure for crossport test
Crossport test passes?
No
Replace Hub if not GBIC port
Replace GBIC if Switch or hub GBIC
Configure for crossport test
Yes
Crossport test passes?
No
Requires Unique Attention
GBIC and switch or hub all replaced?
Yes
No
Replace Switch
Reconnect cable to hub/switch port
Run sendEcho test
sendEcho test passes?
No
To Check Connections PD map
Yes
Problem resolved

For information about sendEcho tests, see Chapter 10, “PD hints: Performing sendEcho tests,” on page 161.

To see the Check Connections PD map, see “Check Connections PD map” on page 19.

Check Connections PD map

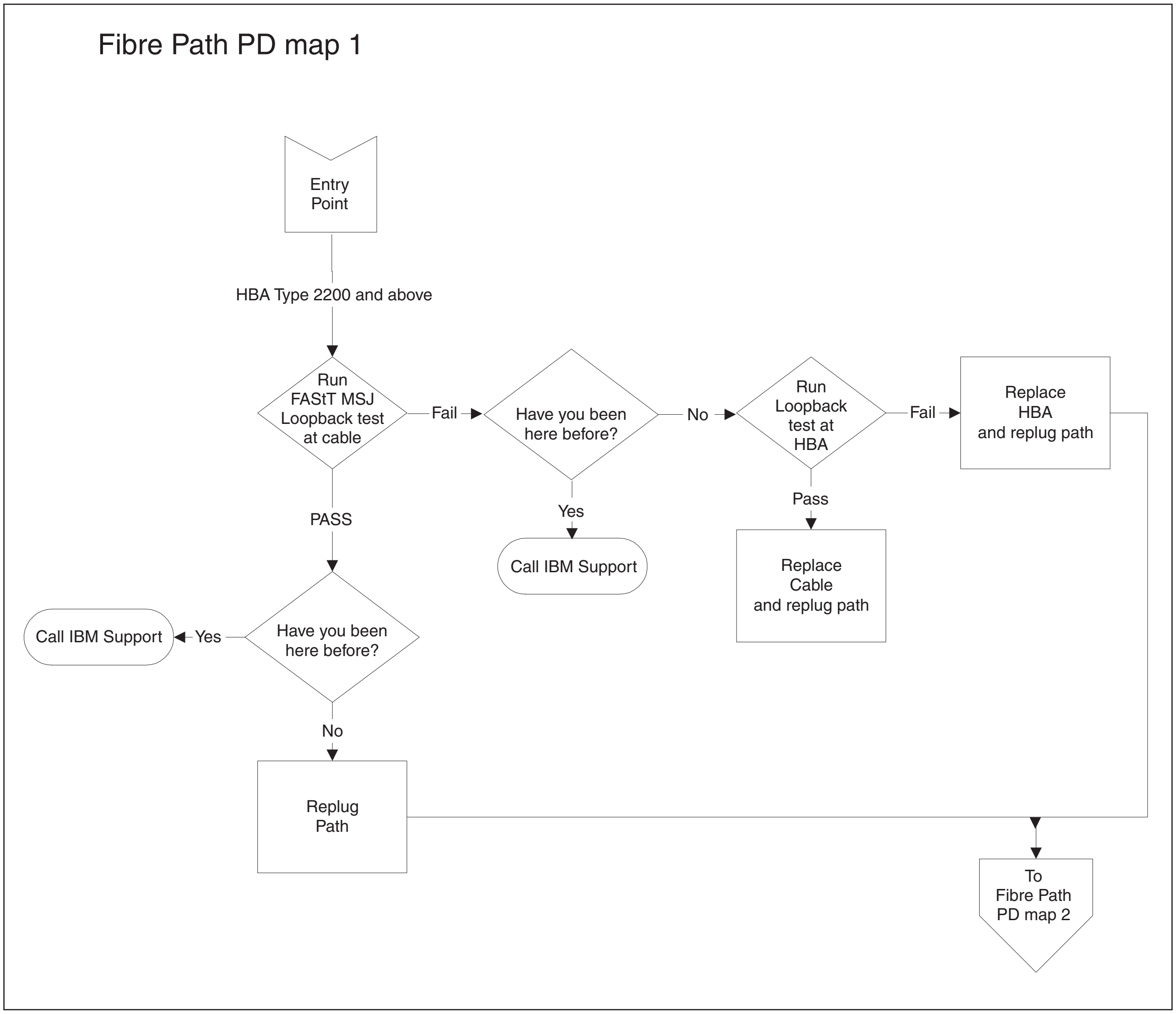
From: “Hub/Switch PD map 2” on page 17.



To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 21.

Fibre Path PD map 1

From: “Common Path PD map 2” on page 25; “Diagnosing with SANavigator PD map 2” on page 31.

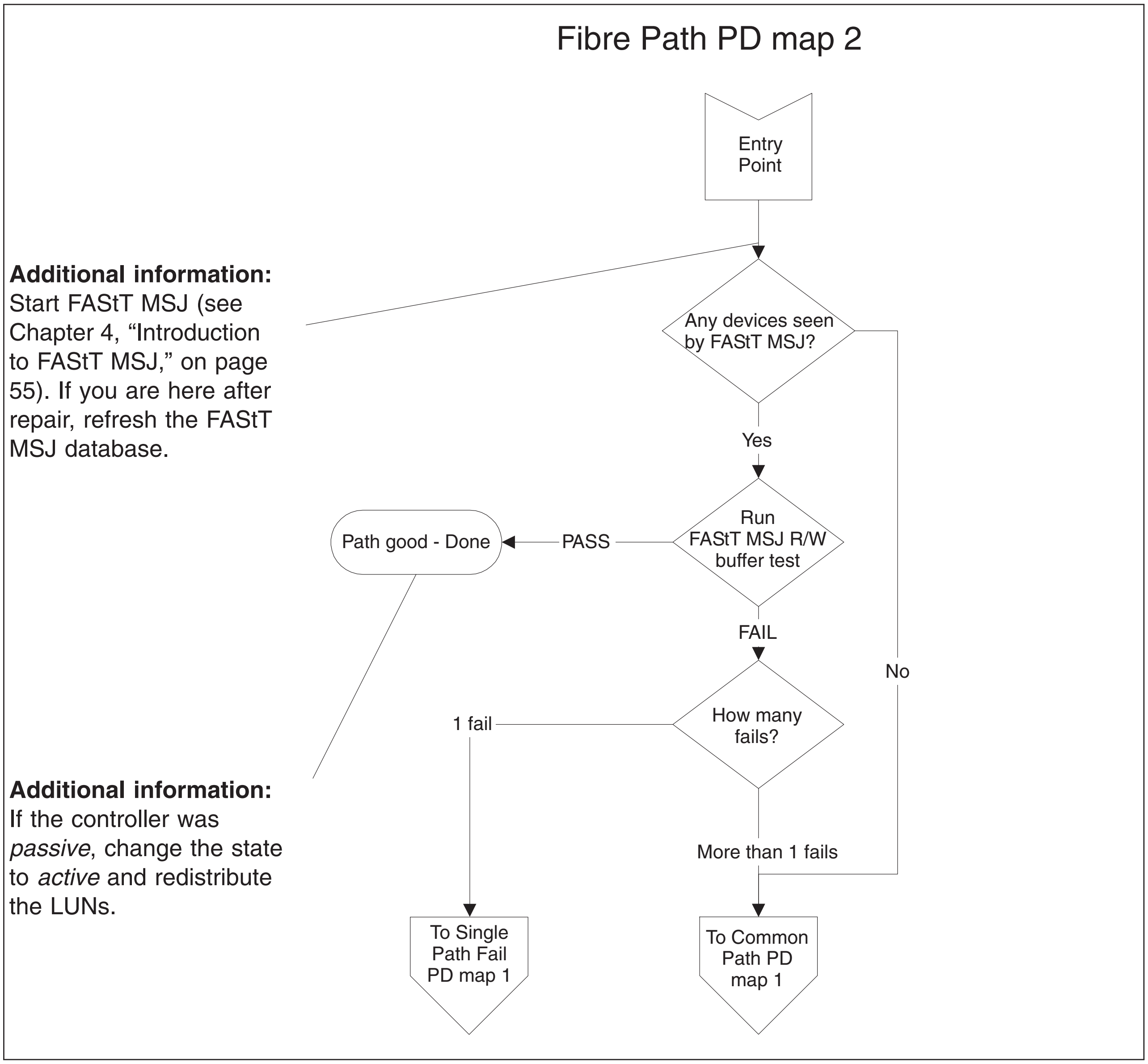


For information about how to run loopback tests, see Chapter 4, “Introduction to FAStT MSJ,” on page 55.

To see Fibre Path PD map 2, go to “Fibre Path PD map 2” on page 21.

Fibre Path PD map 2

From: “Fibre Path PD map 1” on page 20; “Check Connections PD map” on page 19; “RAID Controller Passive PD map” on page 11; “Boot-up Delay PD map” on page 13; “Hub/Switch PD map 1” on page 15; “Diagnosing with SANavigator PD map 2” on page 31.



Fibre Path PD map 2

Additional information: Start FAStT MSJ (see Chapter 4, “Introduction to FAStT MSJ,” on page 55). If you are here after repair, refresh the FAStT MSJ database.

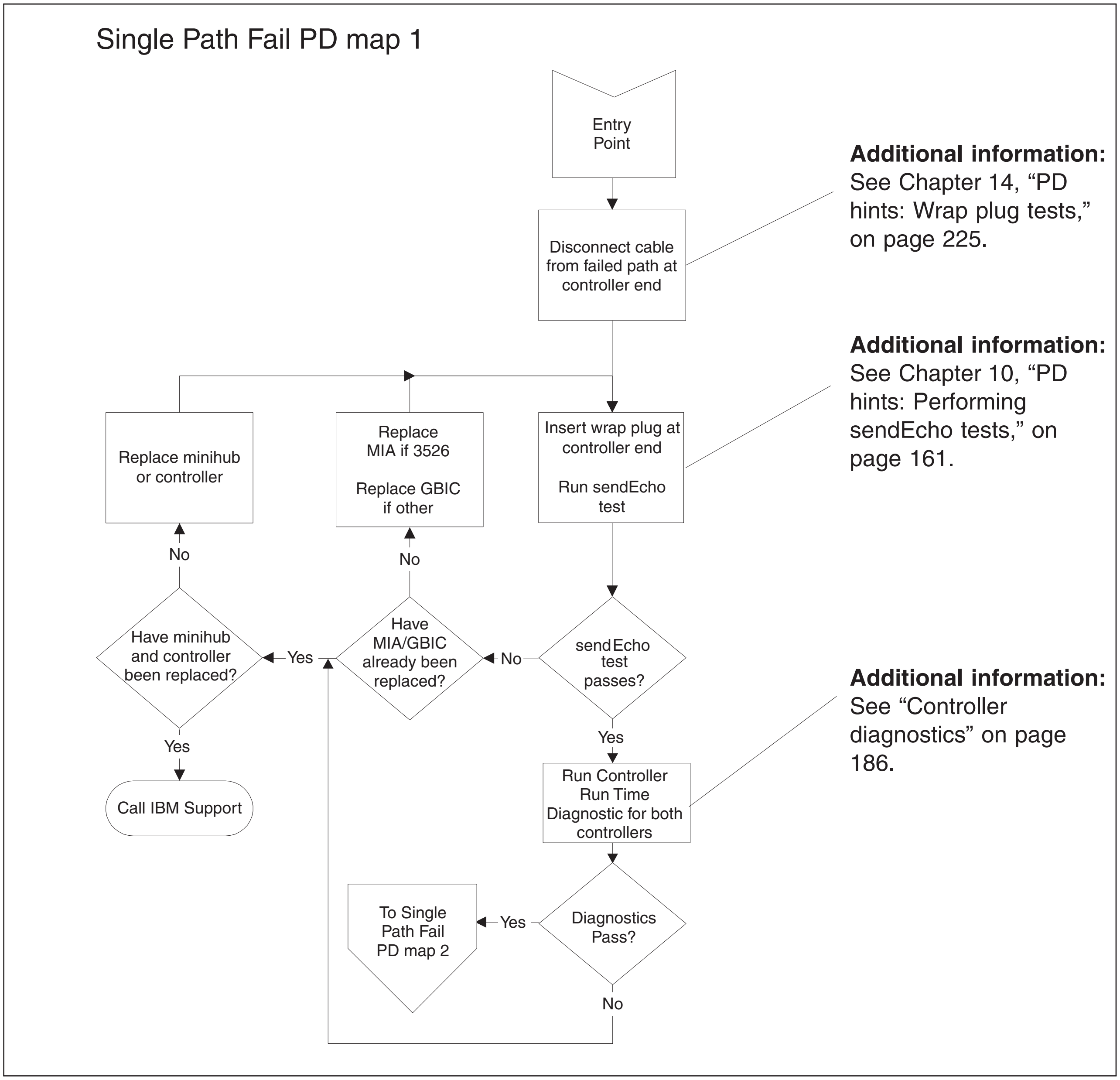
Additional information: If the controller was *passive*, change the state to *active* and redistribute the LUNs.

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

To see Common Path PD map 1, go to “Common Path PD map 1” on page 24.

Single Path Fail PD map 1

From: “Fibre Path PD map 2” on page 21; “Diagnosing with SANavigator PD map 1” on page 28; “Diagnosing with SANavigator PD map 3” on page 33.



Single Path Fail PD map 1

Entry Point
Disconnect cable from failed path at controller end
Insert wrap plug at controller end
Run sendEcho test
Replace minihub or controller
Replace MIA if 3526
Replace GBIC if other
No
No
Have minihub and controller been replaced?
Yes
Have MIA/GBIC already been replaced?
No
send Echo test passes?
Yes
Yes
Call IBM Support
Run Controller Run Time Diagnostic for both controllers
To Single Path Fail PD map 2
Yes
Diagnostics Pass?
No

Additional information: See Chapter 14, “PD hints: Wrap plug tests,” on page 225.

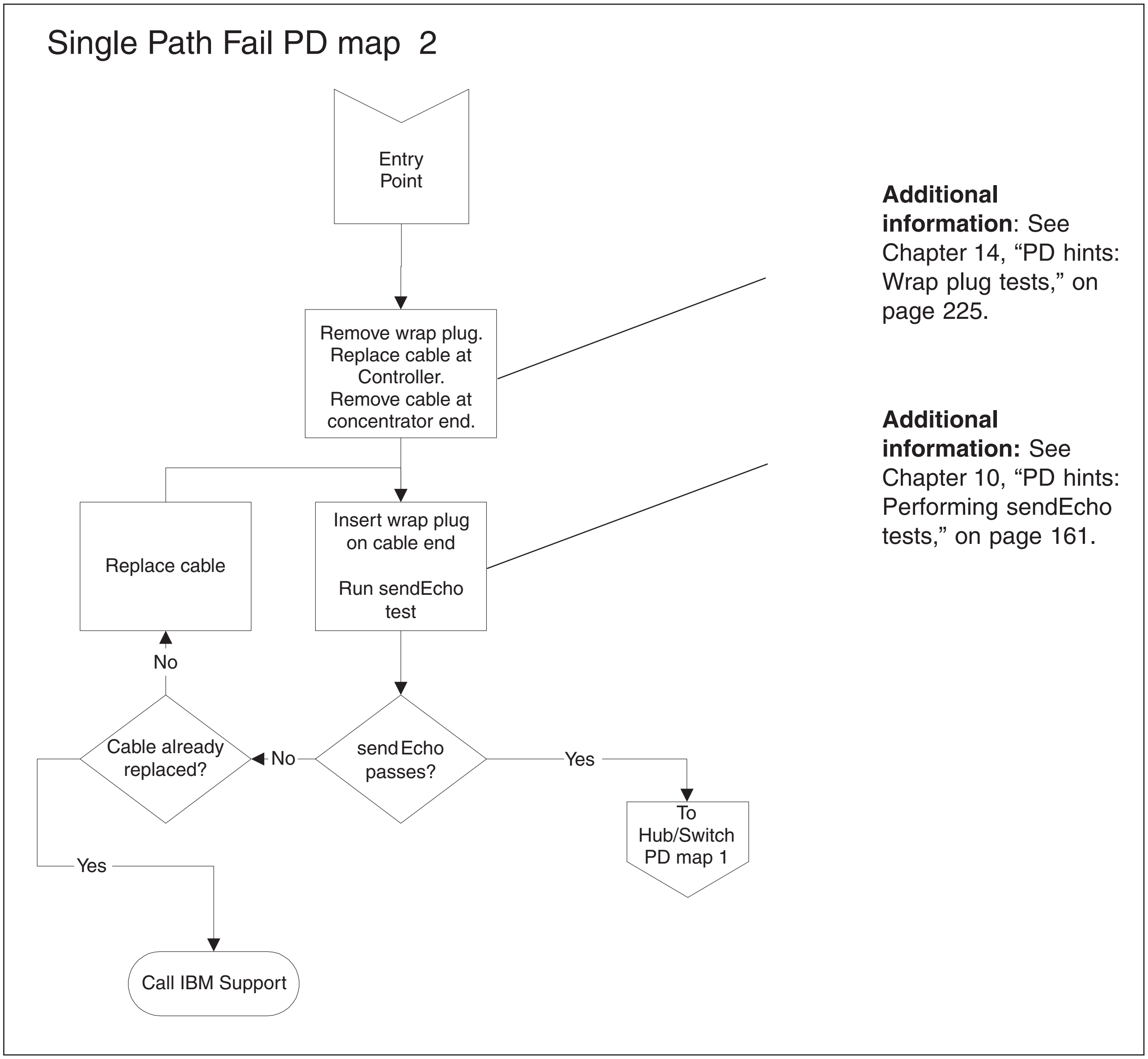
Additional information: See Chapter 10, “PD hints: Performing sendEcho tests,” on page 161.

Additional information: See “Controller diagnostics” on page 186.

To see Single Path Fail PD map 2, go to “Single Path Fail PD map 2” on page 23.

Single Path Fail PD map 2

From: "Single Path Fail PD map 1" on page 22.


Single Path Fail PD map 2
Entry Point
Remove wrap plug. Replace cable at Controller. Remove cable at concentrator end.
Replace cable
Insert wrap plug on cable end
Run sendEcho test
No
Cable already replaced?
No
send Echo passes?
Yes
To Hub/Switch PD map 1
Yes
Call IBM Support

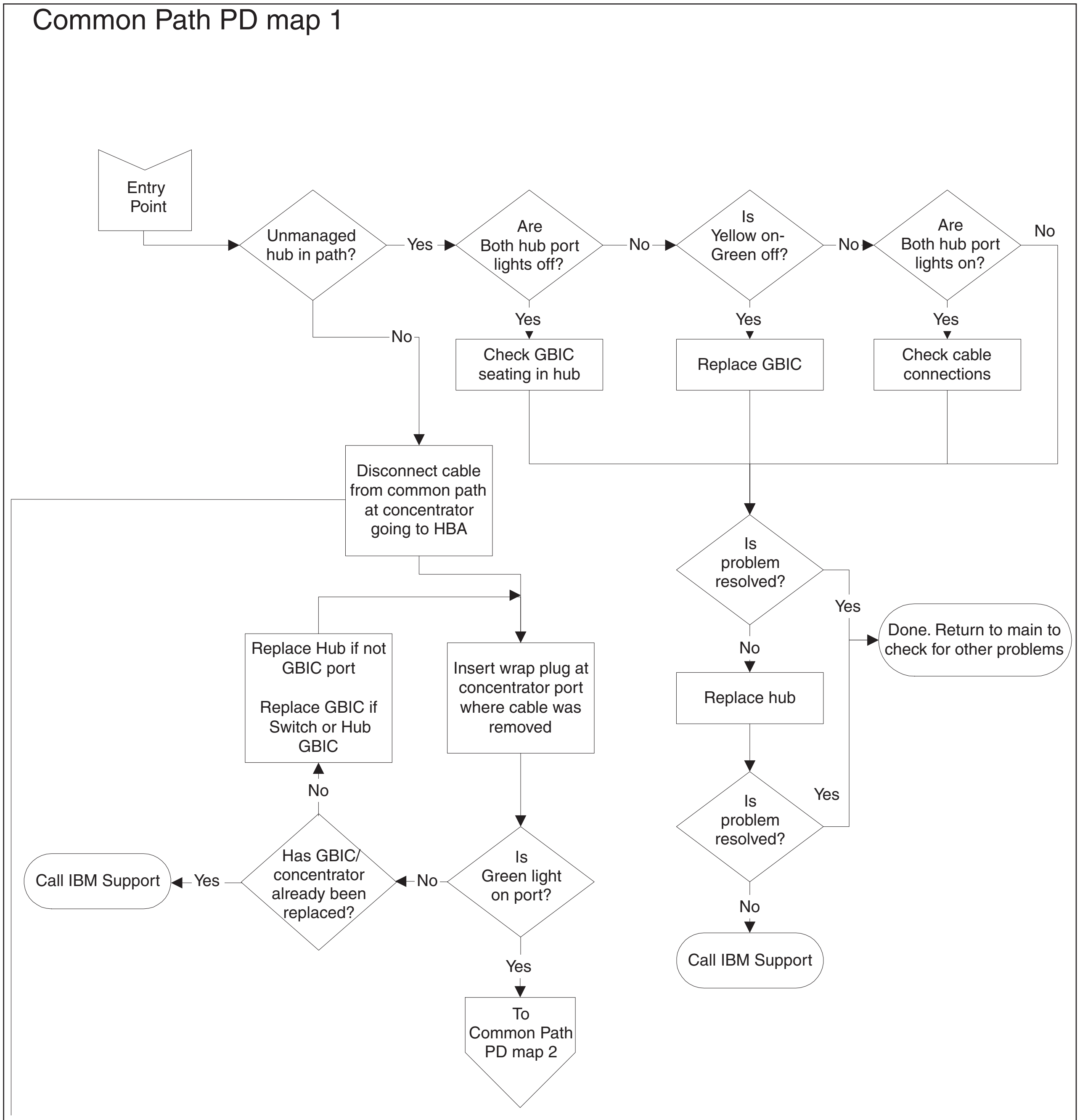
Additional information: See Chapter 14, "PD hints: Wrap plug tests," on page 225.

Additional information: See Chapter 10, "PD hints: Performing sendEcho tests," on page 161.

To see Hub/Switch PD map 1, go to "Hub/Switch PD map 1" on page 15.

Common Path PD map 1

From: “Fibre Path PD map 2” on page 21.

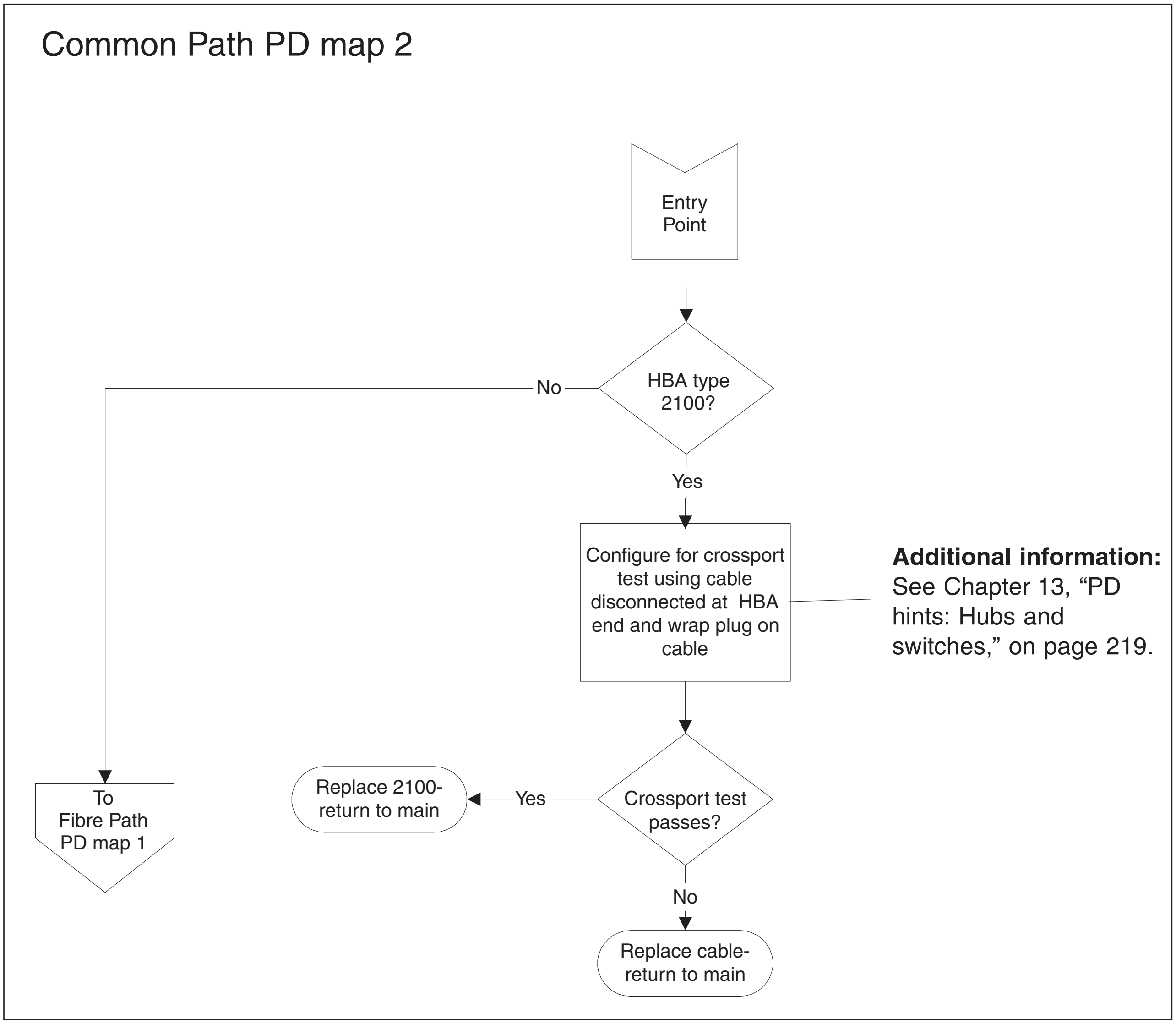

Common Path PD map 1
Entry Point
Unmanaged hub in path?
Yes
No
Are Both hub port lights off?
No
Is Yellow on-Green off?
No
Are Both hub port lights on?
No
Yes
Check GBIC seating in hub
Yes
Replace GBIC
Yes
Check cable connections
Disconnect cable from common path at concentrator going to HBA
Is problem resolved?
Yes
Done. Return to main to check for other problems
No
Replace hub
Is problem resolved?
Yes
No
Call IBM Support
Replace Hub if not GBIC port
Replace GBIC if Switch or Hub GBIC
Insert wrap plug at concentrator port where cable was removed
No
Call IBM Support
Yes
Has GBIC/ concentrator already been replaced?
No
Is Green light on port?
Yes
To Common Path PD map 2

Additional information: See Chapter 6, “PD hints: Common path/single path configurations,” on page 135.

To see Common Path PD map 2, go to “Common Path PD map 2” on page 25.

Common Path PD map 2

From: “Common Path PD map 1” on page 24; “Diagnosing with SANavigator PD map 1” on page 28.

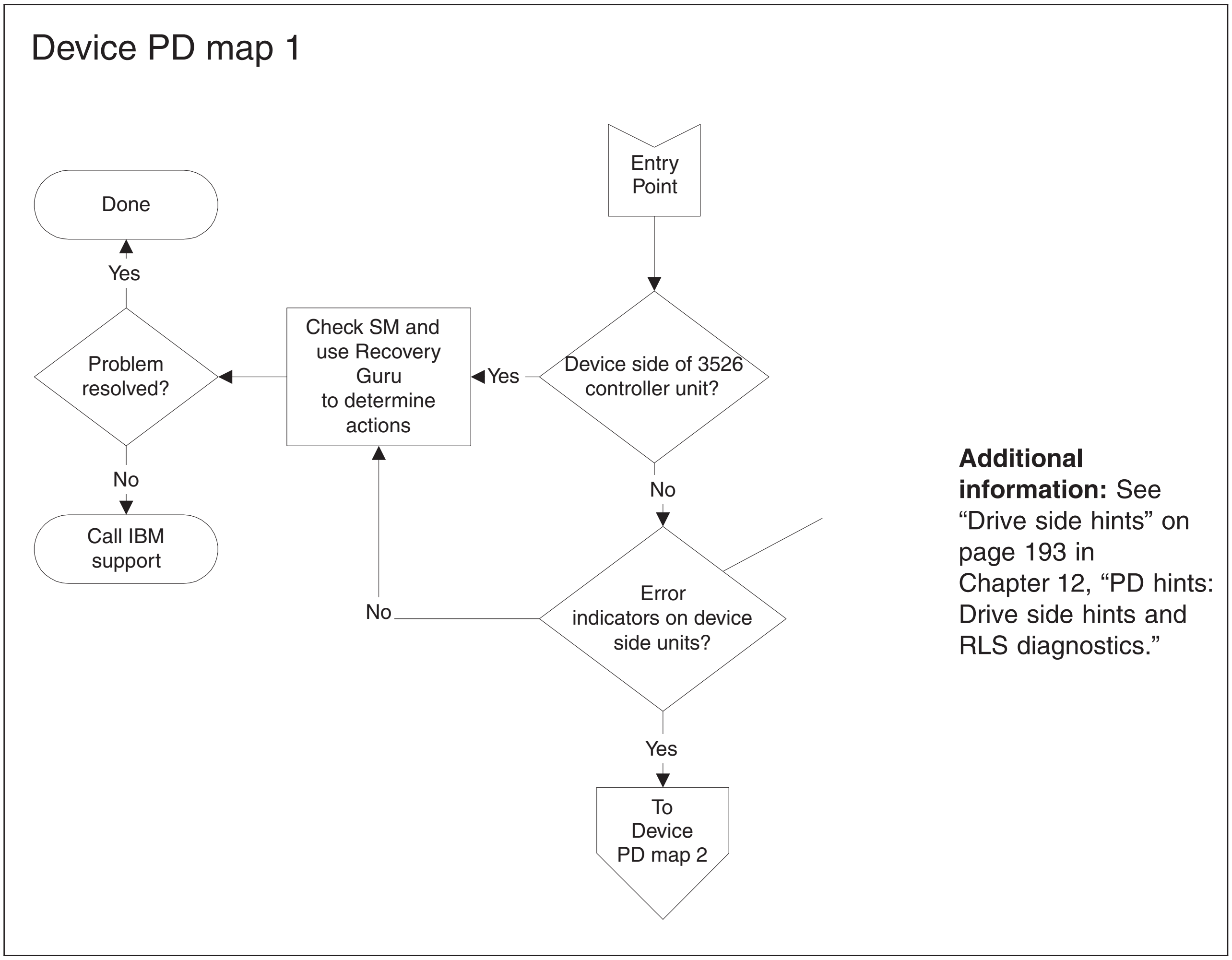

Common Path PD map 2
Entry Point
HBA type 2100?
No
Yes
Configure for crossport test using cable disconnected at HBA end and wrap plug on cable
Crossport test passes?
Yes
Replace 2100- return to main
No
Replace cable- return to main
To Fibre Path PD map 1

Additional information: See Chapter 13, “PD hints: Hubs and switches,” on page 219.

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

Device PD map 1

From: “PD maps and diagrams” on page 6.

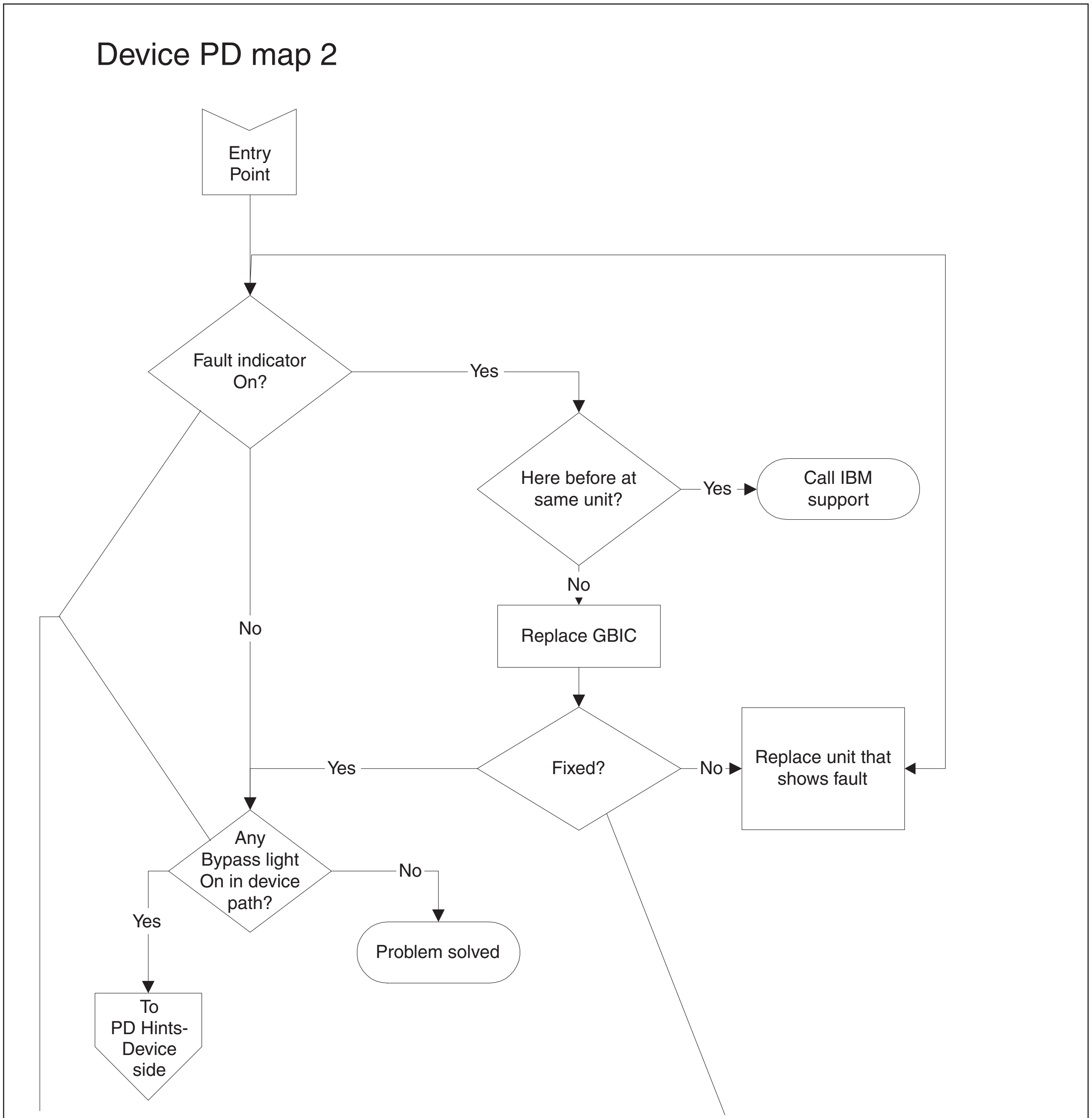

Device PD map 1
Entry Point
Device side of 3526 controller unit?
Yes
Check SM and use Recovery Guru to determine actions
Problem resolved?
Yes
Done
No
Call IBM support
No
Error indicators on device side units?
No
Yes
To Device PD map 2

Additional information: See “Drive side hints” on page 193 in Chapter 12, “PD hints: Drive side hints and RLS diagnostics.”

To see Device PD map 2, go to “Device PD map 2” on page 27.

Device PD map 2

From: “Device PD map 1” on page 26.



Additional information: See “Drive side hints” on page 193.

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 Chapter 12, “PD hints: Drive side hints and RLS diagnostics,” “Drive side hints” on page 193.

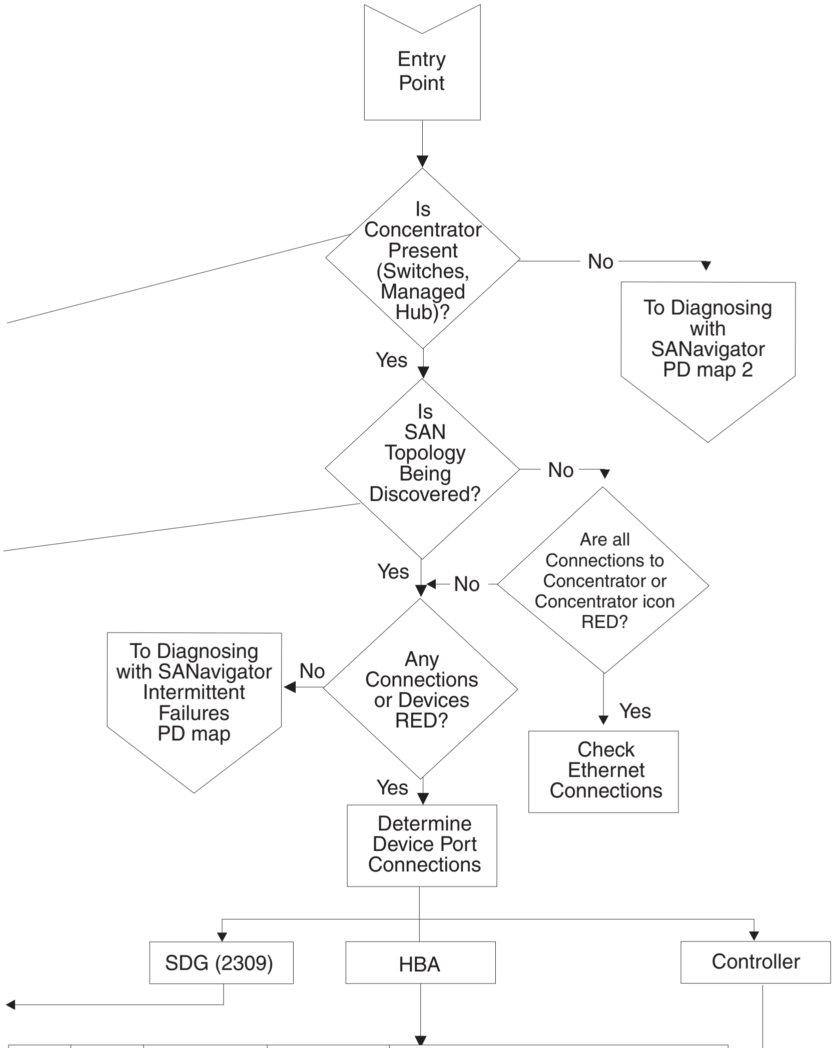
Diagnosing with SANavigator PD map 1

From: “PD maps and diagrams” on page 6.

Diagnosing with SANavigator PD map 1

If unsure, see "Configuration Type PD map" on page 10.

Additional information: See Chapter 5, "Introduction to SANavigator," on page 103. Verify that both In-band and Out-of-band are enabled.



Entry Point
Is Concentrator Present (Switches, Managed Hub)?
No
To Diagnosing with SANavigator PD map 2
Yes
Is SAN Topology Being Discovered?
No
Are all Connections to Concentrator or Concentrator icon RED?
Yes
Check Ethernet Connections
No
Yes
Any Connections or Devices RED?
No
To Diagnosing with SANavigator Intermittent Failures PD map
Yes
Determine Device Port Connections
SDG (2309)
HBA
Controller

Go to Table 18 on page 182.

HBA Inner Diamond	HBA Outer Diamond	All Storage Devices Inner Diamond on same Concentrator	All Storage Devices Outer Diamond on same Concentrator	Action
R	G	R	G	Suspect HBA. To Common Path PD Map 2
G	R	R	G	Suspect cable from HBA, GBIC\Port at concentrator. To Common Path PD Map 2
R	R	R	G	Suspect HBA. To Common Path PD Map 2
C	R	C	G	To Common Path PD Map 2

R-Red
G=Green
C=Clear (In-band disabled)

Storage Server Icon	Storage Server Inner Diamond	Storage Server Outer Diamond	Controller Connection to Concentrator	HBA on same Concentrator Inner Diamond	HBA on same Concentrator Outer Diamond	Action
R	R or C	R	--	G or C	G	Check all cables between Concentrator and Storage Server. Suspect concentrator or Storage Server.
G	R	G	--	R	G	Make sure in-band is enabled. If enabled, suspect HBA. Go to Common Path PD Map 2.
G	R or C	G	R	G or C	G	Go to Single Path Fail PD Map 1

R-Red
G=Green
C=Clear (In-band disabled)
--=Don't care

To see Diagnosing with SANavigator PD map 2, see “Diagnosing with SANavigator PD map 2” on page 31.

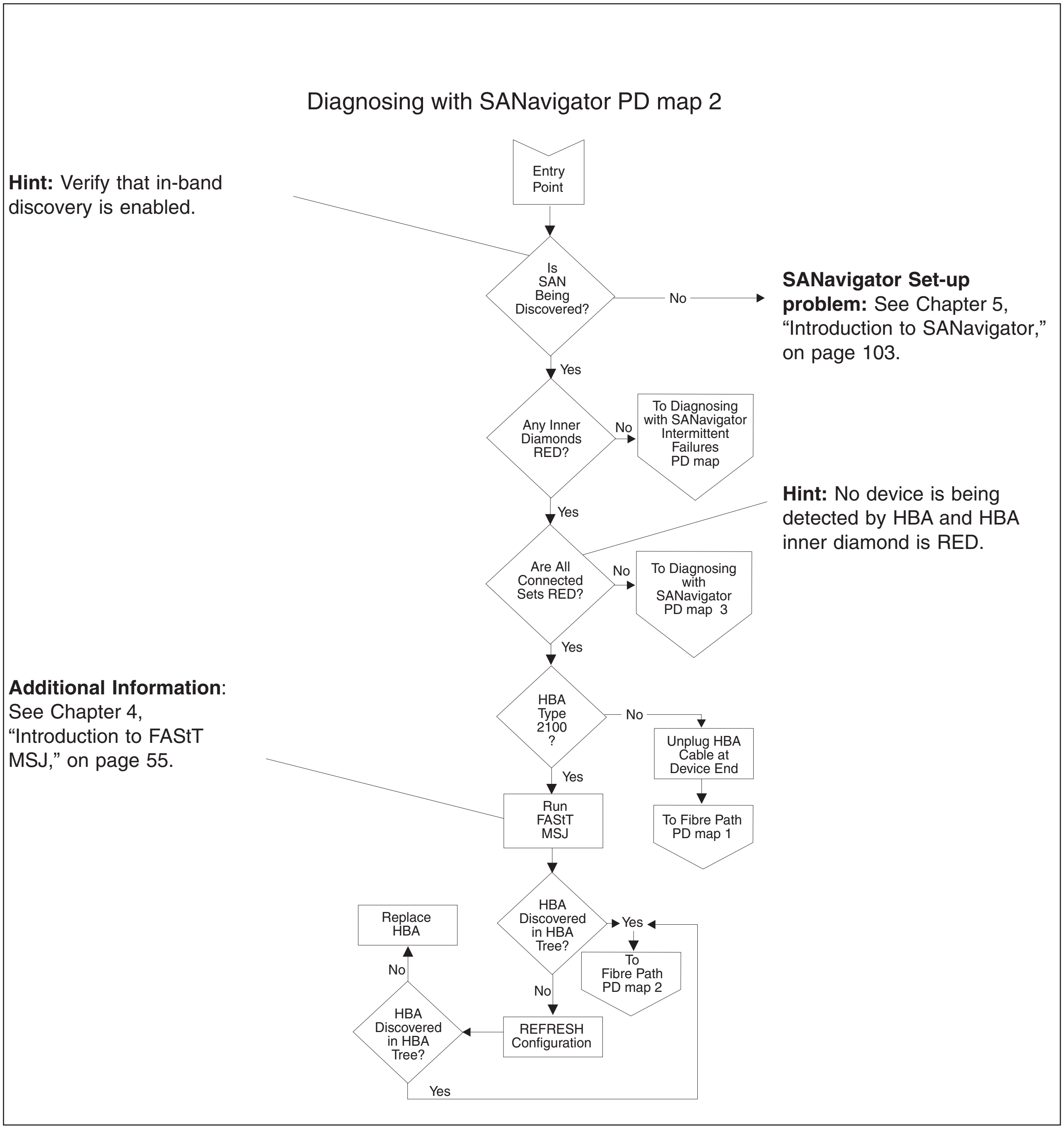
To see Common Path PD map 2, see “Common Path PD map 2” on page 25.

To see the Intermittent Failures PD map, see “Diagnosing with SANavigator - Intermittent Failures PD map” on page 34.

To see Single Path Fail PD map 1, see “Single Path Fail PD map 1” on page 22.

Diagnosing with SANavigator PD map 2

From: "Diagnosing with SANavigator PD map 1" on page 28. This PD map is applicable only to Direct Connect Configurations (either to Controllers or un-managed hubs). It assumes that In-Band discovery is enabled.


Diagnosing with SANavigator PD map 2
Entry Point
Is SAN Being Discovered?
No
Yes
Any Inner Diamonds RED?
No
To Diagnosing with SANavigator Intermittent Failures PD map
Yes
Are All Connected Sets RED?
No
To Diagnosing with SANavigator PD map 3
Yes
HBA Type 2100 ?
No
Unplug HBA Cable at Device End
To Fibre Path PD map 1
Yes
Run FAStT MSJ
HBA Discovered in HBA Tree?
Yes
To Fibre Path PD map 2
No
REFRESH Configuration
HBA Discovered in HBA Tree?
No
Replace HBA
Yes

Hint: Verify that in-band discovery is enabled.

SANavigator Set-up problem: See Chapter 5, "Introduction to SANavigator," on page 103.

Hint: No device is being detected by HBA and HBA inner diamond is RED.

Additional Information: See Chapter 4, "Introduction to FAStT MSJ," on page 55.

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

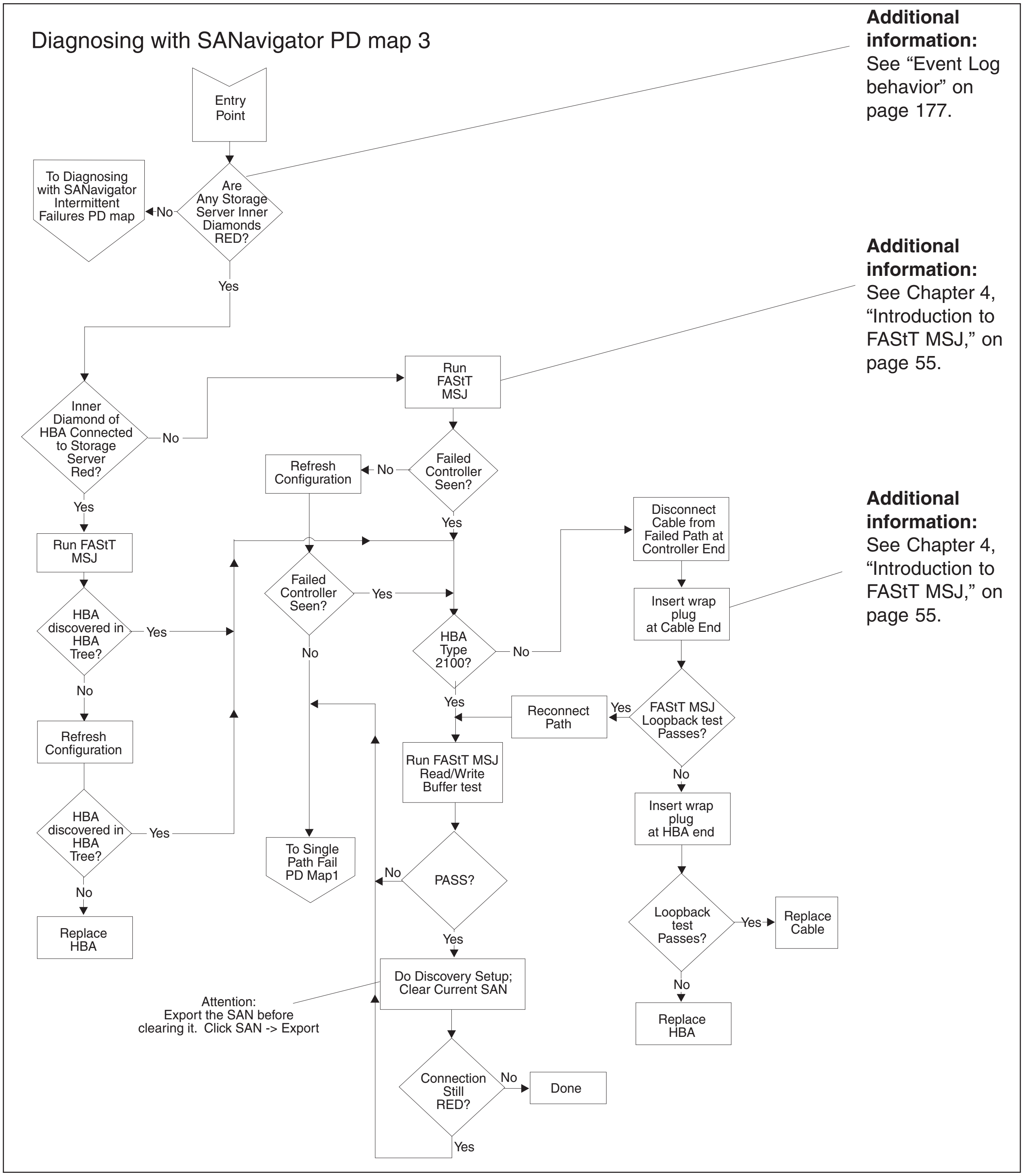
To see Fibre Path PD map 2, see "Fibre Path PD map 2" on page 21.

To see the Intermittent Failures PD map, see "Diagnosing with SANavigator - Intermittent Failures PD map" on page 34.

To see Diagnosing with SANavigator PD map 3, see “Diagnosing with SANavigator PD map 3” on page 33.

Diagnosing with SANavigator PD map 3

From: “Diagnosing with SANavigator PD map 2” on page 31.


Diagnosing with SANavigator PD map 3
Entry Point
Are Any Storage Server Inner Diamonds RED?
No
To Diagnosing with SANavigator Intermittent Failures PD map
Yes
Inner Diamond of HBA Connected to Storage Server Red?
No
Run FASt T MSJ
Failed Controller Seen?
No
Refresh Configuration
Yes
Run FASt T MSJ
HBA discovered in HBA Tree?
Yes
No
Refresh Configuration
HBA discovered in HBA Tree?
Yes
No
Replace HBA
Failed Controller Seen?
Yes
No
To Single Path Fail PD Map1
HBA Type 2100?
No
Yes
Disconnect Cable from Failed Path at Controller End
Insert wrap plug at Cable End
FAStT MSJ Loopback test Passes?
Yes
Reconnect Path
No
Insert wrap plug at HBA end
Loopback test Passes?
Yes
Replace Cable
No
Replace HBA
Run FAStT MSJ Read/Write Buffer test
PASS?
No
Yes
Do Discovery Setup; Clear Current SAN
Attention: Export the SAN before clearing it. Click SAN -> Export
Connection Still RED?
No
Done
Yes

Additional information: See “Event Log behavior” on page 177.

Additional information: See Chapter 4, “Introduction to FAStT MSJ,” on page 55.

Additional information: See Chapter 4, “Introduction to FAStT MSJ,” on page 55.

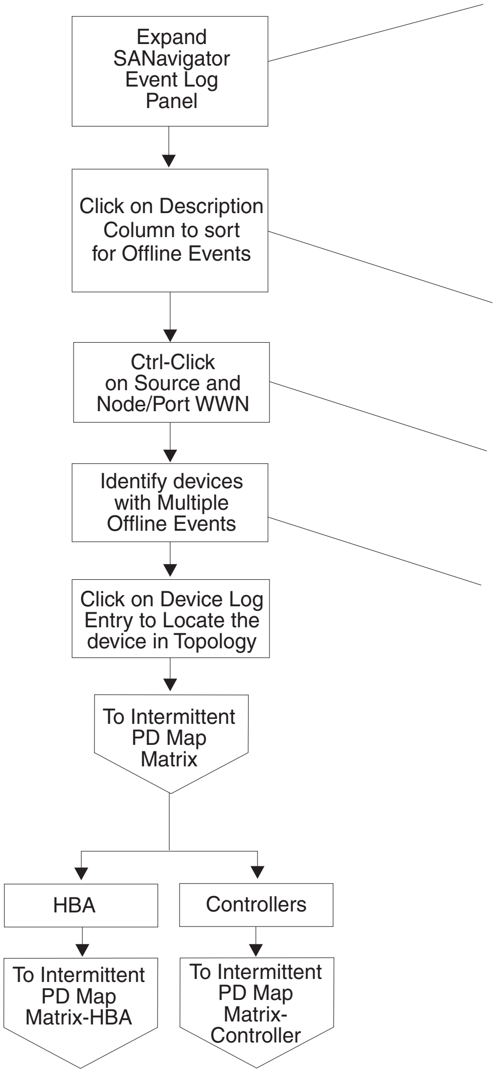
To see the Intermittent Failures PD map, see “Diagnosing with SANavigator - Intermittent Failures PD map” on page 34.

To see Single Path Fail PD map 1, see “Single Path Fail PD map 1” on page 22.

Diagnosing with SANavigator - Intermittent Failures PD map

From: “Diagnosing with SANavigator PD map 1” on page 28; “Diagnosing with SANavigator PD map 2” on page 31; “Diagnosing with SANavigator PD map 3” on page 33.

Diagnosing with SANavigator - Intermittent Failures PD map


Expand SANavigator Event Log Panel
Click on Description Column to sort for Offline Events
Ctrl-Click on Source and Node/Port WWN
Identify devices with Multiple Offline Events
Click on Device Log Entry to Locate the device in Topology
To Intermittent PD Map Matrix
HBA
Controllers
To Intermittent PD Map Matrix-HBA
To Intermittent PD Map Matrix-Controller

Additional information: See Chapter 5, “Introduction to SANavigator,” on page 103.

Hint: Filter the Event Log to display fatal errors only.

Hint: You can move the columns in the Event Log to any desired location by clicking and then dragging the title bar.

Additional information: See “Event Log behavior” on page 177.

(**Hint:** Connection Offline events for devices are also preceded or followed by Concentrator Connection Offline events. When looking for multiple offline events to isolate the intermittent device, focus on the device events rather than the concentrator events.)

To see the Intermittent Failures PD table for a host bus adapter, go to “Intermittent PD table - Host bus adapter” on page 35.

To see the Intermittent Failures PD table for a controller, go to “Intermittent PD table - Controller” on page 35.

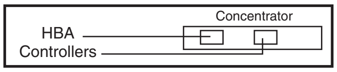
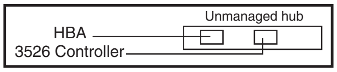
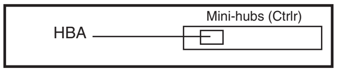
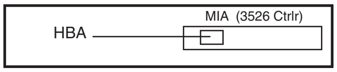
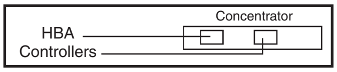
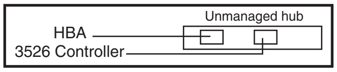
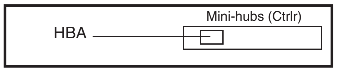
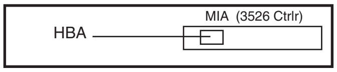
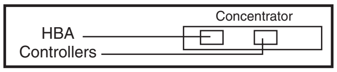
Intermittent Failures PD tables

Use the following tables to help you isolate intermittent failures. Use the SANavigator Event Log to determine which device has a history of intermittent failures. See “Event Log behavior” on page 177 to aid your understanding of event logging.

You can also check the operating status change of your SAN to determine the online/offline status of devices. To generate the report, select **Monitor -> Reports** and check the ″Operating Status Change″ box. See “Generating, viewing, and printing reports” on page 129.

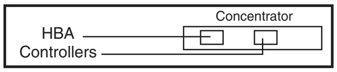
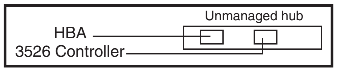
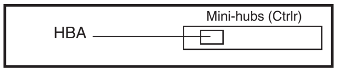
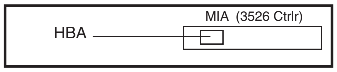
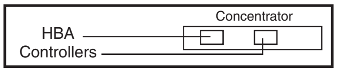
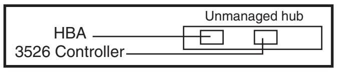
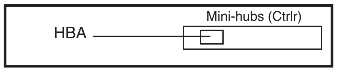
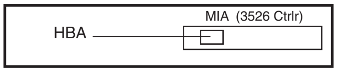
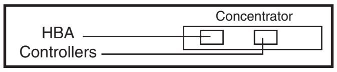
Intermittent PD table - Controller

From: “Diagnosing with SANavigator - Intermittent Failures PD map” on page 34.

ID	Connection type/device	Offline events (Out-of-band discovery)	Offline events (In-band discovery)	Action*
1		**X**		Go to “Controller Fatal Event Logged PD map 1” on page 37.
2		**N/A**		Not applicable (Out-of-band discovery requires switch or managed hubs.)
3		**N/A**		Not applicable (Out-of-band discovery requires switch or managed hubs.)
4		**N/A**		Not applicable (Out-of-band discovery requires switch or managed hubs.)
5			**N/A**	Not applicable (Out-of-band discovery is required.)
6			**X**	Go to “Controller Fatal Event Logged PD map 1” on page 37.
7			**X**	Go to “Controller Fatal Event Logged PD map 1” on page 37.
8			**X**	Go to “Controller Fatal Event Logged PD map 1” on page 37.
9		**X**	**X**	Go to “Controller Fatal Event Logged PD map 3” on page 39.
* When inspecting the event log, look for devices that consistently go offline and come back online before suspecting the component.				
Note: In these diagrams, the term *concentrator* refers to either a switch or a managed hub.				

Intermittent PD table - Host bus adapter

From: “Diagnosing with SANavigator - Intermittent Failures PD map” on page 34.

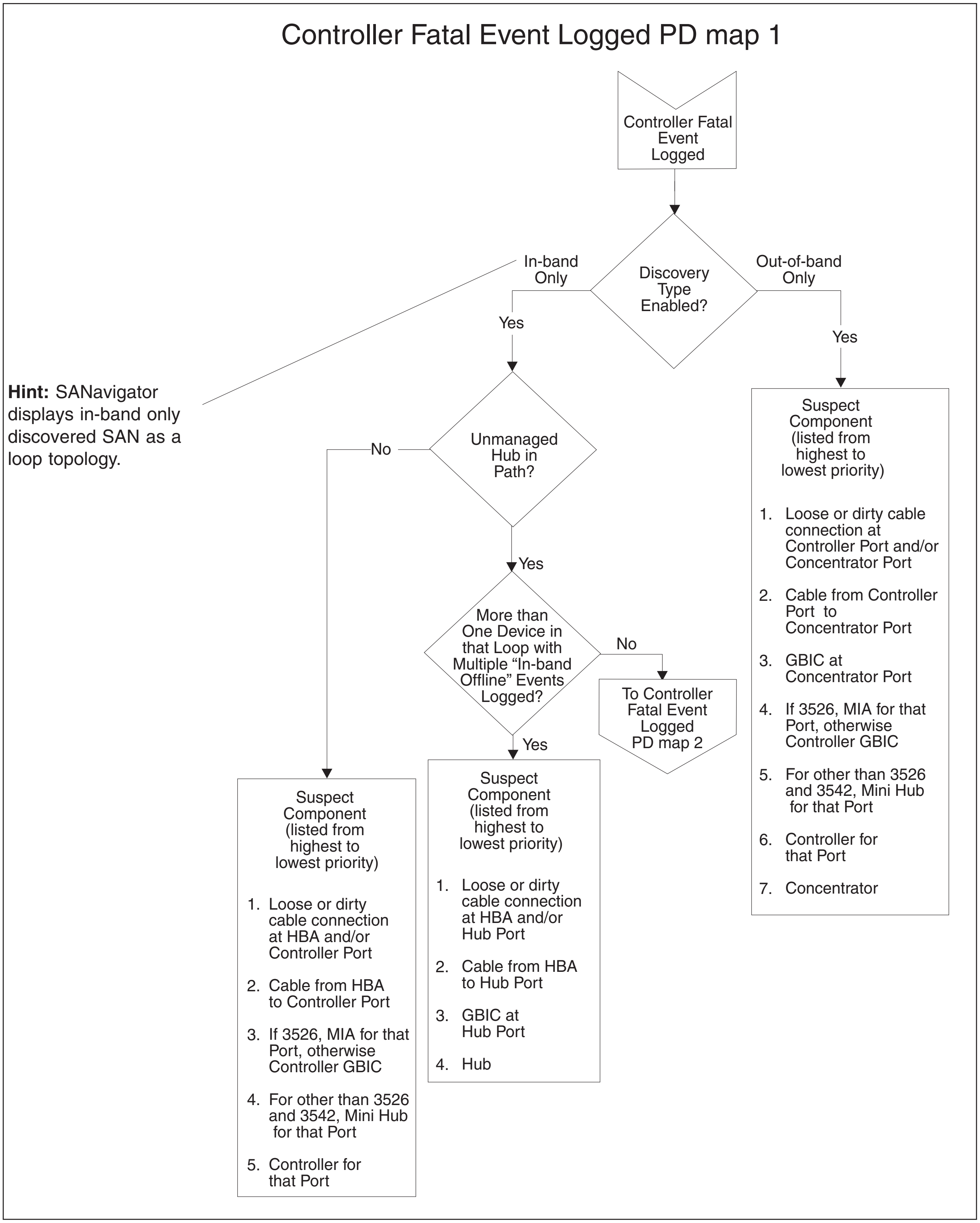
ID	Connection type/device	Offline events (Out-of-band discovery)	Offline events (In-band discovery)	Action*
1		X		Go to “HBA Fatal Event Logged PD map” on page 40.
2		N/A		Not applicable (Out-of-band discovery requires switch or managed hubs.)
3		N/A		Not applicable (Out-of-band discovery requires switch or managed hubs.)
4		N/A		Not applicable (Out-of-band discovery requires switch or managed hubs.)
5			N/A	Not applicable (Out-of-band discovery is required.)
6			X	Go to “HBA Fatal Event Logged PD map” on page 40.
7			X	Go to “HBA Fatal Event Logged PD map” on page 40.
8			X	Go to “HBA Fatal Event Logged PD map” on page 40.
9		X	X	Go to “HBA Fatal Event Logged PD map” on page 40.

* When inspecting the event log, look for devices that consistently go offline and come back online before suspecting the component.

Note: In these diagrams, the term *concentrator* refers to either a switch or a managed hub.

Controller Fatal Event Logged PD map 1

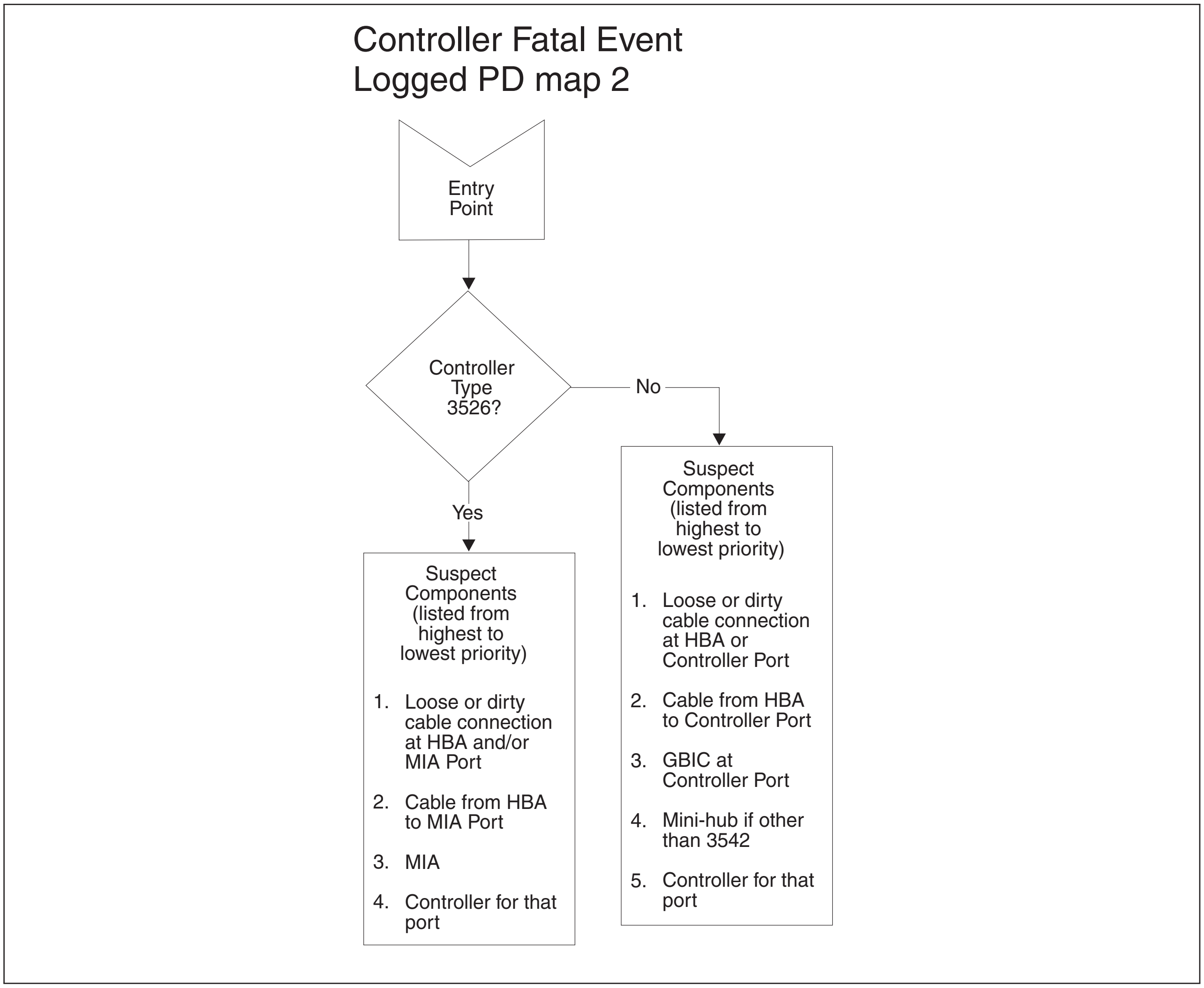
From: “Intermittent PD table - Controller” on page 35.


Controller Fatal Event Logged PD map 1
Controller Fatal Event Logged
Discovery Type Enabled?
In-band Only
Out-of-band Only
Yes
Yes
Hint: SANavigator displays in-band only discovered SAN as a loop topology.
Unmanaged Hub in Path?
No
Yes
More than One Device in that Loop with Multiple “In-band Offline” Events Logged?
No
Yes
To Controller Fatal Event Logged PD map 2
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA and/or Controller Port
2. Cable from HBA to Controller Port
3. If 3526, MIA for that Port, otherwise Controller GBIC
4. For other than 3526 and 3542, Mini Hub for that Port
5. Controller for that Port
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA and/or Hub Port
2. Cable from HBA to Hub Port
3. GBIC at Hub Port
4. Hub
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty cable connection at Controller Port and/or Concentrator Port
2. Cable from Controller Port to Concentrator Port
3. GBIC at Concentrator Port
4. If 3526, MIA for that Port, otherwise Controller GBIC
5. For other than 3526 and 3542, Mini Hub for that Port
6. Controller for that Port
7. Concentrator

To see Controller Fatal Event Logged PD map 2, go to “Controller Fatal Event Logged PD map 2” on page 38.

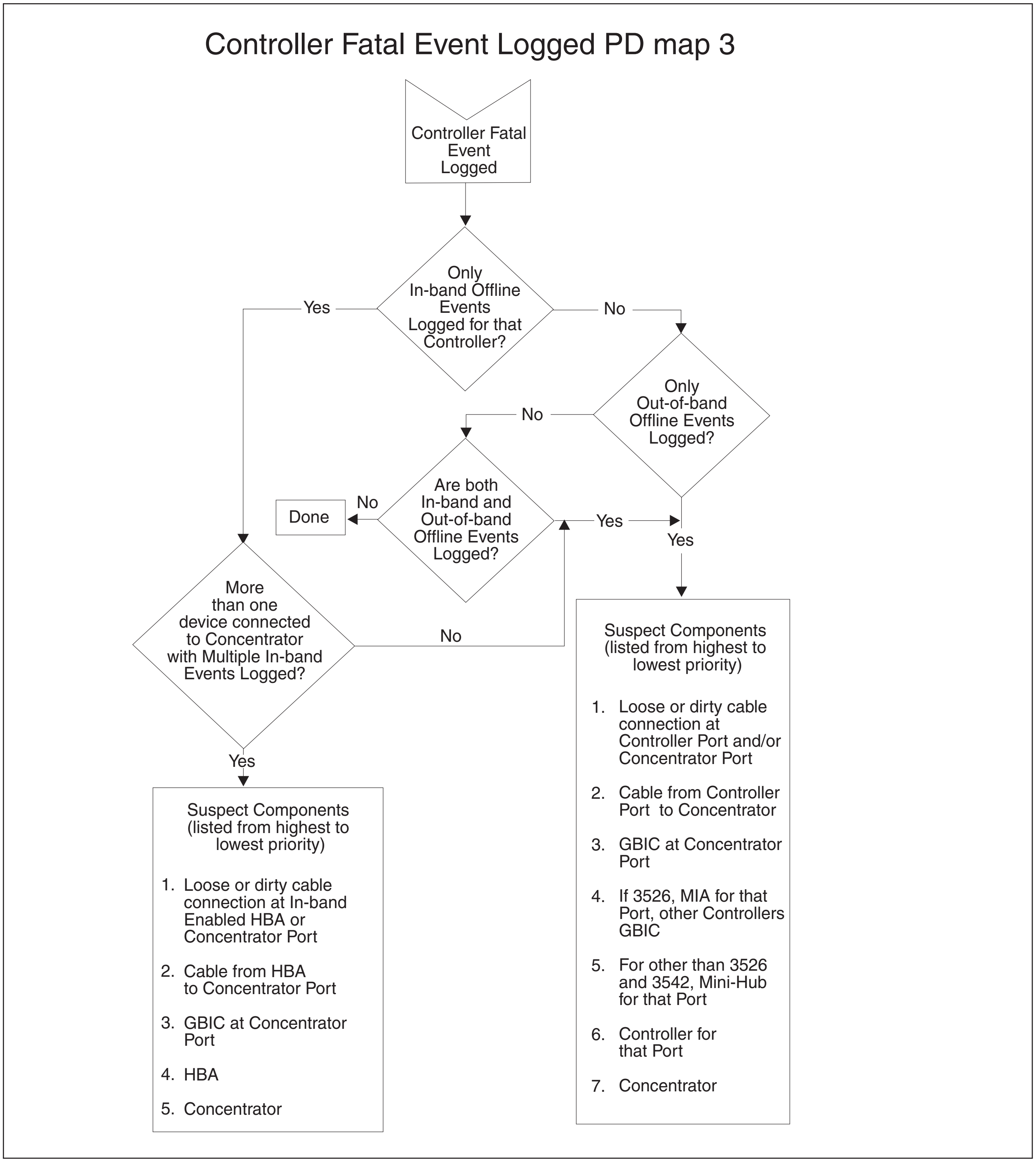
Controller Fatal Event Logged PD map 2

From: “Controller Fatal Event Logged PD map 1” on page 37.


Controller Fatal Event
Logged PD map 2
Entry Point
Controller Type 3526?
No
Yes
Suspect Components (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA and/or MIA Port
2. Cable from HBA to MIA Port
3. MIA
4. Controller for that port
Suspect Components (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA or Controller Port
2. Cable from HBA to Controller Port
3. GBIC at Controller Port
4. Mini-hub if other than 3542
5. Controller for that port

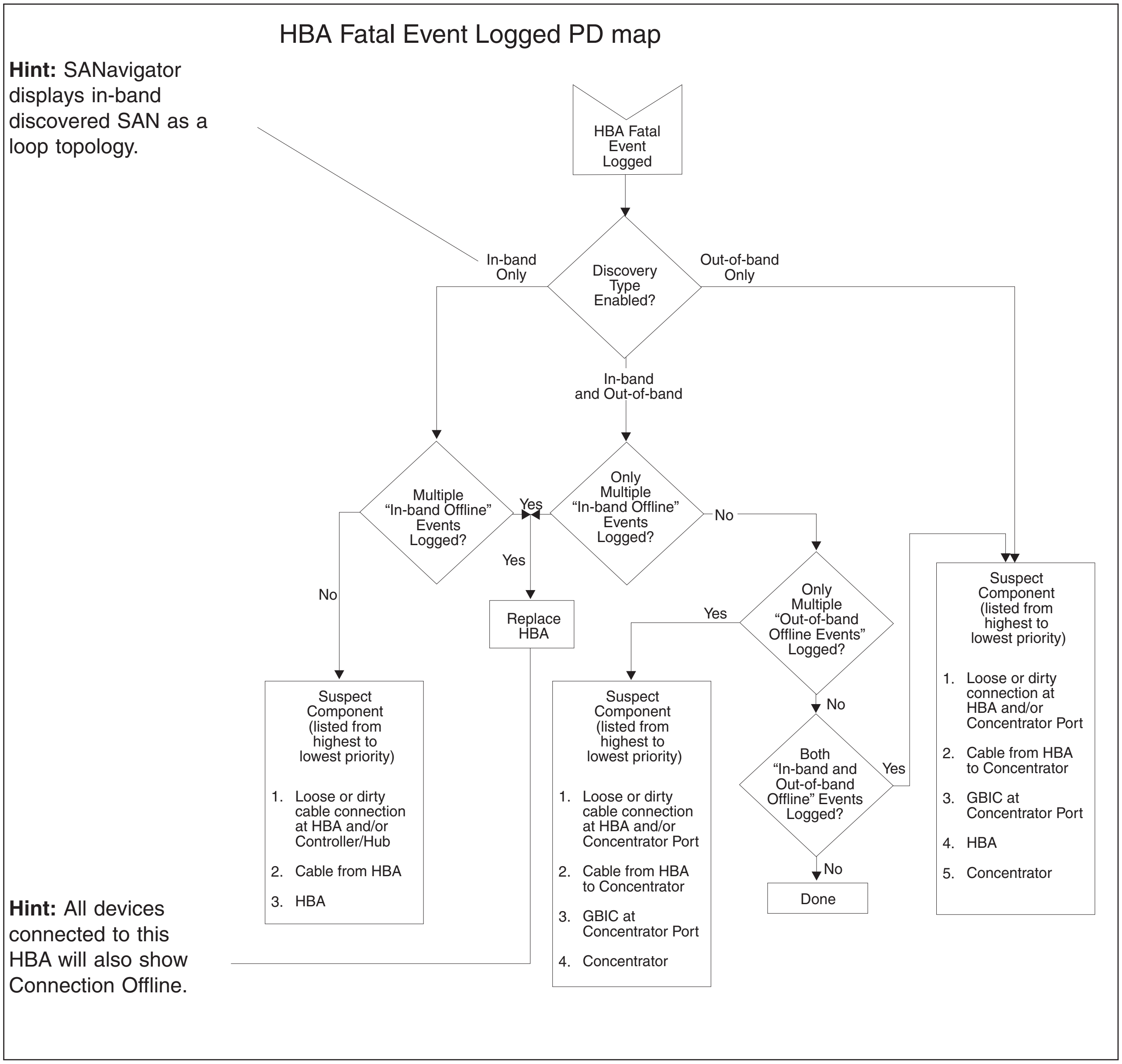
Controller Fatal Event Logged PD map 3

From: “Intermittent PD table - Controller” on page 35; “Controller Fatal Event Logged PD map 1” on page 37.


Controller Fatal Event Logged PD map 3
Controller Fatal Event Logged
Only In-band Offline Events Logged for that Controller?
Yes
No
Only Out-of-band Offline Events Logged?
No
Yes
Are both In-band and Out-of-band Offline Events Logged?
No
Done
Yes
More than one device connected to Concentrator with Multiple In-band Events Logged?
No
Yes
Suspect Components (listed from highest to lowest priority)
1. Loose or dirty cable connection at In-band Enabled HBA or Concentrator Port
2. Cable from HBA to Concentrator Port
3. GBIC at Concentrator Port
4. HBA
5. Concentrator
Suspect Components (listed from highest to lowest priority)
1. Loose or dirty cable connection at Controller Port and/or Concentrator Port
2. Cable from Controller Port to Concentrator
3. GBIC at Concentrator Port
4. If 3526, MIA for that Port, other Controllers GBIC
5. For other than 3526 and 3542, Mini-Hub for that Port
6. Controller for that Port
7. Concentrator

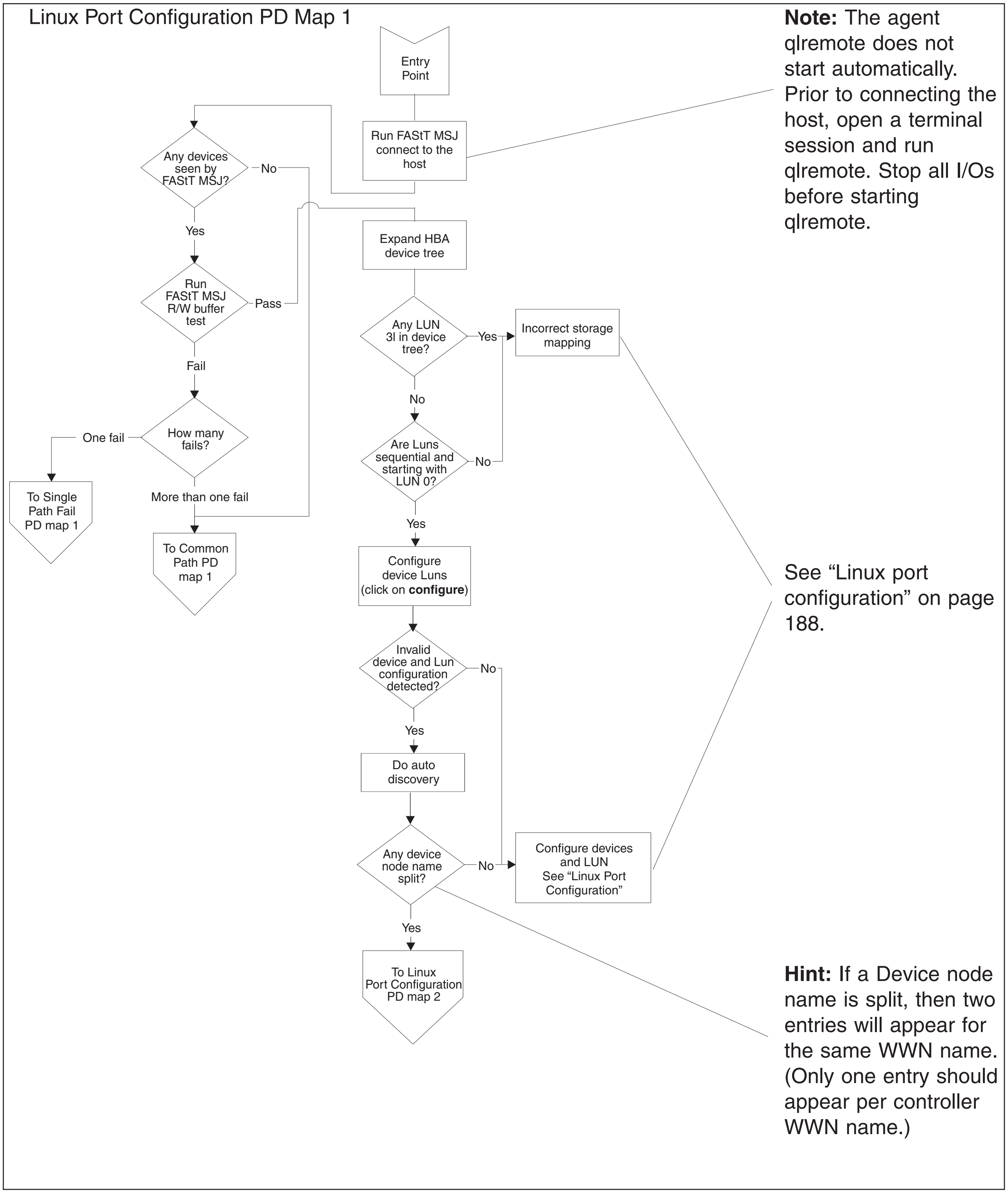
HBA Fatal Event Logged PD map

From: “Intermittent PD table - Host bus adapter” on page 35.


HBA Fatal Event Logged PD map
Hint: SANavigator displays in-band discovered SAN as a loop topology.
HBA Fatal Event Logged
Discovery Type Enabled?
In-band Only
Out-of-band Only
In-band and Out-of-band
Multiple “In-band Offline” Events Logged?
Yes
Only Multiple “In-band Offline” Events Logged?
No
Yes
No
Replace HBA
Only Multiple “Out-of-band Offline Events” Logged?
Yes
No
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA and/or Controller/Hub
2. Cable from HBA
3. HBA
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty cable connection at HBA and/or Concentrator Port
2. Cable from HBA to Concentrator
3. GBIC at Concentrator Port
4. Concentrator
Both “In-band and Out-of-band Offline” Events Logged?
Yes
No
Done
Suspect Component (listed from highest to lowest priority)
1. Loose or dirty connection at HBA and/or Concentrator Port
2. Cable from HBA to Concentrator
3. GBIC at Concentrator Port
4. HBA
5. Concentrator
Hint: All devices connected to this HBA will also show Connection Offline.

Linux Port Configuration PD map 1

From: “Specific problem areas” on page 6.


Linux Port Configuration PD Map 1
Entry Point
Run FAStT MSJ connect to the host
Any devices seen by FAStT MSJ?
No
Yes
Run FAStT MSJ R/W buffer test
Pass
Fail
How many fails?
One fail
More than one fail
To Single Path Fail PD map 1
To Common Path PD map 1
Expand HBA device tree
Any LUN 3l in device tree?
Yes
Incorrect storage mapping
No
Are Luns sequential and starting with LUN 0?
No
Yes
Configure device Luns (click on **configure**)
Invalid device and Lun configuration detected?
No
Yes
Do auto discovery
Any device node name split?
No
Configure devices and LUN See “Linux Port Configuration”
Yes
To Linux Port Configuration PD map 2

Note: The agent qlremote does not start automatically. Prior to connecting the host, open a terminal session and run qlremote. Stop all I/Os before starting qlremote.

See “Linux port configuration” on page 188.

Hint: If a Device node name is split, then two entries will appear for the same WWN name. (Only one entry should appear per controller WWN name.)

To see Single Path Fail PD map 1, see “Single Path Fail PD map 1” on page 22.

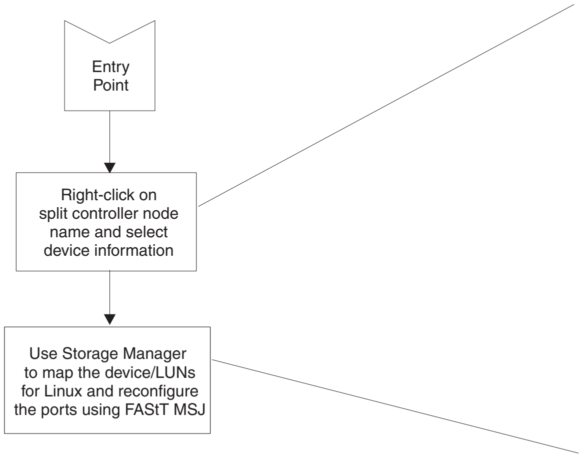
To see Common Path PD map 1, see “Common Path PD map 1” on page 24.

To see Linux Port Configuration PD map 2, see “Linux Port Configuration PD map 2” on page 43.

Linux Port Configuration PD map 2

From: “Linux Port Configuration PD map 1” on page 41

Linux Port Configuration PD Map 2


Entry
Point
Right-click on split controller node name and select device information
Use Storage Manager to map the device/LUNs for Linux and reconfigure the ports using FAStT MSJ

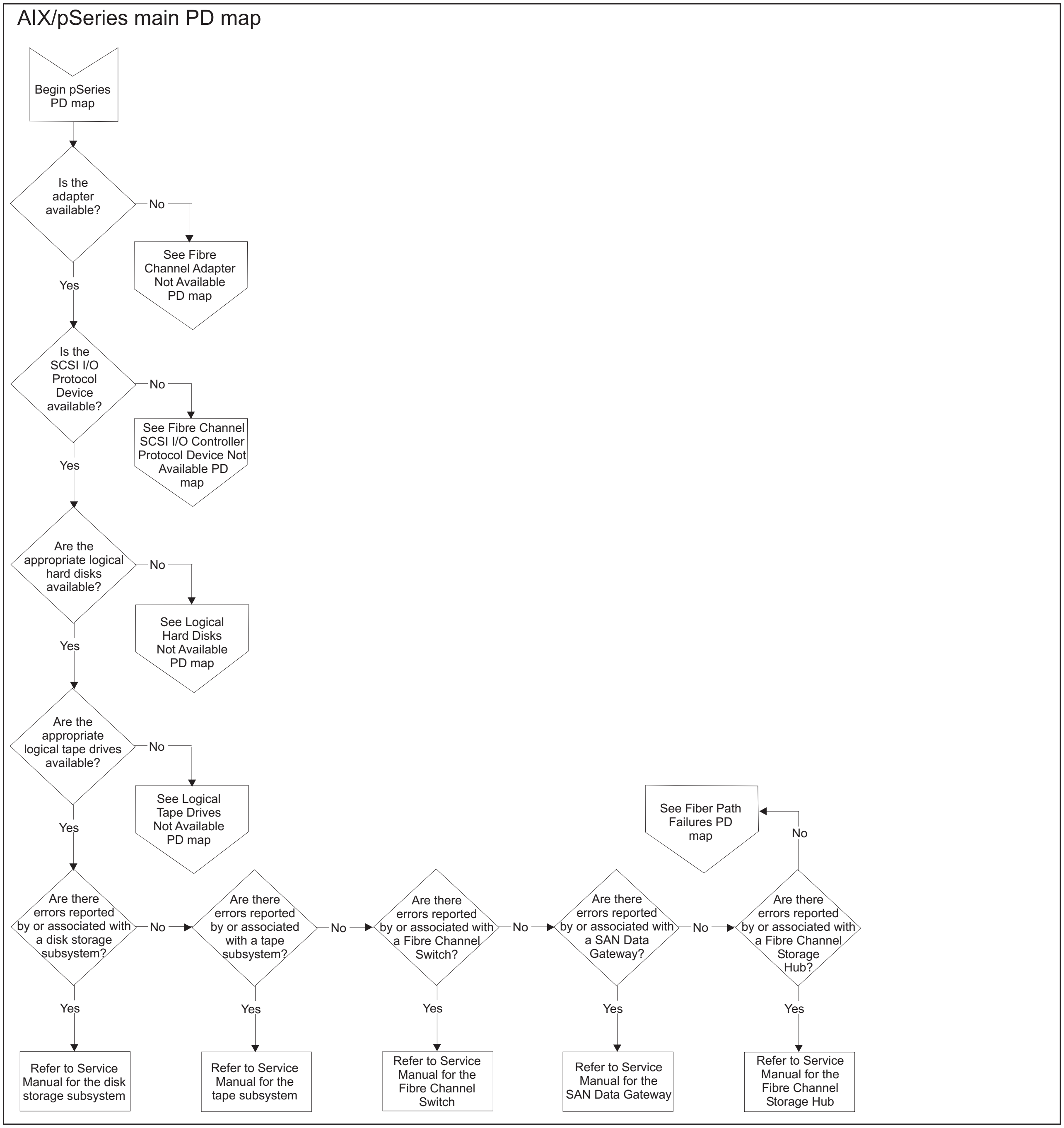
Hint: Right-click the Host icon in the HBA Tree and select “Adapter Persistent Configuration Data . . .” The Adapter(s) WWNN displays. Record this information as it will be required by FAStT Storage Manager to map your storage to the Linux OS.

Additional information: See “Linux port configuration” on page 188.

To see Single Path Fail PD map 1, see “Single Path Fail PD map 1” on page 22.

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.


AIX/pSeries main PD map
Begin pSeries PD map
Is the adapter available?
No
See Fibre Channel Adapter Not Available PD map
Yes
Is the SCSI I/O Protocol Device available?
No
See Fibre Channel SCSI I/O Controller Protocol Device Not Available PD map
Yes
Are the appropriate logical hard disks available?
No
See Logical Hard Disks Not Available PD map
Yes
Are the appropriate logical tape drives available?
No
See Logical Tape Drives Not Available PD map
Yes
Are there errors reported by or associated with a disk storage subsystem?
No
Are there errors reported by or associated with a tape subsystem?
No
Are there errors reported by or associated with a Fibre Channel Switch?
No
Are there errors reported by or associated with a SAN Data Gateway?
No
Are there errors reported by or associated with a Fibre Channel Storage Hub?
No
See Fiber Path Failures PD map
Yes
Refer to Service Manual for the disk storage subsystem
Yes
Refer to Service Manual for the tape subsystem
Yes
Refer to Service Manual for the Fibre Channel Switch
Yes
Refer to Service Manual for the SAN Data Gateway
Yes
Refer to Service Manual for the Fibre Channel Storage Hub

For more detailed information including sample diagnostic information, see Chapter 18, “pSeries supplemental problem determination information,” on page 251.

To see Fibre Channel Adapter Not Available PD map, see “Fibre Channel Adapter Not Available PD map” on page 46.

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 47.

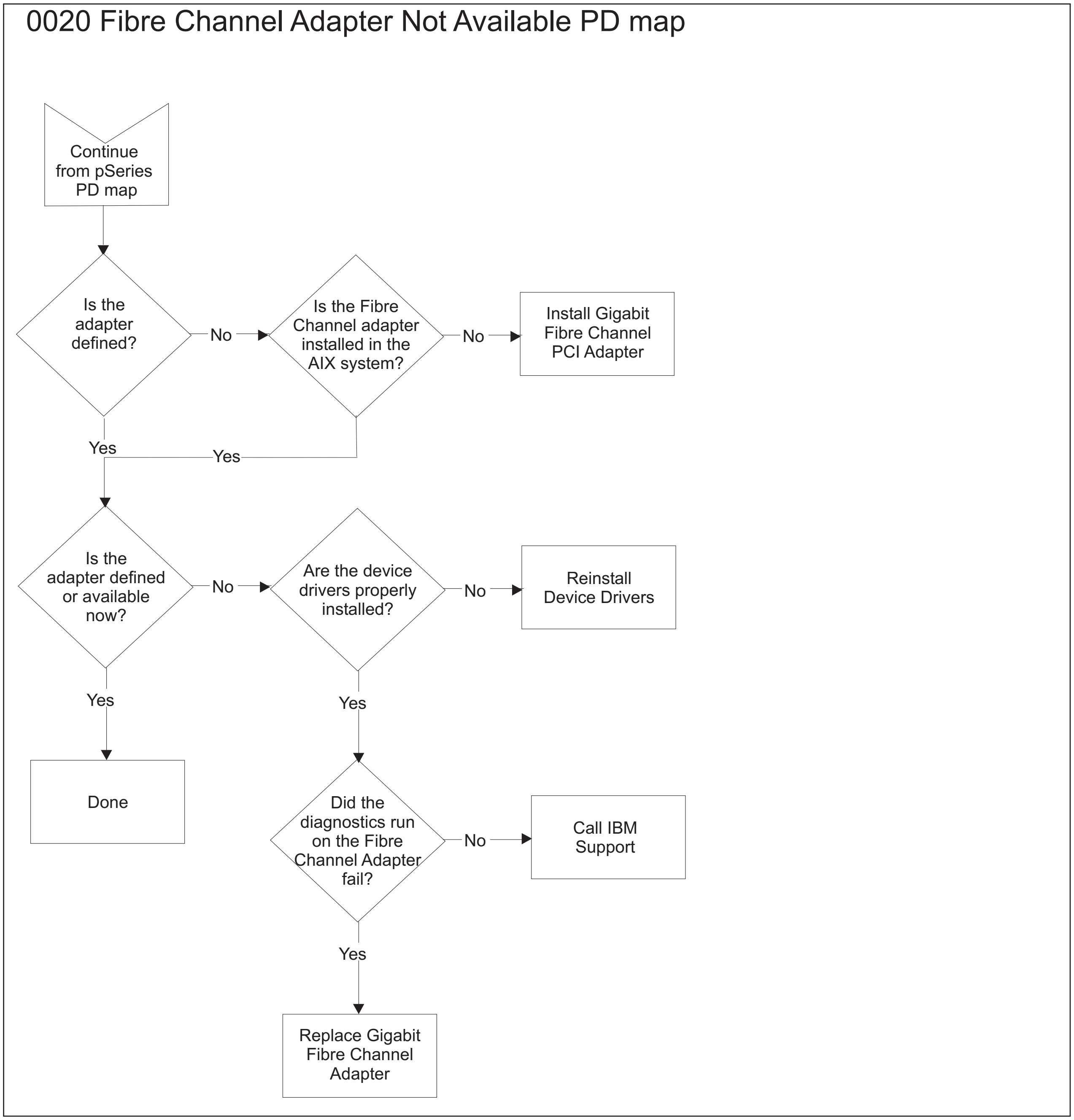
To see Logical Hard Disks Not Available PD map, see “Logical Hard Disks Not Available PD map” on page 48.

To see Logical Hard Tapes Not Available PD map, see “Logical Tape Drives Not Available PD map” on page 50.

To see Fiber Path Failures PD map, see “Fiber Path Failures PD map 1” on page 52.

Fibre Channel Adapter Not Available PD map

From: “pSeries PD map” on page 44

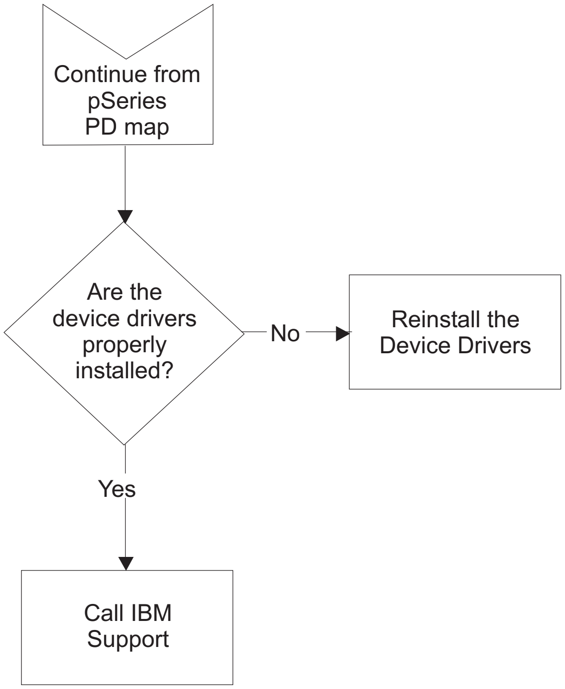

0020 Fibre Channel Adapter Not Available PD map
Continue from pSeries PD map
Is the adapter defined?
No
Is the Fibre Channel adapter installed in the AIX system?
No
Install Gigabit Fibre Channel PCI Adapter
Yes
Yes
Is the adapter defined or available now?
No
Are the device drivers properly installed?
No
Reinstall Device Drivers
Yes
Yes
Done
Did the diagnostics run on the Fibre Channel Adapter fail?
No
Call IBM Support
Yes
Replace Gigabit Fibre Channel Adapter

For more detailed information including sample diagnostic information, see “Start of PDP PD0020 - Fibre Channel Adapter not Available” on page 262.

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

From: “pSeries PD map” on page 44

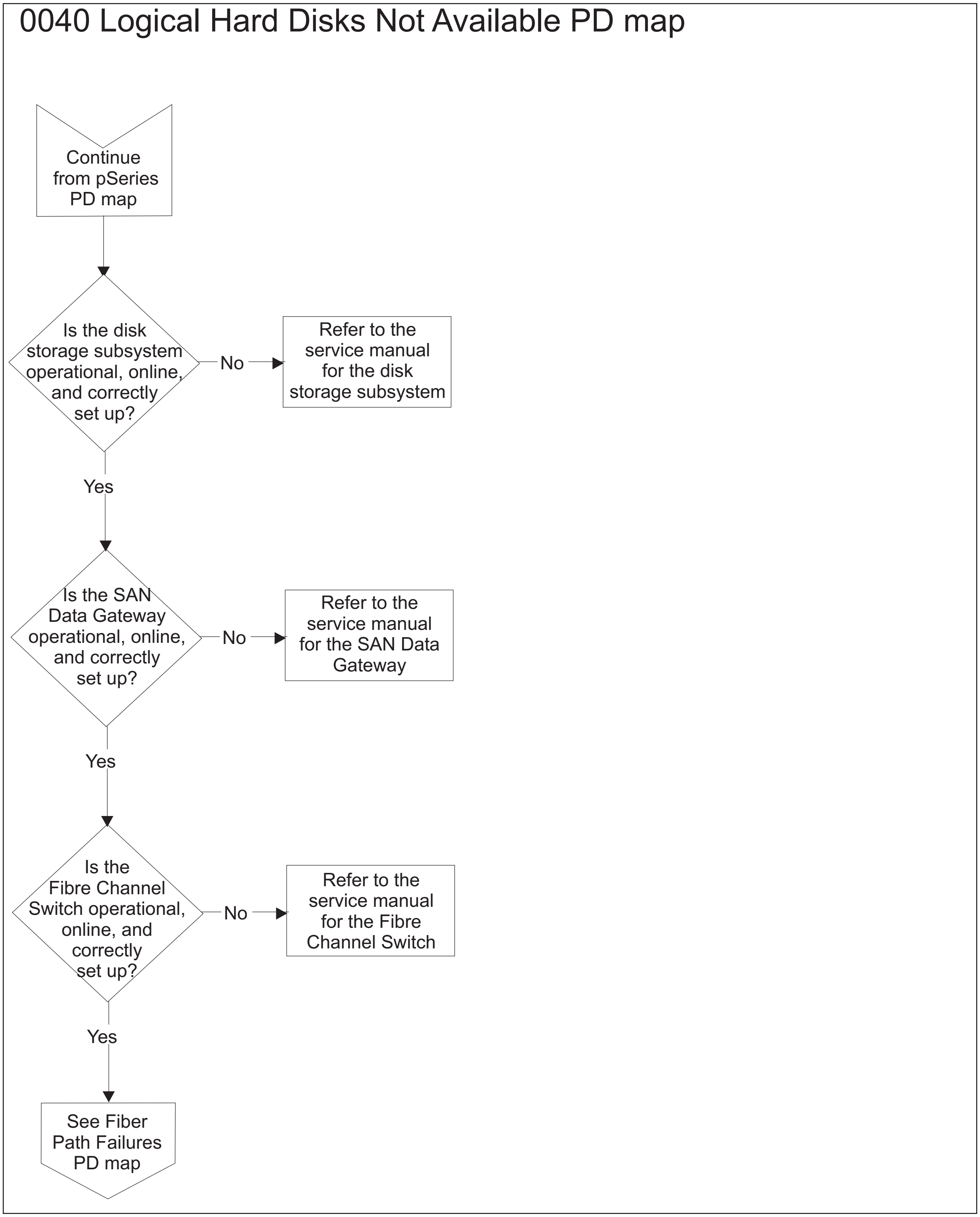
0030 Fibre Channel SCSI I/O Controller Protocol Device Not Available PD map


Continue from pSeries PD map
Are the device drivers properly installed?
No
Reinstall the Device Drivers
Yes
Call IBM Support

For more detailed information including sample diagnostic information, see Chapter 18, “pSeries supplemental problem determination information,” on page 251.

Logical Hard Disks Not Available PD map

From: “pSeries PD map” on page 44

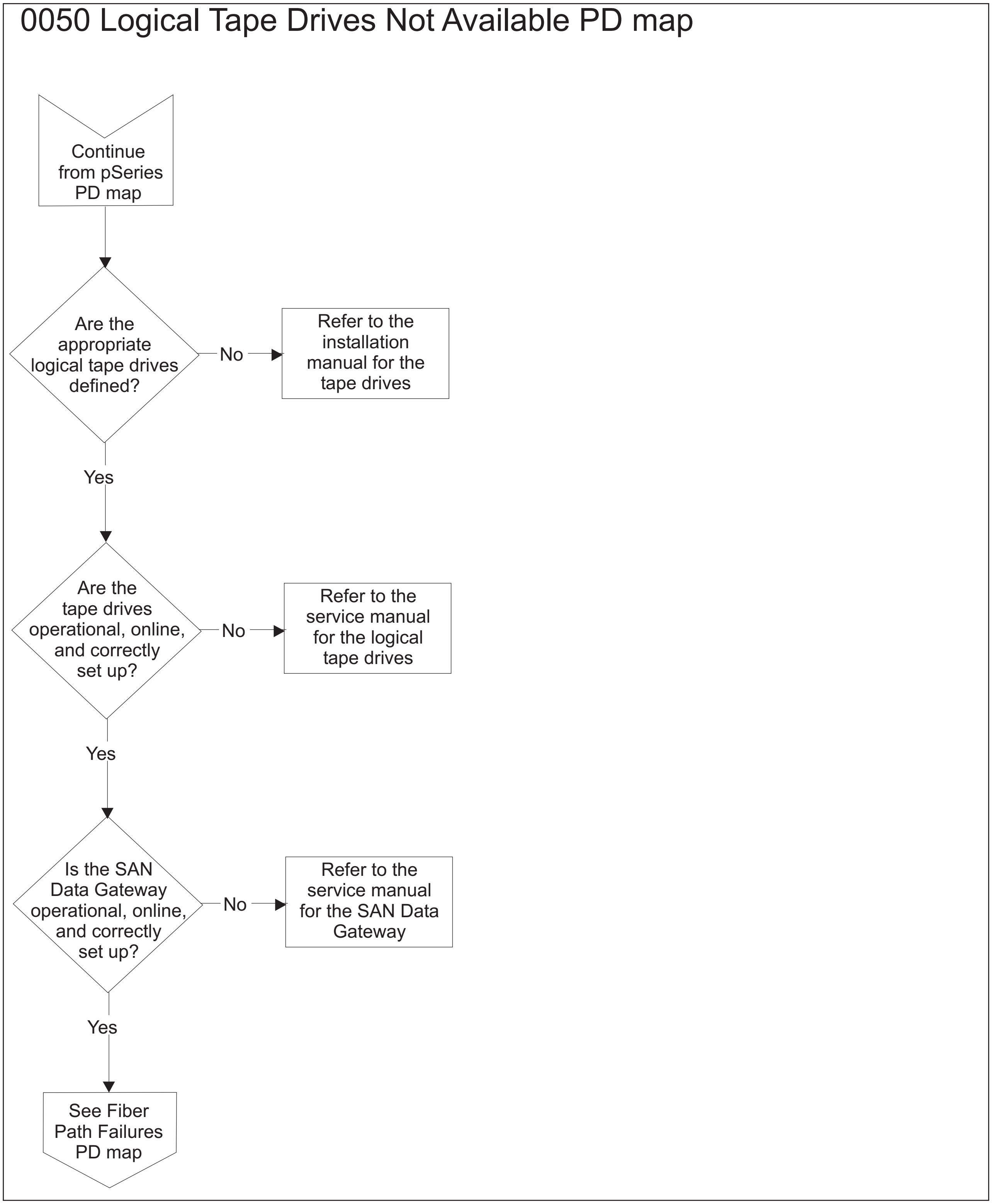

0040 Logical Hard Disks Not Available PD map
Continue from pSeries PD map
Is the disk storage subsystem operational, online, and correctly set up?
No
Refer to the service manual for the disk storage subsystem
Yes
Is the SAN Data Gateway operational, online, and correctly set up?
No
Refer to the service manual for the SAN Data Gateway
Yes
Is the Fibre Channel Switch operational, online, and correctly set up?
No
Refer to the service manual for the Fibre Channel Switch
Yes
See Fiber Path Failures PD map

For more detailed information including sample diagnostic information, see Chapter 18, “pSeries supplemental problem determination information,” on page 251.

To see Fiber Path Failures, see “Fiber Path Failures PD map 1” on page 52.

Logical Tape Drives Not Available PD map

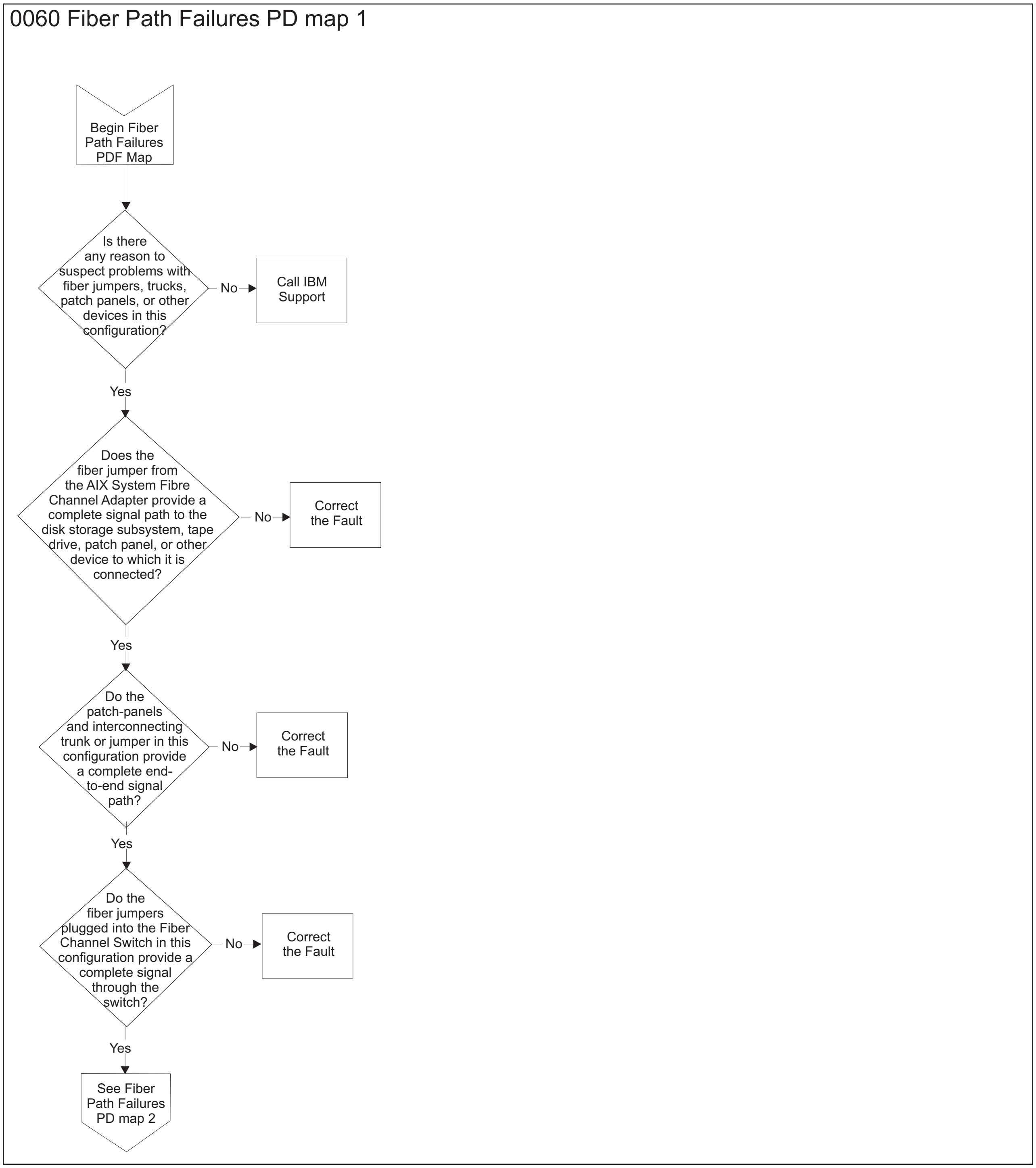
From: "pSeries PD map" on page 44


0050 Logical Tape Drives Not Available PD map
Continue from pSeries PD map
Are the appropriate logical tape drives defined?
No
Refer to the installation manual for the tape drives
Yes
Are the tape drives operational, online, and correctly set up?
No
Refer to the service manual for the logical tape drives
Yes
Is the SAN Data Gateway operational, online, and correctly set up?
No
Refer to the service manual for the SAN Data Gateway
Yes
See Fiber Path Failures PD map

For more detailed information including sample diagnostic information, see Chapter 18, "pSeries supplemental problem determination information," on page 251.

To see Fiber Path Failures, see “Fiber Path Failures PD map 1” on page 52.

Fiber Path Failures PD map 1

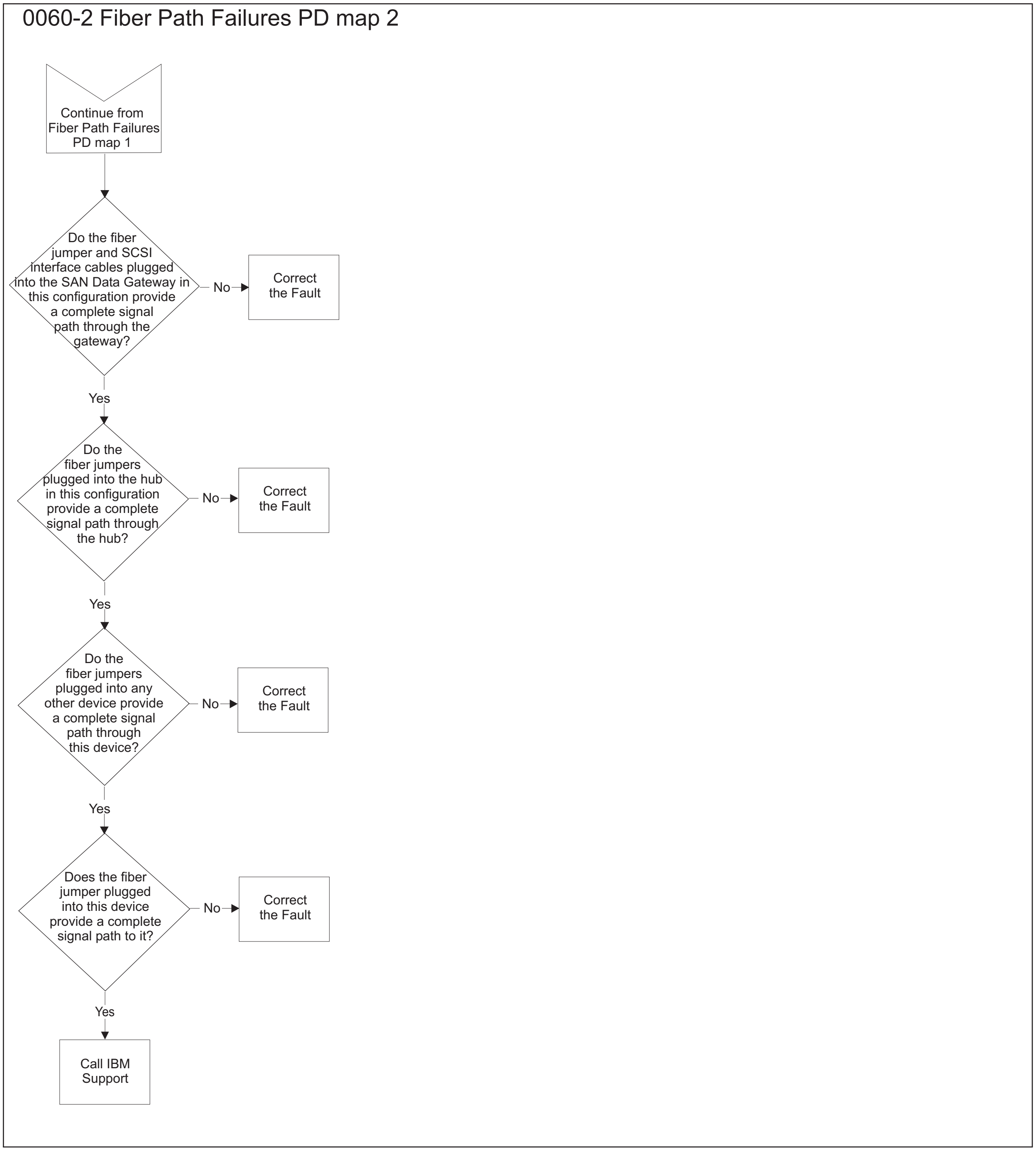

0060 Fiber Path Failures PD map 1
Begin Fiber Path Failures PDF Map
Is there any reason to suspect problems with fiber jumpers, trucks, patch panels, or other devices in this configuration?
No
Call IBM Support
Yes
Does the fiber jumper from the AIX System Fibre Channel Adapter provide a complete signal path to the disk storage subsystem, tape drive, patch panel, or other device to which it is connected?
No
Correct the Fault
Yes
Do the patch-panels and interconnecting trunk or jumper in this configuration provide a complete end-to-end signal path?
No
Correct the Fault
Yes
Do the fiber jumpers plugged into the Fiber Channel Switch in this configuration provide a complete signal through the switch?
No
Correct the Fault
Yes
See Fiber Path Failures PD map 2

For more detailed information including sample diagnostic information, see Chapter 18, “pSeries supplemental problem determination information,” on page 251.

To see Fiber Path Failure PDF Map 2, see “Fibre Path Failures PD map 2” on page 53.

Fibre Path Failures PD map 2

From: “Fiber Path Failures PD map 1” on page 52


0060-2 Fiber Path Failures PD map 2
Continue from Fiber Path Failures PD map 1
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
Yes
Do the fiber jumpers plugged into the hub in this configuration provide a complete signal path through the hub?
No
Correct the Fault
Yes
Do the fiber jumpers plugged into any other device provide a complete signal path through this device?
No
Correct the Fault
Yes
Does the fiber jumper plugged into this device provide a complete signal path to it?
No
Correct the Fault
Yes
Call IBM Support

For more detailed information including sample diagnostic information, see Chapter 18, “pSeries supplemental problem determination information,” on page 251.

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 the IBM FAStT Management Suite

FAStT MSJ is a network-capable application that can connect to and configure remote systems. FAStT MSJ helps you configure IBM Fibre Channel HBAs in a SAN environment. FAStT MSJ uses ONC remote procedure calls (RPC) for network communication and data exchange. The networking capability of FAStT MSJ enables centralized management and configuration of the entire SAN.

Note: The diagnostic functions of FAStT MSJ are available for all supported operating systems. The configuration functions are available for Linux operating systems only. IBM FAStT Storage Manager provides management capability for Microsoft Windows-based platforms.

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 64 MB of physical RAM; 128 MB is preferred. Running with less memory might cause disk swapping, which has a negative effect on performance.
- 30 MB of free disk space

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

- Linux x86
  - PII 233MHz (preferred minimum)

Linux Distribution	Kernel
Red Hat Enterprise Linux Advanced Server 2.1	2.4.9-e.25 UP, SMP, Enterprise (Bigmem) and Summit
RedHat Linux 7.x	2.4.18-19.7.x UP, SMP and Enterprise (Bigmem)

Linux Distribution	Kernel
RedHat Linux 8.0	2.4.18-27.8 UP, SMP, and Enterprise (Bigmem)
United Linux 1.0 with SP2 and 32-bit	2.4.19-333
United Linux 1.0 IA-64	2.4.19 (The client code in this package will only install and run on 32-bit linux)
SuSE Professional 8.1	2.4.19

Note: United Linux support includes the following distributions:

- SuSE Linux Enterprise Server 8 (SLES 8)
- Turbolinux Enterprise Server 8 (TLES 8)
- Conectiva Linux Enterprise Edition Powered by United Linux

- Microsoft Windows 2000 and Windows NT
  - Pentium III processor 450 MHz or greater
- Novell NetWare
  - 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 or Windows 2000 – Agent runs as a Windows NT service
- Novell NetWare installation prerequisites

  Be sure you have the following items before you install the QLremote NetWare Agent:

  - NetWare Client software (from Novell) on the Windows NT or Windows 2000 client
  - NWLink IPX/SPX-compatible transport or TCP/IP transport network protocols

    Note: The TCP/IP transport must be loaded to communicate with the FAStT MSJ agent.
  - NWLink NetBios
  - Drive letter mapped to the root of the SYS volume of the NetWare server. By default, the NetWare Client maps to sys\system or sys\public; however, you must set the root of SYS volume by assigning a drive letter to sys:\.

    Note: You must be logged on as an administrator to map server drive letters.
  - On the NetWare Server – NetWare 5.1 server with Support Pack 6 or later or NetWare 6.x Support Pack 3 or later.

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 FAStT 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 7 for details.

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

Table 7. 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 or Windows 2000 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 or Windows 2000 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 62.
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 2000 or Windows NT.

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, and NetWare, double-click the FAStTMSJ_install.exe file.

     Note: For NetWare, save to the system drive mapped to the NetWare server.
   - 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 2000, Windows NT, or Linux.
4. Perform one of the following actions to install the software appropriate to your configuration:
   - For a system running Windows 2000 or Windows NT, click one of the following preconfigured installation sets, then click **Next**:
     – Click **GUI and NT Agent** if the system running Windows 2000 or Windows NT 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 2000 or Windows NT 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 2000, Windows NT, 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 2000 or Windows NT:

     - **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 mapped to the NetWare server.

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

     The default location for a system running Windows 2000 or Windows NT 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 in the following format: *drive*, *server name*, *server IP address*.

   a. Click the drives on which to install the NetWare agent. Each drive must be a NetWare drive mapped on the system running Windows 2000 or Windows NT. 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 “Security” on page 67 for details.

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 2000 or Windows NT 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 2000 or Windows NT, 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.
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 2000 or Windows NT: On a system running Windows 2000 or Windows NT, 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**.

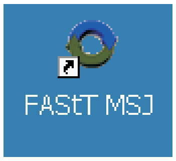


Figure 2. FAStT MSJ icon

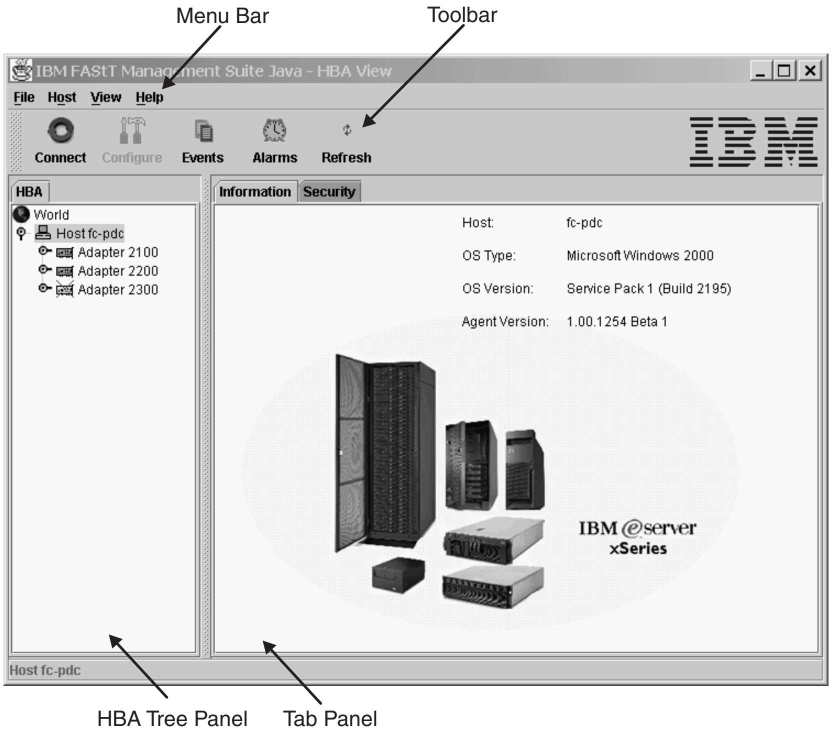
The FAStT MSJ main window opens.

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 64.



Host: fc-pdc
OS Type: Microsoft Windows 2000
OS Version: Service Pack 1 (Build 2195)
Agent Version: 1.00.1254 Beta 1

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.

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

Event log information includes communication and file system errors. FAStT MSJ stores the event entries in the events.txt file. You can log informational and warning events.

You can set the maximum size of the event log to be in the range of 20 to 200 event entries; the default is 20 events. When the maximum size of the event log is exceeded, old entries are automatically deleted to provide space for new entries.

Alarm log

When FAStT MSJ communicates with a host, FAStT MSJ continually receives notification messages from the host, indicating changes directly or indirectly made on adapters. Messages regarding status, configuration, and NVRAM changes are logged. FAStT MSJ stores these alarm messages in the alarms.txt file.

You can set the maximum size of the alarm log to be in the range of 20 to 200 event entries; the default is 200 entries. When the maximum size of the alarm log is exceeded, old entries are automatically deleted to provide space for new entries.

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 two ways to connect to hosts in a network:

- Manually
- Automatically with the Broadcast function

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 **Host** 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.

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.

Diagnostics and utilities

The diagnostic and utility features of FAStT MSJ enable you to perform the following actions:

- View event and alarm log information
- Review host adapter information
  - View general information
  - View statistics
  - View information on attached devices
  - View attached device link status
  - View adapter NVRAM settings
- Perform adapter functions, including:
  - Configure adapter NVRAM settings
  - Perform NVRAM updates on an adapter
  - Perform flash updates on an adapter
  - Run Fibre Diagnostics (read/write and loopback tests)
- 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

Viewing logs

FAStT MSJ records an extensive set of information to the event and alarm logs. The logs are saved as text files (alarms.txt and events.txt) in the folder where FAStT MSJ is installed. FAStT MSJ can parse and view these logs in a window. To view these logs, click **Event Log** or **Alarm Log** from the **View** menu, or click the appropriate button on the button bar.

Viewing the event log

The event log window displays events relating to FAStT MSJ application operations. New events display in the window as they occur. There are three types of time-stamped event messages:

- ℹ Informative - an informative or general information event
- ❗ Warning - a non-critical application event
- ✖ Error - a critical application event

Click **OK** to close the Event Log window. Click **Clear** to purge all event entries from the log.

Sorting: To sort a column in ascending or descending order, right-click the column header, and click the desired sorting method.

Details: To view an individual event entry, double-click the entry; a separate event details window displays. You can navigate individual entries by clicking **Next** or **Previous**.

Viewing the alarm log

The alarm log window displays events that occurred on hosts connected to FAStT MSJ. New alarms display in the window as they occur. Alarm entries have the following properties:

- Time Stamp – The date and time of the logged alarm
- Host Name – The agent host that sent the alarm
- Adapter ID – The host adapter the alarm occurred on
- Application – The type of device that sent the alarm
- Description – The description of the alarm

Click **OK** to close the Alarm Log window. Click **Clear** to purge all alarm entries from the alarm log.

Sorting: To sort a column in ascending or descending order, right-click the column header, and click the desired sorting method.

Colors: When the GUI receives an alarm with a status color other than white (informational), the adapter in the HBA tree with the most severe status blinks until you view the alarm. The following types of alarms are associated with each color:

- Informational: Rows in the table are color coded white.
- Unknown: Rows in the table are color coded blue.
- Warning: Rows in the table are color coded yellow.
- Bad: Rows in the table are color coded red.
- Loop Down: Adapter in the HBA tree is color coded yellow with a red X (see Figure 4 on page 70).

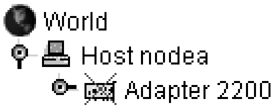
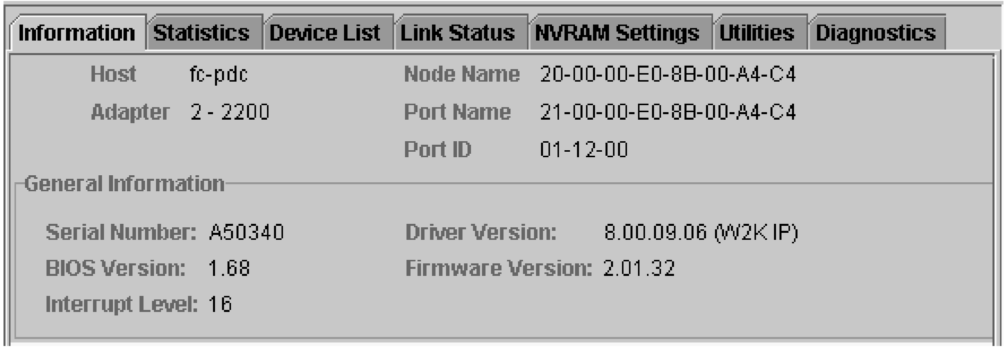


Figure 4. HBA tree adapter

Details: To view an individual alarm entry, double-click the entry; the Alarm Details window displays. You can navigate individual entries by clicking **Next** and **Previous**.

Viewing adapter information

To view adapter information, click the adapter in the HBA tree. The Information panel displays general information about the selected adapter (see Figure 5).



Host fc-pdc

Adapter 2 - 2200

Node Name 20-00-00-E0-8B-00-A4-C4

Port Name 21-00-00-E0-8B-00-A4-C4

Port ID 01-12-00

General Information

Serial Number: A50340

BIOS Version: 1.68

Interrupt Level: 16

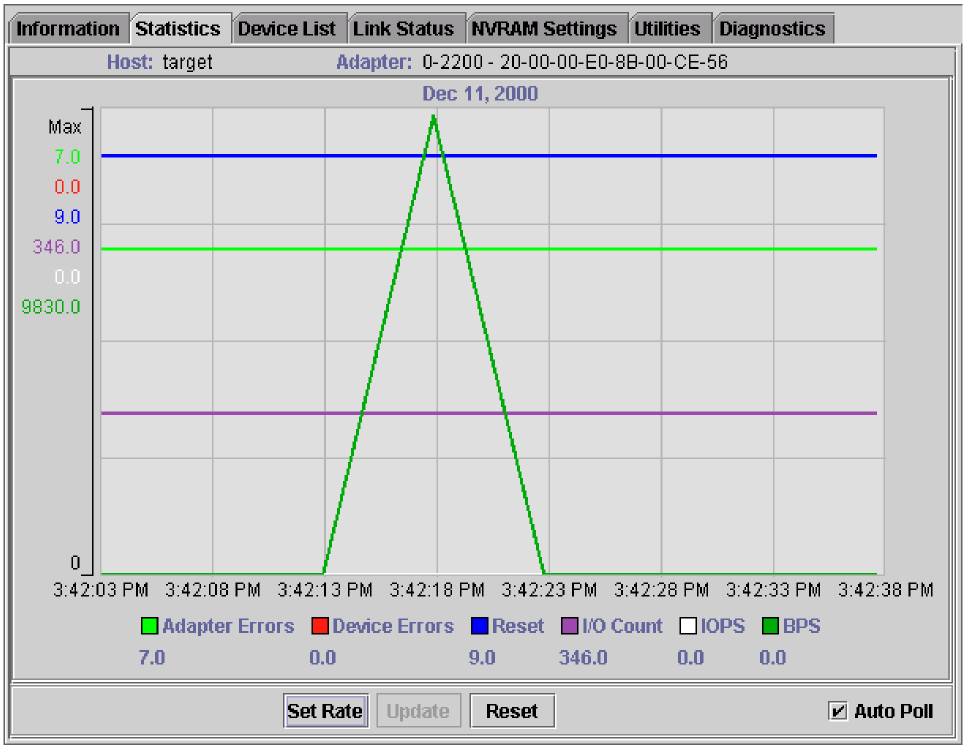
Driver Version: 8.00.09.06 (W2K IP)

Firmware Version: 2.01.32

Figure 5. Adapter Information panel

Viewing adapter statistics

The Statistics panel displays statistical information about the selected adapter (see Figure 6 on page 71).



Host: target Adapter: 0-2200 - 20-00-00-E0-8B-00-CE-56

Dec 11, 2000

🟩 Adapter Errors	🟥 Device Errors	🟦 Reset	🟪 I/O Count	□ IOPS	🟩 BPS
7.0	0.0	9.0	346.0	0.0	0.0

Figure 6. Adapter Statistics panel

The Statistical panel displays the following information:

- Adapter Errors: The number of adapter errors reported by the adapter device driver
- Device Errors: The number of device errors reported by the adapter device driver
- Reset: The number of LIP resets reported by the adapter device driver
- I/O Count: The total number of I/Os reported by the adapter device driver
- IOPS (I/O per second): The current number of I/Os per second
- BPS (bytes per second): The current number of bytes per second processed by the adapter

Use the buttons and check box at the bottom of the Statistics panel to control sampling:

- **Set Rate**

  Click **Set Rate** to set the polling interval at which the GUI retrieves statistics from the host. The valid range is 5 to 30 seconds.
- **Update**

  Click the **Update** button to retrieve statistics from the host.
- **Reset**

  Click the **Reset** button to reset all statistics to the initial value of 0.
- **Auto Poll**

  Select this check box to use automatic sampling mode. To use manual mode, clear the check box. If the check box is selected, use **Set Rate** to define the sampling rate.

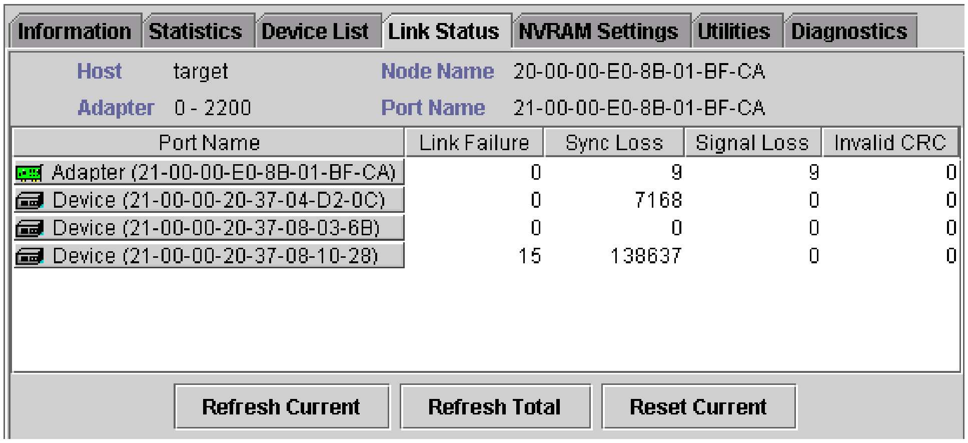
Device list

The Device List panel displays the following information about the devices attached to an adapter connected to a host:

- Host: The name of the host
- Adapter: The ID of the adapter
- Node Name: The node name of the adapter (WWN)
- Port Name: The port name of the adapter
- Path: The path number
- Target: The device ID
- Loop ID: The loop ID of the adapter when operating in loop mode
- Port ID: The port ID of the adapter (the AL-PA if in arbitrated loop environment)
- Vendor ID: ID of the device manufacturer
- Product ID: ID of the device
- Product Revision: Device revision level

Link status

The Link Status panel displays link information for the devices attached to an adapter connected to a host. See Figure 7.



Host target
Node Name 20-00-00-E0-8B-01-BF-CA
Adapter 0 - 2200
Port Name 21-00-00-E0-8B-01-BF-CA

Port Name	Link Failure	Sync Loss	Signal Loss	Invalid CRC
Adapter (21-00-00-E0-8B-01-BF-CA)	0	9	9	0
Device (21-00-00-20-37-04-D2-0C)	0	7168	0	0
Device (21-00-00-20-37-08-03-6B)	0	0	0	0
Device (21-00-00-20-37-08-10-28)	15	138637	0	0

Figure 7. Adapter Link Status panel

Click the Link Status tab to display the latest adapter link status from the device driver and the status for the adapter and all attached targets.

The first column of the Link Status panel is the World Wide Unique Port Name of the adapter and the attached devices.

The remaining columns display the following diagnostic information about the adapter and devices (see Table 8).

Table 8. Link status table

Diagnostic information	Definition
Link Failure	A loss of word synchronization for more than 100 msec or loss of signal.
Sync Loss	Four invalid transmission words out of eight (FC-PH rules) cause loss of synchronization (synch). Only transitions from in sync to out of sync are counted. Three valid ordered sets in a row are required to reestablish word sync.
Signal Loss	The receiver is not detecting a valid input signal.

Table 8. Link status table (continued)

Diagnostic information	Definition
Invalid CRC	The number of Cyclic Redundancy Check (CRC) errors that were detected by the device.

Use the buttons at the bottom of the panel for the following actions:

- **Refresh Current**

  Click this button to query the adapter for updated device link statistics since the last refresh.
- **Refresh Total**

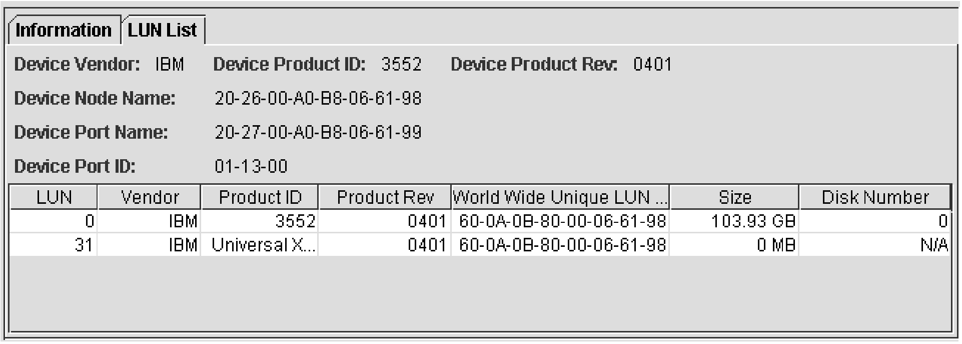
  Click this button to query the adapter for cumulative updated device link statistics.
- **Reset Current**

  Click this button to initialize link statistics.

Displaying device information: You can view general device information or a LUN list.

Viewing general device information: To view general information about a device, click the device in the FAStT MSJ main window HBA tree. The Information panel for the device displays.

Viewing the LUN List: To display information about LUNs, click the device in the FAStT MSJ main window HBA tree; then, click the **LUN List** tab. The LUN List window displays. See Figure 8.
The following LUN list information displays on the LUN List tab:



Device Vendor: IBM Device Product ID: 3552 Device Product Rev: 0401

Device Node Name: 20-26-00-A0-B8-06-61-98

Device Port Name: 20-27-00-A0-B8-06-61-99

Device Port ID: 01-13-00

LUN	Vendor	Product ID	Product Rev	World Wide Unique LUN ...	Size	Disk Number
0	IBM	3552	0401	60-0A-0B-80-00-06-61-98	103.93 GB	0
31	IBM	Universal X...	0401	60-0A-0B-80-00-06-61-98	0 MB	N/A

Figure 8. LUN List window

- LUN: The LUN number
- Vendor: The manufacturer of the LUN
- Product ID: The product ID of the LUN
- Product Rev: The product revision level of the LUN
- World Wide Unique LUN Name: The World wide name of the LUN
- Size: The capacity of the LUN
- Disk Number: The disk number of the LUN

Displaying LUN information: To view general information about a LUN, click the LUN in the FAStT MSJ main window HBA tree; then, click the **Information** tab. The **Information** window for the LUN displays.

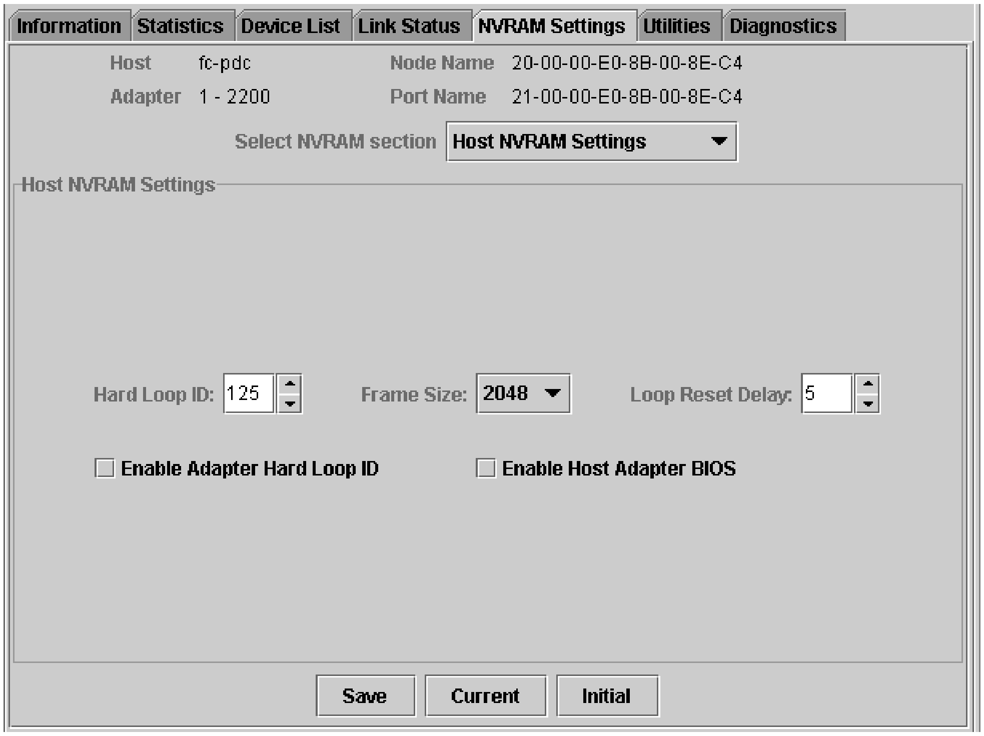
NVRAM settings

The NVRAM Settings panel displays parameters that are saved in the adapter Non-Volatile RAM (NVRAM).

Note: The NVRAM parameters are preset at the factory. Do not alter them unless an IBM technical support representative instructs you to do so. Adapter operation might be adversely affected if you enter the wrong parameters.

The NVRAM Settings panel controls three categories of NVRAM settings: Host NVRAM Settings, Advanced NVRAM Settings, and Extended NVRAM Settings. You access sections by clicking an option in the **Select NVRAM** drop-down list. The following sections define the NVRAM parameters and do not necessarily reflect the IBM default values.

Host NVRAM settings: When you click **Host NVRAM Settings** in the **Select NVRAM section** list box, the information shown in Figure 9 displays.



Host fc-pdc
Node Name 20-00-00-E0-8B-00-8E-C4
Adapter 1 - 2200
Port Name 21-00-00-E0-8B-00-8E-C4
Select NVRAM section Host NVRAM Settings

Host NVRAM Settings

Hard Loop ID: 125
Frame Size: 2048
Loop Reset Delay: 5

□ Enable Adapter Hard Loop ID
□ Enable Host Adapter BIOS

Figure 9. Host NVRAM Settings panel

The following parameters are available in the Host NVRAM Settings section:

Hard Loop ID
ID used by the adapter when the **Enable Adapter Hard Loop ID** setting is enabled.

Frame Size
Specifies the maximum frame length supported by the adapter. The valid frame sizes are: 512, 1024, and 2048.

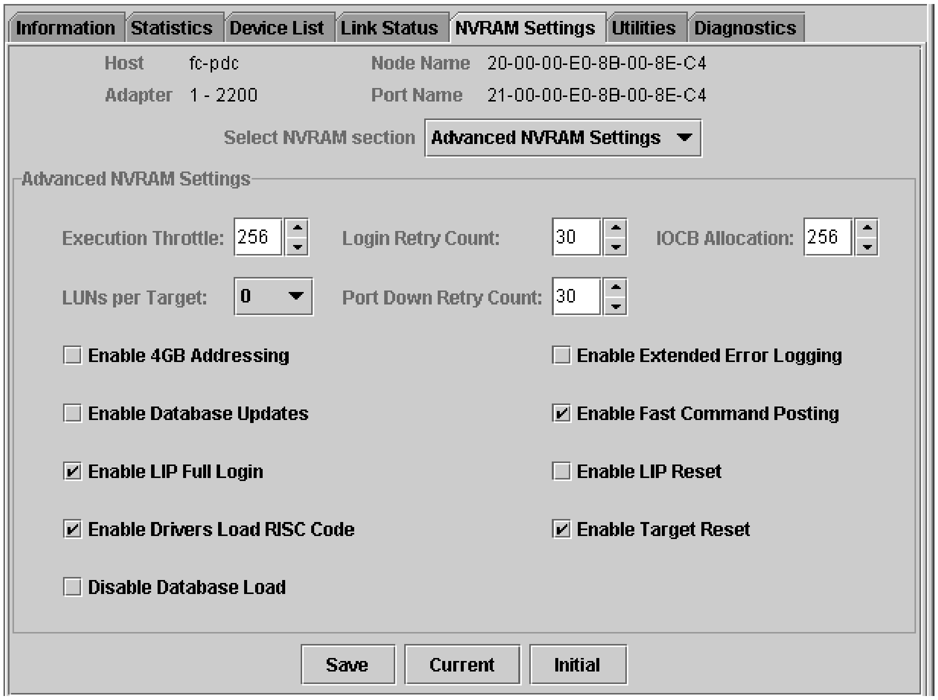
Loop Reset Delay
After resetting the loop, the firmware refrains from initiating any loop activity for the number of seconds specified in this setting. The valid delay is 0 to 60 seconds.

Enable Adapter Hard Loop ID
If this setting is enabled, the adapter uses the ID specified in the **Hard Loop ID** setting.

Enable Host Adapter BIOS
When this setting is disabled, the ROM BIOS on the host bus adapter is disabled, freeing space in the upper memory of the system. Do not disable this setting if you are booting from a fibre channel disk drive attached to the adapter.

The **Initial** button restores all parameters to the settings used when the system was initially started. The **Current** button restores the updated settings modified by FAStT MSJ. The **Save** button saves the updated NVRAM settings.

Advanced NVRAM settings: When you click **Advanced NVRAM Settings** in the **Select NVRAM section** list box, the information shown in Figure 10 displays.



Host fc-pdc
Adapter 1 - 2200
Node Name 20-00-00-E0-8B-00-8E-C4
Port Name 21-00-00-E0-8B-00-8E-C4

Select NVRAM section: Advanced NVRAM Settings

Advanced NVRAM Settings

Execution Throttle: 256
Login Retry Count: 30
IOCB Allocation: 256
LUNs per Target: 0
Port Down Retry Count: 30

☐ Enable 4GB Addressing
☐ Enable Extended Error Logging
☐ Enable Database Updates
☑ Enable Fast Command Posting
☑ Enable LIP Full Login
☐ Enable LIP Reset
☑ Enable Drivers Load RISC Code
☑ Enable Target Reset
☐ Disable Database Load

Figure 10. Advanced NVRAM Settings panel

The following parameters are available in the Advanced NVRAM Settings section:

Execution Throttle
Specifies the maximum number of commands running on any one port. When a port execution throttle is reached, no new commands are run until the current command finishes running. The valid values for this setting are in the range 1 to 256.

Login Retry Count
Specifies the number of retries the adapter uses during a login. This can be a value in the range 0 to 255.

IOCB Allocation
Specifies the maximum number of buffers from the firmware buffer pool to be allocated to any one port. Valid range is 1 to 512.

LUNs per Target

Specifies the number of LUNs per target. Multiple LUN support is typical for Redundant Array of Independent Disk (RAID) boxes that use LUNs to map drives. The valid values for this setting are 0, 8, 16, 32, 64, 128, and 256. If you do not need multiple LUN support, set **LUNs per Target** to 0.

Port Down Retry Count

Specifies the number of times the adapter software retries a command to a port returning port down status. Valid range is 0 to 255.

Enable 4GB Addressing

When enabled, the adapter is notified if the system has more than 4 gigabytes of memory.

Enable Database Updates

When enabled, the adapter device driver saves loop configuration information in the flash (EEPROM) when the system is powered down.

Enable LIP Full Login

When this setting is enabled, the adapter logs in to all ports after a loop initialization process (LIP).

Enable Drivers Load RISC Code

When this setting is enabled, the host adapter uses the RISC firmware that is embedded in the adapter device driver. If this setting is disabled, the adapter device driver loads the latest version of RISC firmware found on the system.

Note: The device driver being loaded must support this setting. If the device driver does not support this setting, the result is the same as disabled regardless of the setting. Leaving this option enabled ensures support of the software device driver and RISC firmware.

Disable Database Load

When enabled, the device database is read from the registry during device driver initialization. When disabled, the device database is created dynamically during device driver initialization. The default value is cleared (Disable Database Load is not enabled).

Note: This option usually applies to Windows NT and Windows 2000 operating environments.

Enable Extended Error Logging

This setting provides additional error and debugging information to the operating system.

Enable Fast Command Posting

When this setting is enabled, command execution time is decreased by minimizing the number of interrupts.

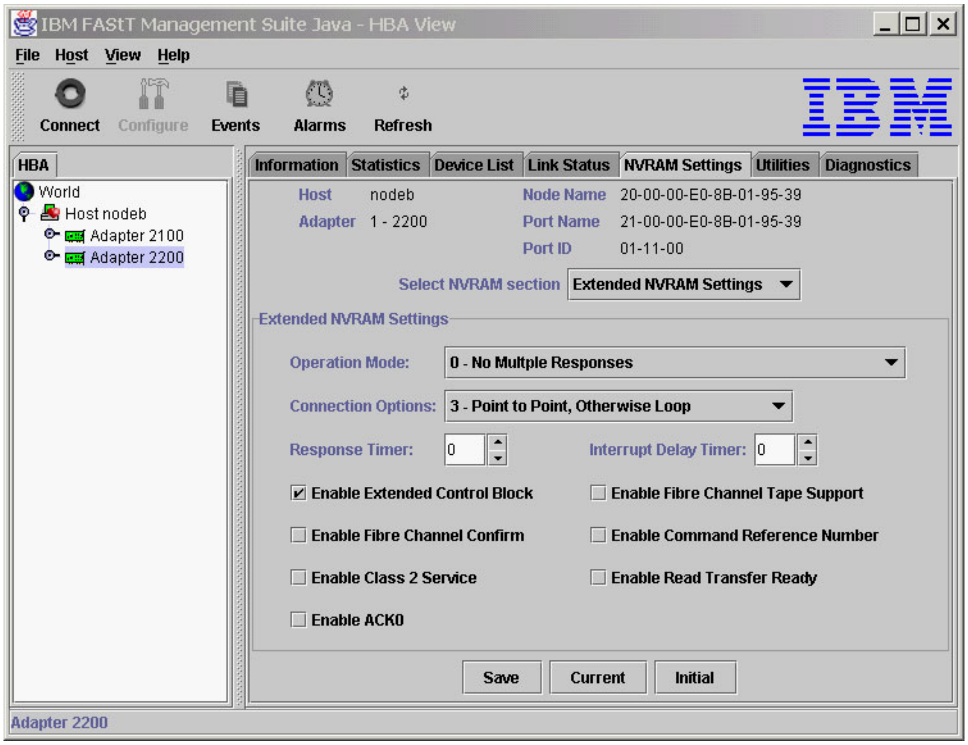
Enable LIP Reset

This setting determines the type of LIP reset that is used when the operating system initiates a bus reset routine. When this setting is enabled, the adapter device driver initiates a global LIP reset to clear the target drive reservations. When this setting is disabled, the device driver initiates a global LIP reset with full login.

Enable Target Reset

When this setting is enabled, the adapter device driver issues a target reset to all devices on the loop during a SCSI bus reset function call.

Extended NVRAM settings: When you click **Extended NVRAM Settings** in the **Select NVRAM section** list box, the information shown in Figure 11 displays.



Host nodeb
Adapter 1 - 2200
Node Name 20-00-00-E0-8B-01-95-39
Port Name 21-00-00-E0-8B-01-95-39
Port ID 01-11-00

Select NVRAM section: Extended NVRAM Settings

Extended NVRAM Settings

Operation Mode: 0 - No Multple Responses

Connection Options: 3 - Point to Point, Otherwise Loop

Response Timer: 0

Interrupt Delay Timer: 0

☑ Enable Extended Control Block

☐ Enable Fibre Channel Tape Support

☐ Enable Fibre Channel Confirm

☐ Enable Command Reference Number

☐ Enable Class 2 Service

☐ Enable Read Transfer Ready

☐ Enable ACK0

Figure 11. Extended NVRAM Settings panel

The following parameters are available in the Extended NVRAM Settings section:

Operation mode

Specifies the reduced interrupt operation (RIO) modes (see Table 9). RIO modes enable posting multiple command completions in a single interrupt.

Table 9. Reduced interrupt operation modes

Bit	Description
0	RIO is disabled; enable fast posting by setting the Fast Posting option.
1	Combine multiple responses, 16-bit handles, interrupt the host. The handles are reported by asynchronous event codes 8031h-8035h or the RIO Type 2 IOCB.
2	Combine multiple responses, 32-bit handles, interrupt the host. The handles are reported by asynchronous event code 8020h or 8042h or the RIO Type 1 IOCB.
3	Combine multiple responses, 16-bit handles, delay the host interrupt. The handles are reported by the RIO Type 2 IOCB.
4	Combine multiple responses, 32-bit handles, delay the host interrupt. The handles are reported by the RIO Type 1 IOCB.

Connection Options

Defines the type of connection (loop or point-to-point) or connection preference during startup (see Table 10 on page 78).

Table 10. Connection type and preference

Bit	Description
0	Loop only
1	Point-to-point only
2	Loop preferred, otherwise point-to-point
3	Point-to-point preferred, otherwise loop

Response Timer
Sets the time limit (in 100-microsecond increments) for accumulating multiple responses. For example, if this field is 8, the time limit is 800 microseconds.

Interrupt Delay Timer
Sets the time to wait (in 100-microsecond increments) between accessing a set of handles and generating an interrupt. (An interrupt is not generated when the host updates the queue out-pointer during this period.) For example, if this field is set to 4, then 400 microseconds pass between the DMA operation and the interrupt.

Enable Extended Control Block
This setting enables all extended NVRAM settings. The default is enabled.

Enable Fibre Channel Confirm
This setting is reserved for fibre channel tape support.

Enable Class 2 Service
Select this check box to provide class 2 service parameters during all automatic logins (loop ports). Clear the check box if you do not want to provide class 2 service parameters during automatic logins.

Enable ACK0
Select this check box to use ACK0 when class 2 service parameters are used. Clear this check box to use ACK1.

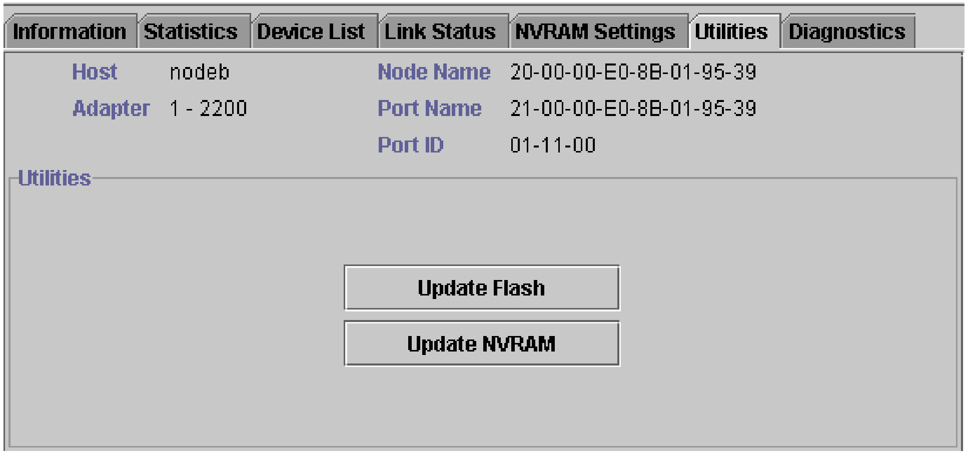
Enable Fibre Channel Tape Support
Select this check box to enable the firmware to provide fibre channel tape support.

Enable Command Reference Number
This setting is reserved. The default is disabled.

Enable Read Transfer Ready
Select this check box to enable the read transfer ready option (XFR-RDY). The firmware also sends an XPR-RDY IU before transferring read data as a SCSI target.

Utilities

Within the Utilities panel you can perform adapter-level configurations on a host-connected adapter. See Figure 12 on page 79.



Host nodeb
Adapter 1 - 2200
Node Name 20-00-00-E0-8B-01-95-39
Port Name 21-00-00-E0-8B-01-95-39
Port ID 01-11-00

Figure 12. Utilities panel

Update flash: When you click this button (and the adapter accepts the update), the application prompts for the file name that contains the new flash BIOS. You can obtain this file from the IBM Web site or service personnel. The file name ends with .BIN (for example, QL22ROM.BIN).

After you enter a valid flash file, click **OK** to proceed with the update or click **Cancel** to abort.

When you click **OK**, FAStT MSJ verifies the file name and format of the new file. If the file is valid, the application compares the version of the file with the adapter flash version. If the adapter version is the same or newer than the file flash version, the application asks if you still want to update the flash.

If the update fails, an error message displays.

Update NVRAM: When you click this button (and the adapter accepts the update), the application prompts for the file name that contains the new NVRAM. You can obtain this file from the IBM Web site or service personnel. The file name ends with .DAT (for example, NVRM22.DAT).

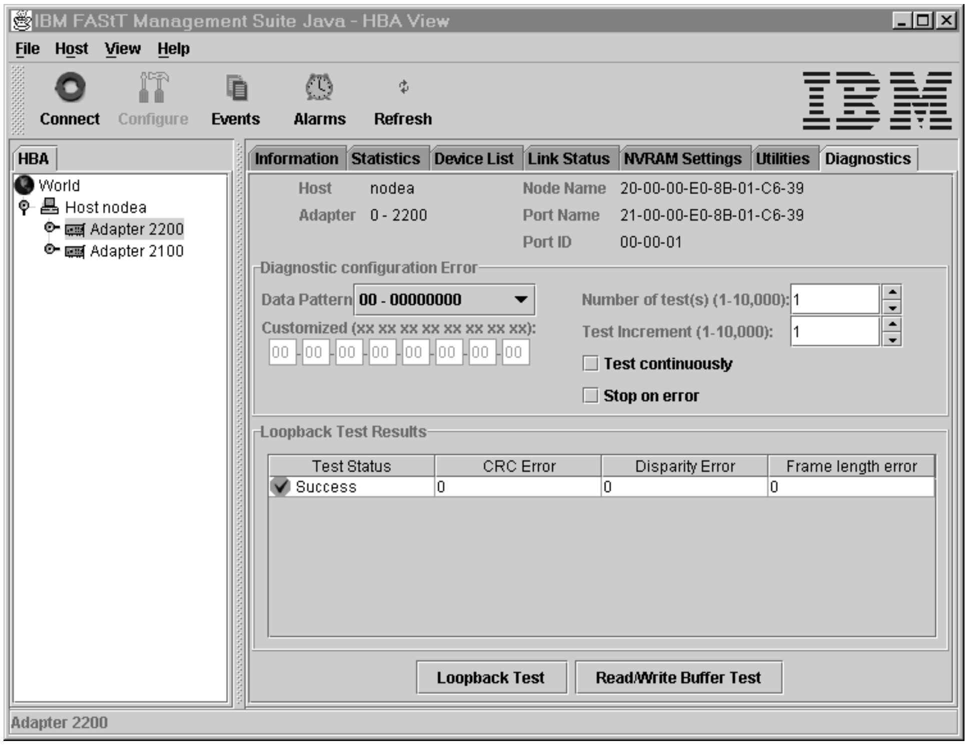
After you enter a valid NVRAM file, click **OK** to proceed with the update or click **Cancel** to abort.

When you click **OK**, FAStT MSJ verifies the contents of the new file.

If the update fails, an error message displays.

Diagnostics

You can perform the loopback and read/write buffer tests using the Diagnostics panel (see Figure 13 on page 80).



Host nodea

Adapter 0 - 2200

Node Name 20-00-00-E0-8B-01-C6-39

Port Name 21-00-00-E0-8B-01-C6-39

Port ID 00-00-01

Diagnostic configuration Error

Data Pattern 00 - 00000000

Customized (xx xx xx xx xx xx xx xx): 00 00 00 00 00 00 00 00

Number of test(s) (1-10,000): 1

Test Increment (1-10,000): 1

□ Test continuously

□ Stop on error

Loopback Test Results

Test Status	CRC Error	Disparity Error	Frame length error
✓ Success	0	0	0

Figure 13. Diagnostics panel

The loopback test is internal to the adapter. The test evaluates the fibre channel loop stability and error rate. The test transmits and receives (loopback) the specified data and checks for frame CRC, disparity, and length errors.

The read/write buffer test sends data through the SCSI Write Buffer command to a target device, reads the data back through the SCSI Read Buffer command, and compares the data for errors. The test also compares the link status of the device before and after the read/write buffer test. If errors occur, the test indicates a broken or unreliable link between the adapter and the device.

The Diagnostics panel has the following three main parts:

- Identifying Information

  This part of the panel displays information about the adapter being tested. This information includes:
  - Host
  - Adapter
  - Node Name
  - Port Name
  - Port ID
- Diagnostic Configuration Error

  This part of the panel contains the following testing options:

  Data Pattern

  Sets the test pattern. You can click a data pattern in the list or specify a customized pattern.

To specify a customized pattern, click **Customized** in the list and type the data pattern in hex format (0x00 - 0xFF) into the boxes under **Customized**.

When you select the random pattern from the list, a new random 8-byte pattern is sent to the devices, the adapter, or both (depending on whether you select the loopback or read/write buffer test).

Number of test(s)
Sets the number of tests you want to run. You can run the test for a certain number of times (up to 10,000) or continuously. You can also set the number of test increments per test up to 10,000.

Test continuously
Select this check box to test continuously.

Test Increment
The Test Increment value determines the number of times a test will be run against a particular device (read/write buffer test). For example if the value is set to 10, the read/write buffer test will be run 10 times against that device before moving to the next device in the Device List. The Number of tests parameter determines the total number of tests that will be run.

If you select **Test continuously**, the Test Increment value is set to 125 as the default value. You can increase this value up to 10,000. While the test is running, a test progress dialog window displays. You can cancel the test at any time by clicking the **Stop** button in this window. FAStT MSJ waits until the Test Increment value is reached before stopping. Thus, a large Test Increment value will delay the stop action. The delay is dependent on the number of devices being tested.

Stop on error
Select this check box if you want continuous testing to discontinue when an error is encountered.

- Loopback Test Results

  The Loopback Test Results section displays the results of a test. The first column shows whether the test passed or failed. The remaining columns display error counters.

  For a loopback test, the test result includes the following information: Test Status, CRC Error, Disparity Error, and Frame Length Error.

  For a read/write buffer test, the test result shows the following information: Loop ID/Status, Data Miscompare, Link Failure, Sync Loss, Signal Loss, and Invalid CRC.

  Some devices do not support read/write buffer commands. FAStT MSJ displays the result for these devices as Information (blue) with the `R/W buffer not supported` message in the Data Miscompare column. The test results are sorted in the following order:

  1. Errors
  2. Information
  3. Success

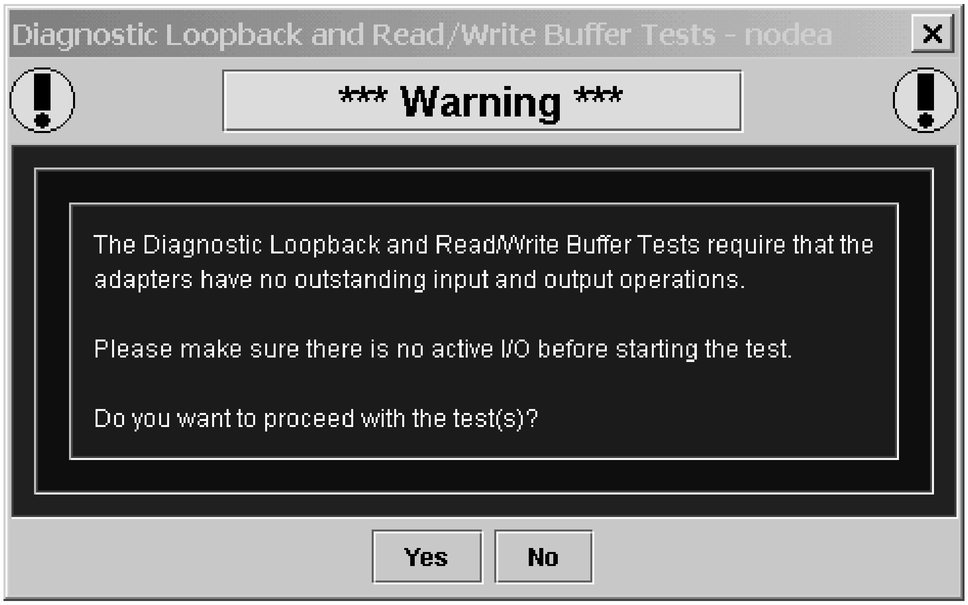
  Notes:

  1. The TotalStorage Fibre Channel host bus adapter (QLA2100) does not support loopback mode. Use only the read/write test for this type of adapter.
  2. A wrap connector and coupler (see the readme file for the part number) is available to assist in isolating loop problems. When running the loopback test,

you can plug the wrap connector directly into the FAStT host bus adapter to verify whether the adapter is functional. You can then move the wrap connector to other points in the loop (for example, ends of cables, hubs, and so on) to isolate the point of failure.

3. If the read/write buffer test returns the message `The Adapter has no devices attached`, make sure that the HBA is connected to the devices, and click **Refresh**. Detected devices will appear in the HBA tree of the selected host.

Running the diagnostic tests: After you have chosen the loopback and read/write buffer test parameters as described in “Diagnostics” on page 79, click **Loopback Test** or **Read/Write Buffer Test** to run the loopback or read/write buffer test. If displaying warnings is enabled, the warning window shown in Figure 14 displays.



The Diagnostic Loopback and Read/Write Buffer Tests require that the adapters have no outstanding input and output operations.

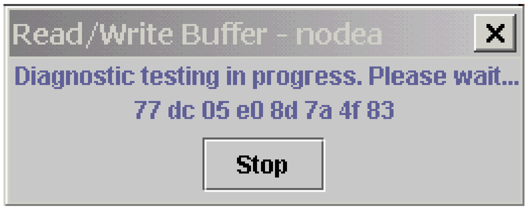
Please make sure there is no active I/O before starting the test.

Do you want to proceed with the test(s)?

Figure 14. Diagnostic Loopback and Read/Write Buffer Test Warning window

Note: To disable the warning message, click **View** -> **Options**, and clear the **Enable Warning Messages Displays** check box.

If you selected the **Test continuously** check box or a large value for number of tests or test increments, the Test Progress dialog window displays (see Figure 15). Click **Stop** to cancel the test.



Diagnostic testing in progress. Please wait...
77 dc 05 e0 8d 7a 4f 83

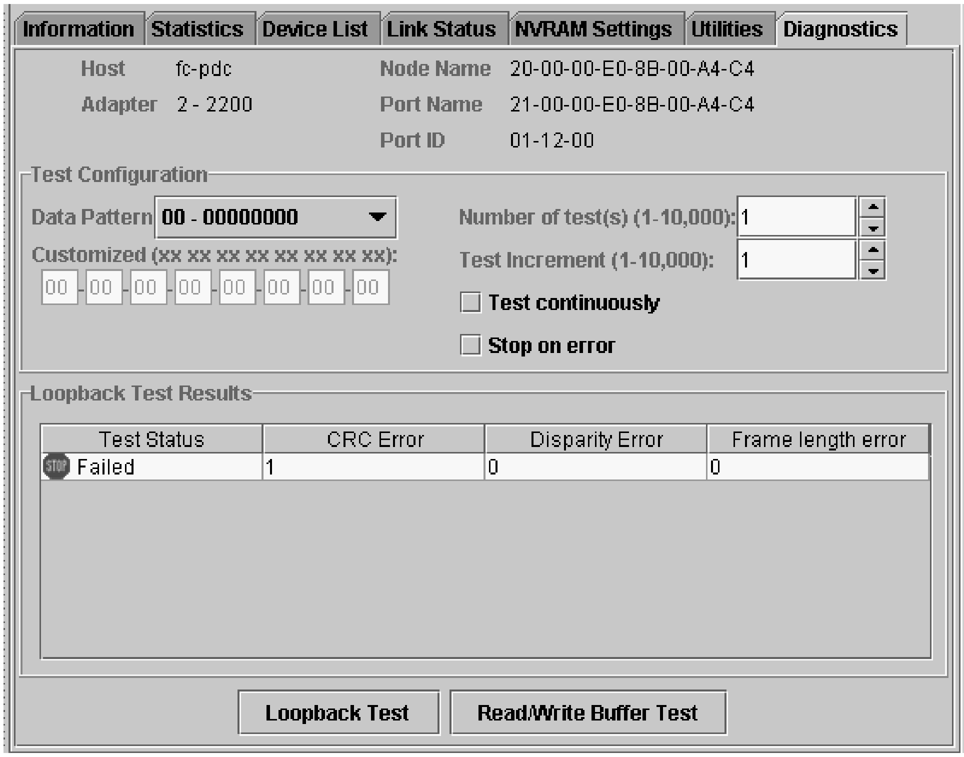
Figure 15. Test Progress dialog window

Diagnostic test results: The Test Result section of the Diagnostics panel displays the results of a test. Descriptions of the loopback and read/write test results sections follow.

Loopback test results: The Loopback Test Results section provides the following information:

- Tests Status – whether the test passed or failed. The possible values are:
  - Success – The test passed.
  - Error – CRC, disparity, or frame length errors occurred.
  - Failed – An error occurred when attempting to issue a command.
  - Loop down – The loop is down.
- CRC Error – Number of CRC errors
- Disparity Error – Number of disparity errors
- Frame Length Errors – Number of frame length errors

The Test Status column in Figure 16 shows that the loopback test failed.



Host fc-pdc

Adapter 2 - 2200

Node Name 20-00-00-E0-8B-00-A4-C4

Port Name 21-00-00-E0-8B-00-A4-C4

Port ID 01-12-00

Test Configuration

Data Pattern 00 - 00000000

Customized (xx xx xx xx xx xx xx xx): 00 - 00 - 00 - 00 - 00 - 00 - 00 - 00

Number of test(s) (1-10,000): 1

Test Increment (1-10,000): 1

□ Test continuously

□ Stop on error

Loopback Test Results

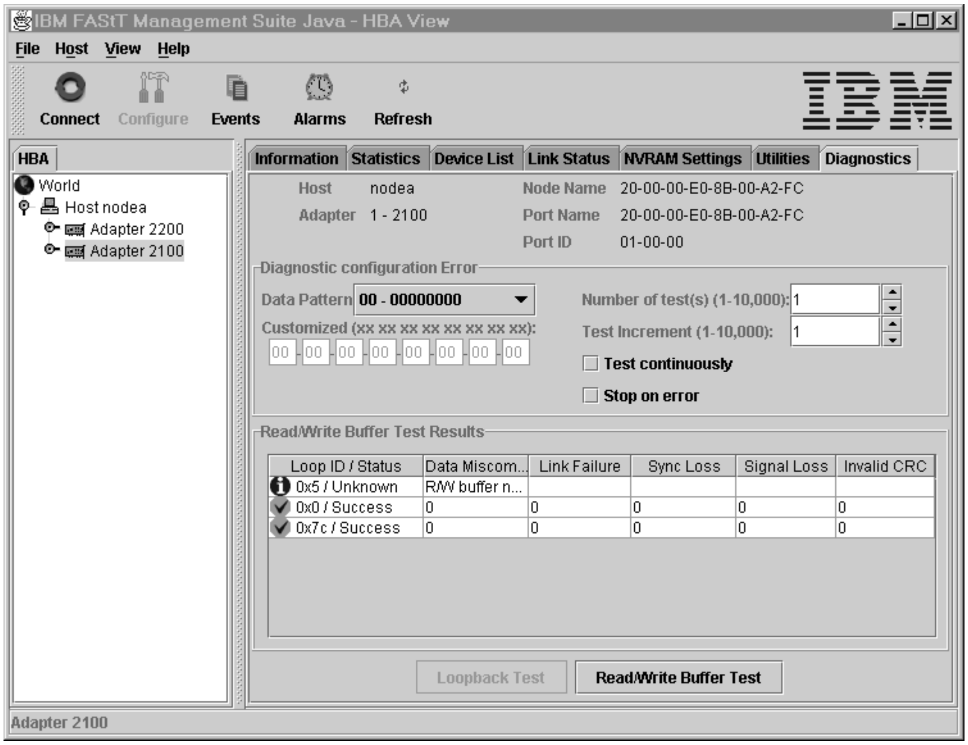
Test Status	CRC Error	Disparity Error	Frame length error
STOP Failed	1	0	0

Figure 16. Test Results section of the Diagnostics panel

Read/Write Buffer Test Results: The Read/Write Buffer Test Results section provides the following information (see Figure 17 on page 84):

- Loop ID – The loop ID of the adapter when operating in loop mode
- Status – Whether the test passed or failed. The possible values:
  - Success – The test passed.
  - Error – A data miscompare or link status firmware error occurred.
  - Failed – A link status error, SCSI write buffer error, or SCSI read buffer error occurred.
  - Unknown – The target was not present.
  - Unsupported – The device does not support this test.
- Data Miscompare – Type of data miscompare. The possible values:

  - 0 (no data miscompares)
  - Get link status failed
  - Read buffer failed
  - Reserve unit failed
  - Release unit failed
  - R/W buffer not supported
  - Write buffer failed
- Link Failure – Number of link failures
- Sync Loss – Number of sync loss errors
- Signal Loss – Number of signal loss errors
- Invalid CRC – Number of CRCs that were not valid



Host	nodea	Node Name	20-00-00-E0-8B-00-A2-FC
Adapter	1 - 2100	Port Name	20-00-00-E0-8B-00-A2-FC
		Port ID	01-00-00

Diagnostic configuration Error

Data Pattern 00 - 00000000

Customized (xx xx xx xx xx xx xx xx): 00-00-00-00-00-00-00-00

Number of test(s) (1-10,000): 1

Test Increment (1-10,000): 1

□ Test continuously

□ Stop on error

Read/Write Buffer Test Results

Loop ID / Status	Data Miscom...	Link Failure	Sync Loss	Signal Loss	Invalid CRC
0x5 / Unknown	R/W buffer n...				
✓ 0x0 / Success	0	0	0	0	0
✓ 0x7c / Success	0	0	0	0	0

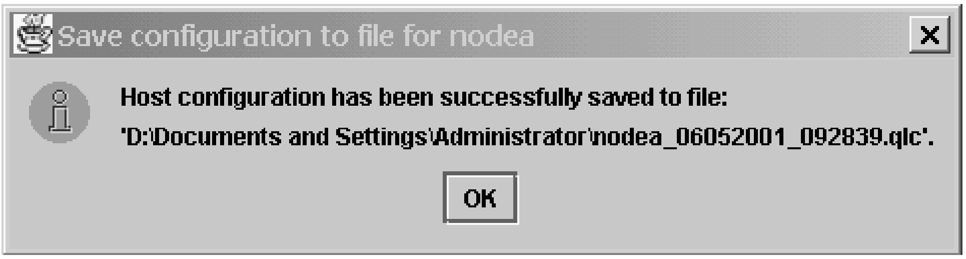
Figure 17. Read/Writer Buffer Test Results section of the Diagnostics panel

Saving a configuration to a file

You can save a virtual image of a host that has been configured and might no longer be connected to the network by saving the host configuration to a file. To load the configuration of the host that has been saved, you must first configure and save the host information to a file.

To save the host configuration, click **File -> Save Configuration to File** in the Host Adapter Configuration window.

You are alerted with the information shown in Figure 18 on page 85.



Host configuration has been successfully saved to file:
'D:\Documents and Settings\Administrator\nodea_06052001_092839.qlc'.

Figure 18. Save Configuration to File Notification dialog window

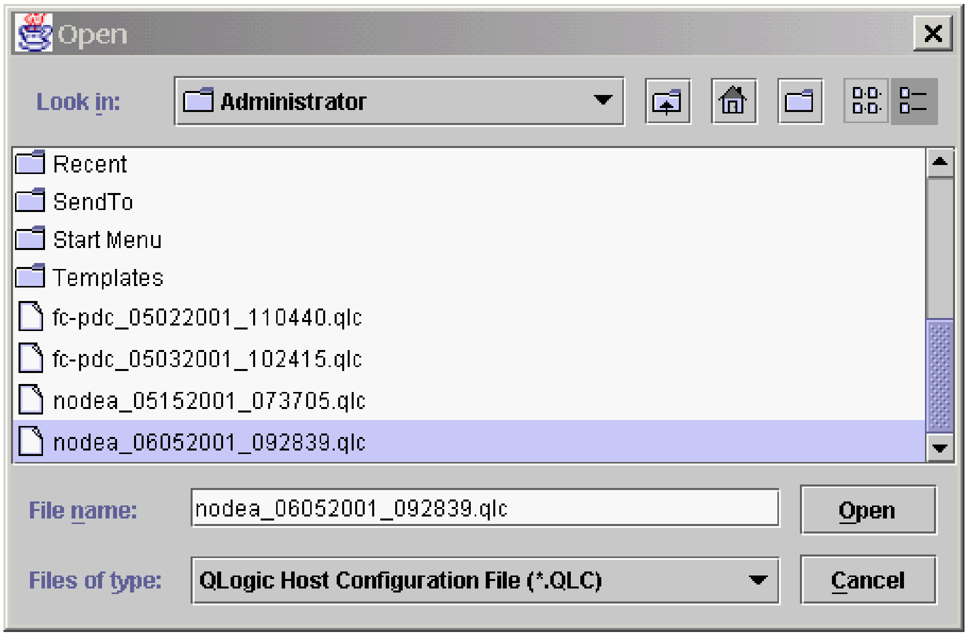
After you save the .qlc file, you can load it.

Loading a configuration from a file

After you save the host configuration to a file, you can load the configuration. Loading from a file enables you to load a virtual image of a host that was previously configured and is no longer connected to the network.

To load a configuration from FAStT MSJ, perform the following steps:

1. Click **Host -> Load from File** in the Host Adapter Configuration window.
2. In the Open window, click the file you want to load, and then click **Open** (see Figure 19).



Open
Recent
SendTo
Start Menu
Templates
fc-pdc_05022001_110440.qlc
fc-pdc_05032001_102415.qlc
nodea_05152001_073705.qlc
nodea_06052001_092839.qlc
Open
Cancel

Look in: Administrator

File name: nodea_06052001_092839.qlc

Files of type: QLogic Host Configuration File (*.QLC)

Figure 19. Open window

After you load the file, the adapters under the newly loaded host will appear in blue in the HBA. Blue adapters indicate that the host was loaded from a file rather than a live host.

Opening a group

Opening the group from a file enables the user to reload all the host information that was previously saved by the Save Group operation. FAStT MSJ will then connect the host and identify any discrepancies between the saved configuration and the newly discovered one.

To open a host configuration, click **File** -> **Open Group** in the **host adapter configuration** window. Select the desired .hst file from the **Open** window. After the file opens, the newly loaded host will be connected and displayed in the HBA tree panel.

Saving a group

Saving a Host Group to a file enables the user to save the HBA tree for that host including the device list and configuration settings. This feature also allows a system administrator to create Host files to selectively connect a number of hosts in the same SAN.

To save a host configuration to FAStT MSJ, you must configure the host adapter. Click **File** -> **Save Group** in the host adapter configuration window.

After you select **Save Group**, the Save window displays. Select a file name (for example, Host NodeA.HST) and click **Enter.**

SAN port configuration on Linux

This section describes the port configuration function of FAStT MSJ and includes the following information:

- Configuring fibre channel devices
- Configuring LUNs for a device
- Viewing adapter, device, and path information
- Editing persistent configuration data
- Saving and printing the host configuration file
- Using the failover watcher

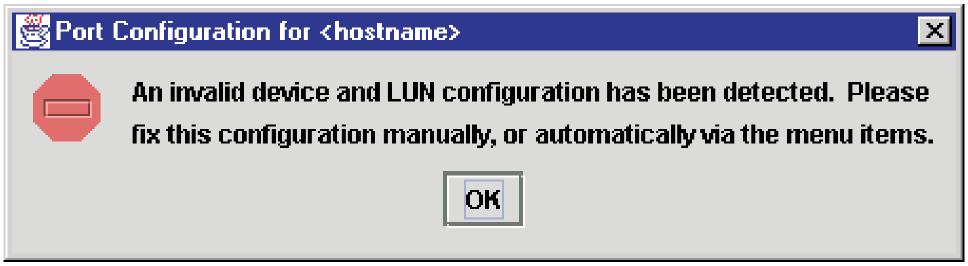
Note: All of these configuration functions are available for only Linux operating systems.

Configuring fibre channel devices

Perform the following steps to configure fibre channel devices:

1. Perform one of the following actions from the FAStT MSJ main menu:
   - In the HBA tree, click the host or an adapter connected to the host. Click **Configure** on the toolbar.
   - Right-click the host or adapter in the HBA tree. From the pop-up menu, click **Configure**. If FAStT MSJ detects an erroneous port configuration, the following message displays. Click **OK** to continue.

     Note: You will see the message shown in Figure 20 on page 87 prior to configuring the ports for the first time.



Port Configuration for <hostname>

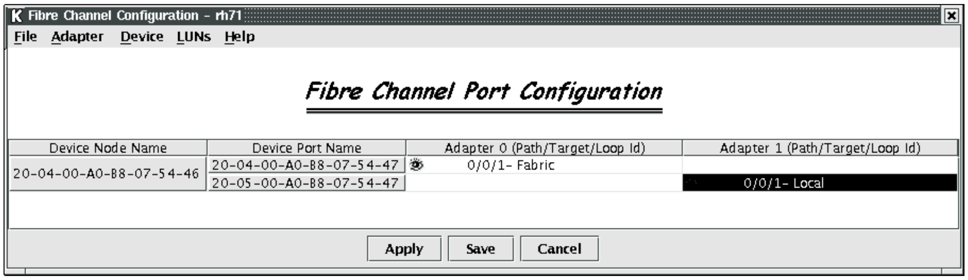
An invalid device and LUN configuration has been detected. Please fix this configuration manually, or automatically via the menu items.

Figure 20. Port Configuration Message dialog window

Erroneous port configurations include:

- A device with contradictory visible paths. Only one path can be visible at a time.
- A LUN with contradictory (both disabled and enabled) paths. A configuration is valid when all paths are either enabled or disabled.
- More than one preferred path in the system. Only one path can be preferred at a time.

The Fibre Channel Port Configuration window displays (see Figure 21). The host name displays in the title bar. The window displays the adapters and devices in the computer. The following information displays.



Fibre Channel Configuration – rh71

Fibre Channel Port Configuration

Device Node Name	Device Port Name	Adapter 0 (Path/Target/Loop Id)	Adapter 1 (Path/Target/Loop Id)
20-04-00-A0-B8-07-54-46	20-04-00-A0-B8-07-54-47	0/0/1- Fabric	
	20-05-00-A0-B8-07-54-47		0/0/1- Local

Figure 21. Fibre channel port configuration

- Device Node Name: World wide device node name
- Device Port Name: World wide device port name
- Adapter n (Path/Target/Loop ID): The adapter cell in the table represents a path (the device is visible to the adapter)

Adapter cell information consists of the following information:

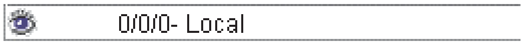
– Path: Path number

– Target: Device ID

– Loop ID: Complement of the arbitrated loop_physical address (AL_PA)

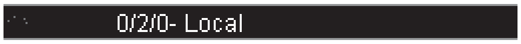
The adapter cells are color-coded to represent path information, as follows:

– White with open eye icon: The path is visible to the operating system.



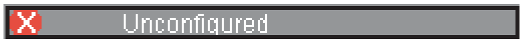
0/0/0- Local

– Black with no icon: The path is hidden from the operating system.



0/2/0- Local

– Gray with stop icon: The device is unconfigured.



Unconfigured

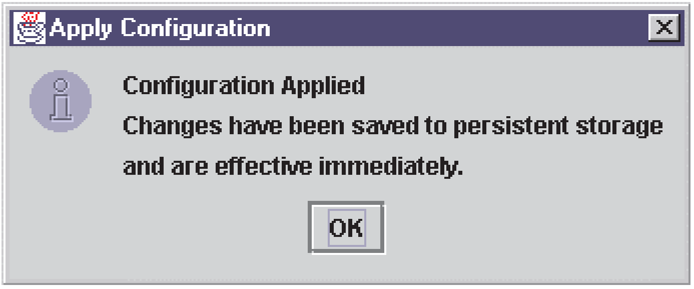
- White with no icon: There is no path present.

2. Select the following, as appropriate, from the Fibre Channel Port Configuration window menu.
   - Modify the devices, LUNs, and paths:
     - Editing persistent configuration data (see “Editing persistent configuration data” on page 98)
     - Separating and combining separated device ports (see “Separating and combining separated device ports” on page 89)
     - Auto configuring device paths (see “Automatically configuring device paths” on page 90)
     - Configuring LUNs for a device (see “Configuring LUNs for a device” on page 91)
     - Enabling and disabling LUNs (see “Enabling and disabling all LUNs” on page 90)
     - Load balancing LUN paths on this host (see “Load balancing LUN paths on this host” on page 90)
     - Setting device path visibility (see “Setting device path visibility” on page 91)
   - View information:
     - Adapter information (see “Viewing adapter information” on page 97)
     - Device information (see “Viewing device information” on page 97)
     - Help information. Click **Help** -> **Browse Contents**. The help text for the Fibre Channel Port Configuration window displays.
3. The modified configuration set up by FAStT MSJ can be applied to the live system for dynamic updates, or can be saved to the system persistent configuration file. When you save the configuration, the adapter device driver retrieves the data from the persistent configuration file at the next system startup and configures the system accordingly.

Perform one of the following actions:

- Click **Apply** to apply the new configuration. The new configuration is saved to the persistent configuration file; it will be used the next time you start the system. The new configuration remains in memory and displays after the apply operation completes. If configuration is successful, the message shown in Figure 22 on page 89 displays. Click **OK**.

  Note: For Linux operating systems, the applied configuration is only effective after the device driver is unloaded and subsequently reloaded with modprobe.



Apply Configuration

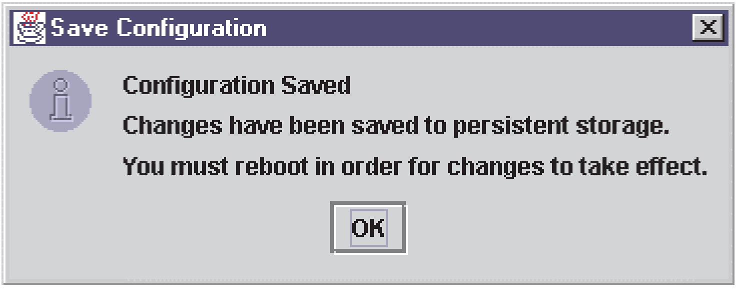
Configuration Applied

Changes have been saved to persistent storage and are effective immediately.

Figure 22. Apply Configuration dialog window

- Click **Save** to save the new configuration. The new configuration is saved to the persistent configuration file; it will be used the next time you start the system. The current configuration remains in memory and is redisplayed after the save operation completes.

  If the save was successful, the following message displays (see Figure 23). Click **OK**.



Save Configuration

Configuration Saved

Changes have been saved to persistent storage.

You must reboot in order for changes to take effect.

Figure 23. Save Configuration dialog window

  If the save failed, the **Save Configuration Failed** message displays. The failure is usually caused by communication problems between the GUI and agent. Click **OK**.

- Click **Cancel** on the Fibre Channel Port Configuration window if you do not want to save the configuration changes.

Note: For Linux operating systems, the saved configuration is effective after the device driver is reloaded. Restarting is not required.

Separating and combining separated device ports

Failover and currently active paths are usually configured based on the device (as represented by the device node name). This method allows for adapter level and port failover. You can, however, separate a device into two devices based on a port (by device port name), where each device has a subset of paths. This allows only for adapter level failover.

Forcing separate devices: Perform the following steps to divide a device with two ports into two distinct devices based on the port. Click **Edit** -> **Force Separate Devices**, or right-click the device node name and click **Force Separate Devices**.

Combining separated devices: Perform the following steps to combine two devices with the same device node name (separated based on their port name) back into one device based on the device node name:

1. Click the device node name in the Fibre Channel Port Configuration window.

2. Click **Edit** -> **Combine Separated Devices**, or right-click the **Device Node Name** and click **Combine Separated Devices**.

Automatically configuring device paths

The **Auto Configure** option configures all device paths for the selected host to the default values. The default path for each device is the first available path as visible, with the other paths hidden. This option prompts for the automatic configuration of LUNs associated with these devices.

Perform the following steps to configure the device paths, and optionally the LUN paths, on this host to default values:

1. From the Fibre Channel Port Configuration window, click **Tools** -> **Auto Configure**. The system prompts whether you also want to use default LUN configurations.
2. Click **Yes** to change the current LUN configurations to the default values. Click **No** to keep the current LUN configuration settings.

Enabling and disabling all LUNs

Perform the following steps to configure all LUNs attached to devices on this host as enabled or disabled:

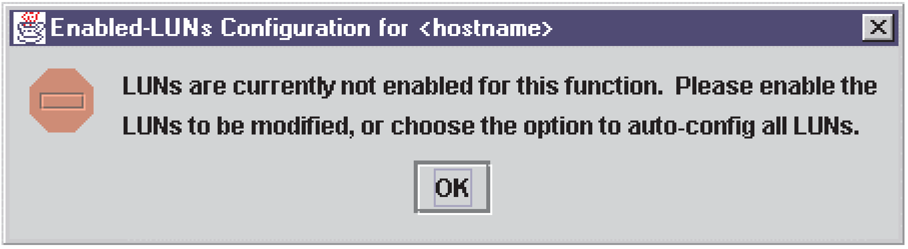
1. From the Fibre Channel Port Configuration window, click **Tools** -> **Enable LUNs**.
2. Perform one of the following actions:
   - Click **Enable All** to configure all LUNs as enabled.
   - Click **Disable All** to configure all LUNs as disabled.
   - Click **Inverse State** to enable currently disabled LUNs and disable currently enabled LUNs.

Load balancing LUN paths on this host

The **Load Balance** option configures all LUN paths on this host to use system resources most efficiently. The LUNs are staggered between the adapters for load distribution. You can configure all LUNs or only LUNs that are enabled.

Perform the following steps to configure LUNs on this host:

1. From the Fibre Channel Port Configuration window, click **Tools** -> **Load Balance**.
2. Perform one of the following actions:
   - Click **Enabled LUNs Only** to configure only enabled LUNs for load balancing across the paths within this device. When you click this option for a device with no enabled LUNs, the message shown in Figure 24 displays. Click **OK**.



Enabled-LUNs Configuration for <hostname>

LUNs are currently not enabled for this function. Please enable the LUNs to be modified, or choose the option to auto-config all LUNs.

Figure 24. Enabled LUNs Only Warning dialog window

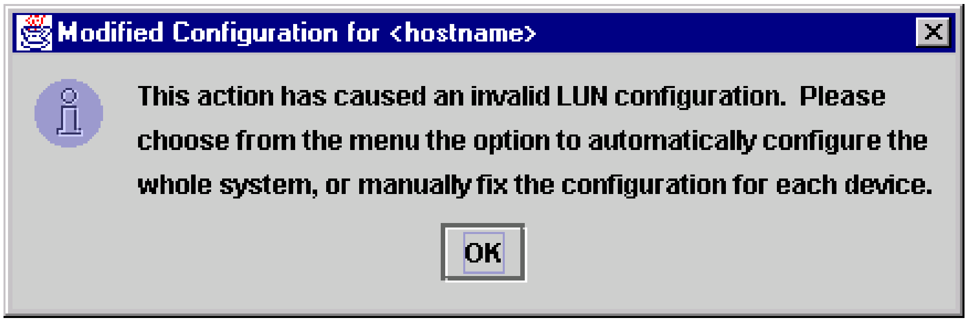
   - Click **All LUNs** to configure all LUNs for load balancing across the paths within this device.

Setting device path visibility

Perform the following steps to set device path visibility to the operating system.

Note: There must be one visible path for the operating system to see the device.

1. In the Fibre Channel Port Configuration window, right-click the cell in the Adapter n column that contains the adapter name.
2. From the pop-up menu, click one of the following options:
   - Click **Set Visible** to set this path as visible to the operating system during the start process.
   - Click **Set Hidden** to set this path as not visible to the operating system during the start process but used in failover conditions.
   - Click **Set Unconfigured** to set this path as not visible to the operating system. The path is not used in failover conditions. If setting the path has caused the LUNs associated with this device to have an invalid configuration, the error message shown in Figure 25 displays. This problem is usually the result of changing the configuration state of a device. You must modify the LUN configuration for this device before you can save or apply the configuration.



This action has caused an invalid LUN configuration. Please choose from the menu the option to automatically configure the whole system, or manually fix the configuration for each device.

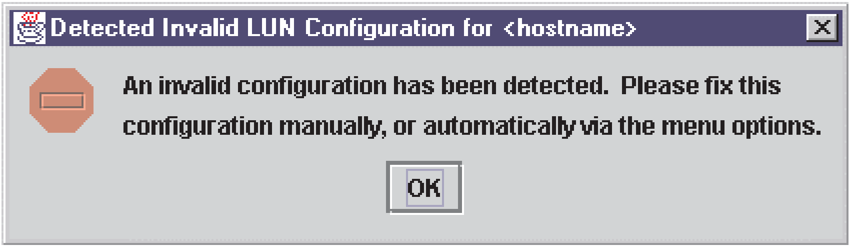
Figure 25. Modified Configuration Error dialog window

Configuring LUNs for a device

Perform the following steps to configure individual LUNs for a selected device:

1. In the Fibre Channel Port Configuration window, right-click the cell in the Device Node Name or Device Port Name column that contains the device name.
2. From the pop-up menu, click **Configure LUNs**.
   - If FAStT MSJ detects an erroneous LUN configuration, the message shown in Figure 26 displays. Click **OK** to continue.

   Erroneous LUN configurations include:



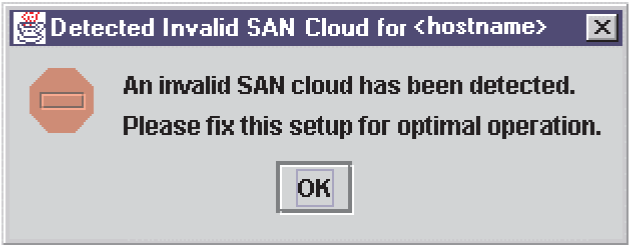
An invalid configuration has been detected. Please fix this configuration manually, or automatically via the menu options.

Figure 26. Detected Invalid LUN Configuration Error dialog window

   – A LUN with both enabled and disabled paths. All paths must be either enabled or disabled.

  - Too many preferred paths in the system. Only one path can be preferred at a time.
- If FAStT MSJ detects an erroneous SAN cloud configuration, the message shown in Figure 27 displays. Change this configuration before continuing; FAStT MSJ cannot manage erroneous SAN configurations. Click **OK** to continue.

The LUN Configuration window for the device displays (see Figure 28).

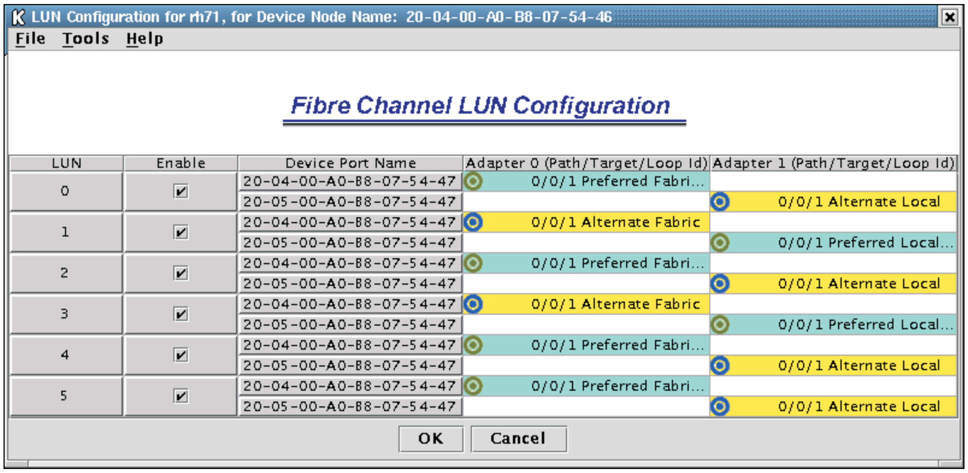


Detected Invalid SAN Cloud for <hostname>

An invalid SAN cloud has been detected.

Please fix this setup for optimal operation.

Figure 27. Detected Invalid SAN Cloud dialog window



LUN Configuration for rh71, for Device Node Name: 20-04-00-A0-B8-07-54-46

Fibre Channel LUN Configuration

LUN	Enable	Device Port Name	Adapter 0 (Path/Target/Loop Id)	Adapter 1 (Path/Target/Loop Id)
0	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Preferred Fabri...	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Alternate Local
1	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Alternate Fabric	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Preferred Local...
2	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Preferred Fabri...	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Alternate Local
3	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Alternate Fabric	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Preferred Local...
4	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Preferred Fabri...	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Alternate Local
5	☑	20-04-00-A0-B8-07-54-47	◎ 0/0/1 Preferred Fabri...	
		20-05-00-A0-B8-07-54-47		◎ 0/0/1 Alternate Local

Figure 28. LUN Configuration window

The title displays the host name and world wide device node name. The table displays the following information:

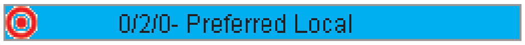
- LUN: LUN number
- Enable: Whether the LUN is enabled
- Device Port Name: World wide device port name
- Adapter n (Path/Target/Loop ID): The adapter cell in the table represents a path (the device is visible to the adapter)

Adapter cell information consists of the following:

  - Path: Path number
  - Target: Device ID
  - Loop ID: Loop IDs are 7-bit values that represent the 127 valid AL_PA addresses.
  - Path type: Preferred or Alternate, and Current

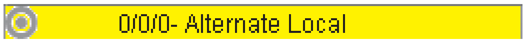
  The adapter cells are color-coded to represent path information, as follows:

  - Cyan with green bull's-eye: The preferred path to the LUN.



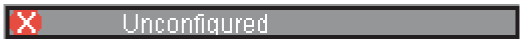
0/2/0- Preferred Local

- Yellow with blue bull's-eye: An alternate path to the LUN.



0/0/0- Alternate Local

- Gray with Stop icon: This is an unconfigured device.

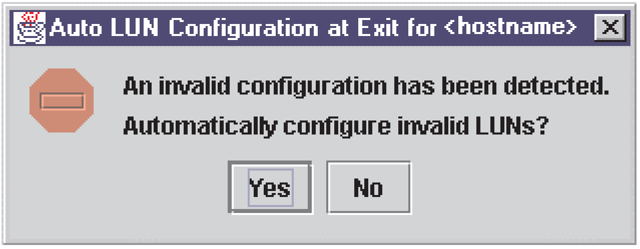


Unconfigured

- White with no icon: There is no path present.

3. Click the following, as appropriate, from the LUN Configuration window menu:
   - Modify the LUNs and paths for this device:
     - Auto configuring LUN paths (see "Automatically configuring LUN paths" on page 94)
     - Load balancing LUN paths on this device (see "Load balancing LUN paths on this device" on page 94)
     - Configuring a LUN path using the default (see "Configuring a LUN path using the default" on page 94)
     - Enabling and disabling all LUNs (see "Enabling and disabling all LUNs" on page 90)
     - Enabling and disabling individual LUNs (see "Enabling and disabling individual LUNs" on page 95)
     - Setting LUN path failover (see "Setting LUN path failover" on page 95)
   - View information:
     - Adapter information (see "Viewing adapter information" on page 97)
     - Device information (see "Viewing device information" on page 97)
     - Path information (see "Viewing path information" on page 98)
   - Help information. Click **Help** -> **Browse Contents**. The help text for the LUN Configuration window displays.
4. Click **OK** to save the changes until you exit the Fibre Channel Port Configuration window; then, review the configuration changes (see Step 3). If FAStT MSJ detects an erroneous LUN configuration while saving the configuration, the Auto LUN Configuration at Exit for <*hostname*> window displays (see Figure 29).

Perform one of the following actions:



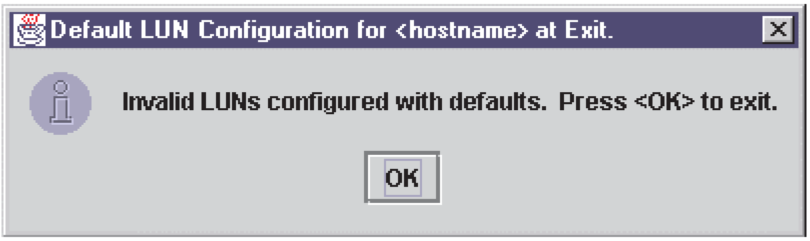
Auto LUN Configuration at Exit for <hostname>

An invalid configuration has been detected.

Automatically configure invalid LUNs?

Figure 29. Auto LUN Configuration at Exit dialog window

- Click **Yes** if you want the software to configure the invalid LUNs with the default paths. The confirmation message shown in Figure 30 on page 94 displays. Click **OK**.



Invalid LUNs configured with defaults. Press <OK> to exit.

Figure 30. Invalid LUNs Configured with Defaults Error dialog window

- Click **No** if you do not want to configure the invalid LUNs. The configuration changes you made are not saved.
- Click **Cancel** if you do not want to apply the configuration changes.

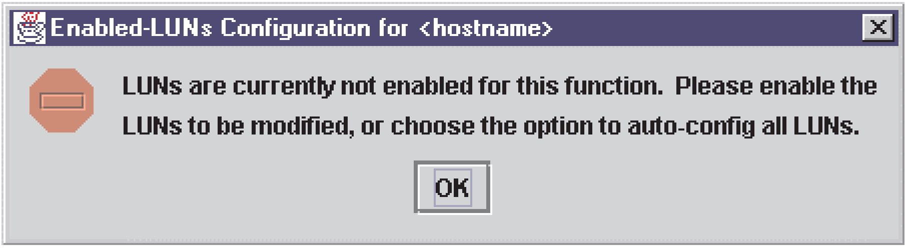
Automatically configuring LUN paths

The **Auto Configure** option configures all LUN paths for the selected device to the default values. The default path for each LUN is the first available preferred path, with the other paths as alternates. From the LUN Configuration window **Tools** menu, click **Auto Configure** to configure the LUN paths on this device to the default values.

Load balancing LUN paths on this device

The **Load Balance** option configures all LUN paths on this device to use system resources most efficiently. The LUNs are staggered between the devices to provide load distribution. You can configure all LUNs or only LUNs that are enabled. Perform the following steps to configure the LUNs on this device:

1. From the LUN Configuration window **Tools** menu, click **Load Balance**.
2. Perform one of the following actions:
   - Click **Enabled LUNs Only** to configure only those LUNs enabled for load balancing across the paths within this device. If you clicked this option for a device with no enabled LUNs, the message shown in Figure 31 displays. Click **OK**.



LUNs are currently not enabled for this function. Please enable the LUNs to be modified, or choose the option to auto-config all LUNs.

Figure 31. Enabled LUNs Configuration Error dialog window

   - Click **All LUNs** to configure all LUNs for load balancing across the paths within this device.

Configuring a LUN path using the default

Perform the following steps to configure LUN paths to the default values for LUN failover, with the first configured path as preferred and all other paths as alternates.

Note: This option is available only if the LUN is enabled and there are at least two available paths.

1. For the LUN you want to configure, right-click the LUN, Enable, or Device Port Name column.
2. From the pop-up menu, click **Configure Path Using Default**.

Enabling and disabling all LUNs

Perform the following steps to configure all LUNs attached to this device as either enabled or disabled:

1. In the LUN Configuration window, right-click the **Enable** heading.
2. From the pop-up menu, click one of the following:
   - **Enable All LUNs** to configure all LUNs as enabled
   - **Disable All LUNs** to configure all LUNs as disabled
   - **Inverse State** to enable currently disabled LUNs and disable currently enabled LUNs

Enabling and disabling individual LUNs

To configure a specific LUN as enabled or disabled, in the LUN Configuration window Enable column perform one of the following actions:

- Select the **Enable** check box to configure the LUN as enabled.
- Clear the **Enable** check box to configure the LUN as disabled.

Setting LUN path failover

Perform the following steps to set a LUN path as the preferred or alternate path in a failover condition. You can also click the preferred or alternate path as the currently active path.

1. In the LUN Configuration window, right-click the cell for the device in the Adapter n column.
2. From the pop-up menu, click one of the available options.
   - Click **Set LUN to Preferred** to set the alternate path as the preferred path in a failover condition.
   - Click **Set LUN to Alternate** to set the preferred path as the alternate path in a failover condition.
   - Click **Set Path to Current** to set this preferred or alternate path as the currently active path.

Notes:

1. You can set the path of an enabled LUN only. A LUN path can be set as either preferred or alternate (but not as unconfigured) if the device path is configured as hidden or visible.
2. You can use the failover watcher to view the failover settings for a selected host and set the preferred or alternate LUN path as the currently active path (see “Using the failover watcher” on page 100).

Configuring LUNs to match FAStT Storage Manager configuration

To avoid the ″Driver not on preferred path″ error, perform the following steps to configure the LUNs to match the FAStT Storage Manager’s configuration:

1. Unload the qla2200 or qla2300 driver module by opening a terminal window and typing one of the following commands:

   `# modprobe -r qla2200` or `# modprobe -r qla2300`
2. Delete the options string in /etc/modules.conf that is added by the FAStT MSJ load-balancing process. This is typically the last line in the /etc/modules.conf file:

```
 "options qla2200 ConfigRequired=1 ql2xopts=scsi-qla00- adapter-
port=..."
```

3. In the terminal windows, type the following command:

   ```
   depmod -a
   ```

4. Reload the qla2200 or qla2300 device drivers by typing one of the following commands:

   `# modprobe qla2200` or `# modprobe qla2300`

5. Run the FAStT Storage Manager client to redistribute the logical volumes.
6. Open a terminal windows and run:

   ```
   qlremote
   ```

7. Open another terminal window and run:

   ```
   /usr/FAStT_MSJ
   ```

8. Connect to the local host and configure LUNs to match the preferred paths shown in IBM FAStT Storage Manager. Click **Storage Subsystem -> Profile** in the Subsystem Management window to display the world-wide port name for each controller. Ensure that the preferred path in the FAStT_MSJ LUN configuration window matches the controller assignment in IBM FAStT Storage Manager.
9. Save the configuration and exit FAStT MSJ.
10. Switch to the terminal window that has qlremote running and press **<CTL - C>** to stop qlremote.
11. In the terminal windows type the following command:

    ```
    depmod -a
    ```

12. Unload the qla2200 or qla2300 driver and then reload the driver by using modprobe so the driver will pull in the new option string that was added by FAStT_MSJ.
13. Type the following command:

    ```
    # mkinitrd -f <ramdisk image file name> <kernel version>
    ```

    Note: This step overwrites the original ramdisk image file if it is executed within the /boot directory. Specify a unique ramdisk image name to preserve the original ramdisk image.

    Copy the file to /boot.

    For SuSE Distribution, type the following command:

    ```
    # /sbin/mk_initrd
    ```

    Note: By default, the RAMDISK images created are:

    ```
    /boot/initrd
     /boot/initrd.suse
    ```

14. If you are using lilo, in a terminal window type:

    ```
    /sbin/lilo
    ```

    Otherwise, you will not be able to boot your new ramdisk image.
15. Reboot the system to the ram disk image you just created.

Viewing adapter, device, and path information

You can view adapter, device, and path information in the Fibre Channel Port Configuration and LUN Configuration windows. In the LUN Configuration window, you can also view LUN information. See “Diagnostics and utilities” on page 68 for information about viewing host, adapter, device, and LUN information from the tab panel.

Viewing adapter information

Perform the following steps in the Fibre Channel Port Configuration and LUN Configuration windows to view adapter information:

1. Right-click the Adapter n column heading to display information about a specific adapter. The Adapter Information window displays. This window lists the following information:
   - Number: Adapter number
   - Type: Type of board. 2200 indicates a QLA22xx
   - Serial Number: Serial number of the adapter
   - Driver Version: Version of the adapter driver on the host that controls the adapter
   - Firmware Version: Version of the adapter firmware on the host that controls the adapter
   - BIOS Version: BIOS version on the adapter
   - PCI Slot Number: PCI slot number assigned by the host
   - Node Name: World wide adapter node name
   - Port Name: World wide adapter port name
   - Total Number of Devices: Number of devices attached to the adapter
2. Click **OK** to close the Adapter Information window.

Viewing device information

Perform the following steps in the Fibre Channel Port Configuration and LUN Configuration windows to view device information.

1. To display information for a device node, perform one of the following actions:
   - In the Fibre Channel Port Configuration window, right-click a cell in either the Device Node Name or Device Port Name column.
   - In the LUN Configuration window, right-click a cell in the LUN, Enable, or Device Port Name column.

   The Device Information window displays. This window lists the following information:
   - Product Identification: Product ID of the device
   - Product Vendor: Device manufacturer
   - Product Revision: Device revision level
   - Path: Path number
   - Target: Device number
   - LUN: The first LUN attached to the device
   - Loop ID: Loop IDs are 7-bit values that represent the 127 valid AL_PA addresses.
   - Port ID: Port ID of the selected device’s port
   - Node Name: Click World wide node name of the device
   - Port Name: World wide port name of the selected device’s port

     Note: If the Device Node Name was selected, all the device’s port names display.
   - Number of LUN(s): Number of LUNs attached to the device

2. Click **OK** to close the Device Information window.

Viewing path information

Perform the following steps to view path information in the LUN Configuration window:

1. Right-click the cell for the device in the Adapter n column. The Path Information window displays the following information:
   - Device Node Name: World wide node name of the device
   - Device Port Name: World wide port name of the selected device's port
   - LUN: LUN number
   - Device Port ID: Port ID of the selected device's port
   - Vendor ID: Device manufacturer
   - Product ID: Product ID of the device
   - Product Revision: Device revision level
   - For the Preferred Path and Alternate Path sections:
     - Adapter Number: Number of the adapter
     - Path ID: Path number
     - Target ID: Device ID
2. Click **OK** to close the Path Information window.

Editing persistent configuration data

When you select **Persistent Configuration Data**, the current configuration data displays if a configuration exists. You can perform the following actions:

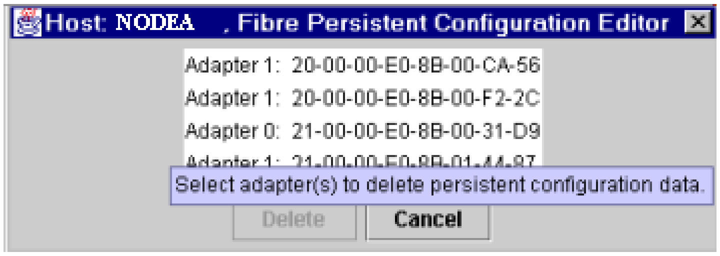
- Click **Adapter Persistent Configuration** to delete the persistent configuration data for an adapter and its devices and LUNs (see "Deleting adapter persistent configuration data").
- Click **Device Persistent Configuration** to delete the persistent configuration data for a device and its LUNs (see "Deleting device persistent configuration data" on page 99).

Deleting adapter persistent configuration data

Perform the following steps to delete the persistent configuration data for an adapter, its devices, and LUNs.

1. Perform one of the following actions:
   - From the FAStT MSJ main window, right-click the host or adapter in the HBA tree. In the resulting pop-up menu, click **Adapter Persistent Configuration Data**.
   - From the Fibre Channel Port Configuration window **Adapter** menu, click **Adapter Persistent Configuration Data**.

The Fibre Persistent Configuration Editor window displays (see Figure 32 on page 99). For each adapter connected to the host, the current persistent configuration editor lists the adapter number and its world wide port name.



Host: NODEA , Fibre Persistent Configuration Editor

Adapter 1: 20-00-00-E0-8B-00-CA-56
Adapter 1: 20-00-00-E0-8B-00-F2-2C
Adapter 0: 21-00-00-E0-8B-00-31-D9
Adapter 1: 21-00-00-E0-8B-01-44-87

Select adapter(s) to delete persistent configuration data.

Figure 32. Fibre Persistent Configuration Editor window

2. Perform one of the following actions to delete one or more entries:
   - Click the adapter entries that you want to delete.
   - Click **Delete** to remove the entries.

     The Security Check window displays. Enter the password, and click **OK**.

     Note: Changes made to the persistent configuration are final. If you do not want the changes, reconfigure the host (see “Configuring fibre channel devices” on page 86).

Deleting device persistent configuration data

Perform the following steps to delete the persistent configuration data for a device and its LUNs.

1. Perform the following steps:
   - From the FAStT MSJ main window, right-click the device or LUN in the HBA tree. In the resulting pop-up menu, click **Device Persistent Configuration Data**.
   - From the Fibre Channel Port Configuration window, click **Device** -> **Device Persistent Configuration Data**.

   The Device Persistent Configuration Editor window displays.
   For each device connected to the adapter, the current persistent configuration editor displays the device number and its world wide port name.
2. Perform the following steps to delete one or more entries:
   a. Click the device entries that you want to delete.
   b. Click **Delete** to remove the entries. The Security Check window displays.
   c. Type the password and click **OK**.

      Note: Changes made to the persistent configuration are final. If you do not want the changes, reconfigure the host (see “Configuring fibre channel devices” on page 86).

Saving and printing the host configuration file

You can save the host configuration file and then view a virtual image of the host. The file name includes the host name, date saved, and time saved. See “Saving a configuration to a file” on page 84 for details.

To print a device and LUN configuration, perform the following steps:

1. From the FAStT MSJ main window, perform the following steps:
   a. In the HBA tree, click the host (or adapter connected to the host).
   b. Perform one of the following actions:
      - Click **Configure** on the toolbar.

- Right-click the host (or adapter) in the HBA tree. From the resulting pop-up menu, click **Configure**.

The Fibre Channel Port Configuration window displays.

2. Click **File** -> **Print**.
3. Select the printer and print the configuration.

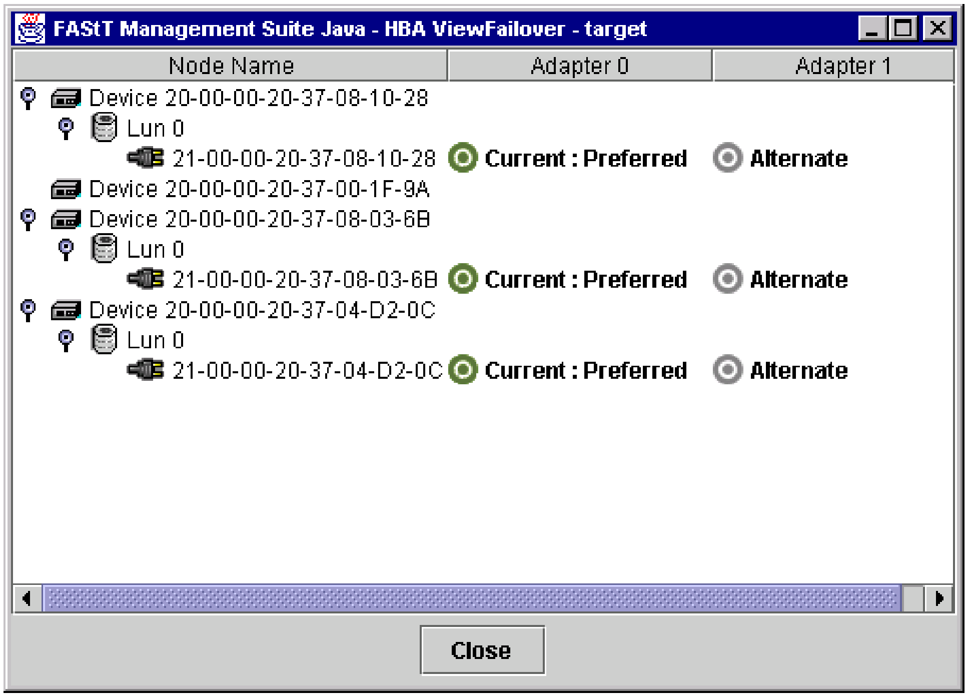
Using the failover watcher

The failover watcher enables you to view the failover settings for a selected host and set a preferred or alternate LUN path as the currently active path.

Note: See “Setting LUN path failover” on page 95 for more information.
Perform the following steps to view or modify the failover information:

1. In the FAStT MSJ main window HBA tree, click the host for which you want to view failover information.
2. Perform one of the following actions:
   - Click **Host** -> **Current Path**.
   - Right-click the host in the HBA tree. From the pop-up menu, click **Current Path**. The HBA View Failover window displays (see Figure 33).

   The identifying information displays:



FAStT Management Suite Java - HBA ViewFailover - target

Node Name	Adapter 0	Adapter 1
Device 20-00-00-20-37-08-10-28		
Lun 0		
21-00-00-20-37-08-10-28	● Current : Preferred	○ Alternate
Device 20-00-00-20-37-00-1F-9A		
Device 20-00-00-20-37-08-03-6B		
Lun 0		
21-00-00-20-37-08-03-6B	● Current : Preferred	○ Alternate
Device 20-00-00-20-37-04-D2-0C		
Lun 0		
21-00-00-20-37-04-D2-0C	● Current : Preferred	○ Alternate

Figure 33. HBA View Failover window

- **Host**

  The title displays the host name.

  The failover information displays:

- **Node Name**

  Listing of the devices and LUNs.

  – Devices

    World wide device port name of the devices.

  – LUNs

LUNs are listed under the devices to which they are connected. Includes the LUN number and world wide LUN port name.

- **Adapters**

  Lists the adapters connected to the host and specifies their path status:

  - Preferred
  - Alternate

  Path status:

  - Green bull's-eye and **Current**: currently active
  - Gray bull's-eye: not active
  - Red bull's-eye: preferred path that is not active

3. To set the path of a device as currently active, perform the following actions:
   a. Right-click the path status in the Adapter column.
   b. In the pop-up menu, click **Set Current**. The bull's-eye changes to green and the word *Current* displays.

Chapter 5. Introduction to SANavigator

This chapter provides an overview of the functions of SANavigator. See the User manual (PDF format) located in the SANavigator install folder to learn more about the features of SANavigator.

SANavigator management software provides easy, centralized management of your SAN, and quick access to device configuration applications. The complete SAN displays graphically, so administrators of all levels can manage networks with ease.

Operating in a SAN environment

SANavigator enables you to easily monitor and manage your SAN through the following features:

1. **Discovery**

   SANavigator uses TCP/IP (out-of-band) and fibre channel (in-band) to establish contact with a large number of SAN devices, gather embedded information, and then depict it all graphically. SANavigator discovers the devices attached to your SAN. It then presents a visual map of devices and their interconnections, enabling you to identify any problem components in the map.
2. **Launching Device Applications and Utilities**

   You can launch applications and utilities such as IBM FAStT Storage Manager and IBM FAStT MSJ from SANavigator by right-clicking the respective devices. A pop-up menu displays where you select the applications as well as link to the IBM Fibre Channel Solution Support Web site.
3. **Monitoring**

   SANavigator generates events and messages about the status of devices and their respective properties. SANavigator offers self-monitoring event logging and messaging feature to enable you to stay informed about the current state of the SAN.
4. **Reporting**

   SANavigator enables you to generate, view, and print reports.

New features of SANavigator 3.1

Version 3.1 has significantly enhanced the capability of SANavigator. It includes the following new features:

- Remote Discovery Connector enabling you to In-Band manage remote hosts from a local Management Station. In previous versions In-Band management was possible only on the system where the SANavigator Server was installed and where the HBAs were located.
- Login/Logout function that enables you to log in or out of a SANavigator server without closing the application.
- Customizable topology views. You can now select to view a single Fabric or all Fabrics. You can also customize the Device List (show/hide/relocate columns on device list).
- Improved user administration function
- Auto-detection of topology overload
- Detachable and scalable mini map to allow a more user-customized desktop
- Latency graphs to monitor performance

- An improved GUI

System requirements

The following the minimum requirements are for SANavigator:

- Windows operating systems (NT SP 6a and Windows 2000 Professional, Enterprise Server, and Advanced Server)
  - 700 MHz Intel Pentium III and up
  - CD-ROM
  - 512 MB RAM
  - Disk Space: 150 MB
  - VGA - 256 colors or greater
- Linux operating system (Red Hat 7.2)
  - 700 MHz Intel Pentium III and up
  - 512 MB RAM
  - Disk Space: 150 MB
  - VGA - 256 colors or greater

Installing SANavigator and getting started

This section contains instructions on how to install and uninstall SANavigator on your system.

You can install SANavigator as a client, a server, both client and server, or as a Remote Discovery Connector. The major benefit of using the Client/Server feature is that a SAN running on a server can have a number of clients working simultaneously on the same SAN. Each client can monitor what all other clients are doing, whether across the room or halfway around the world. Each client can access all servers for which it is authorized. Clients can set personal preferences; preferences are saved locally.

You install the Remote Discovery Connector on host(s) that you want to In-Band manage remotely. In addition, the hosts must have the HBA API library installed.

Note: When performing any SANavigator install or uninstall, be sure that no part of the application (client, server, or Remote Discovery Connector) is running. This could cause a variety of problems, including a system failure.

You can install SANavigator from a CD or by downloading it from the Web.

Note: Always uninstall any prior version of SANavigator before you install a new version.

Windows installation and uninstallation

This section describes how to install SANavigator for Windows (NT or 2000) from both a CD and from the Web as well as how to uninstall the software.

Note: To further enhance the SANavigator discovery engine, install the HBA API library. This library is automatically installed by the IBM FAStT HBA Driver install package (driver version 8.1.5.60 and above). The API library enables you to discover your SAN through the fibre channel medium in addition to the Fabric network.

Installing from a CD

To install SANavigator for Windows from a CD, perform the following steps:

1. Insert the SANavigator CD that came with your FAStT storage server into the CD-ROM drive.

   If you have autorun enabled, the install begins automatically. If you do not have autorun enabled, run the setup.exe application file in the Windows folder.

   Follow the instructions that the InstallShield wizard presents.
2. If you want to install a SANavigator client only, clear the **SANavigator Client and Server** check box in the Select Components and Destination window and select **Client**. If you want this machine to be remotely In-Band managed, select the Remote Discovery Connector. You will skip installation steps that are not required.
3. Review the readme_ibm.txt file (located in the root directory of the CD).

Installing from a Web download

To download SANavigator for Windows, go to the IBM Solution Support Web site

http://www.ibm.com/pc/support.

A link to the SANavigator Web site is available to download the IBM version of SANavigator. You will need to have your FAStT storage server model number and serial number available.

To install SANavigator from the Web, perform the following steps:

1. After extracting the zip file, run the setup.exe application file in the Windows folder.

   Follow the instructions that the InstallShield wizard presents.
2. If you want to install a SANavigator client only, clear the **SANavigator Client and Server** check box in the Select Components and Destination window and select **Client**. If you want this Host to be remotely In-Band managed, select the Remote Discovery Connector. This will skip installation steps that are not required.
3. Review the readme file (located on the IBM Solution Support Web site).

Uninstalling SANavigator

Note: Before uninstalling SANavigator, the SANavigator Server needs to be terminated. Make sure that no other client is using the server prior to ending the process. To terminate the server and client, click **Server** -> **Shutdown** from the menu bar. A dialog displays asking you to confirm the Shutdown and whether or not you want to also exit the client. If you do not uncheck the ″Shutdown Client also″ box, both the Client and Server (on the local machine) will be terminated provided no other remote clients are running.

Click **Start -> Program -> SANavigator -> Uninstall SANavigator** to begin the uninstall process. You are presented with the following three choices:

- Reinstall - SANavigator will be reinstalled. All SAN files are retained.
- Partial Uninstall - Retain Data and Preference Files - SANavigator will be uninstalled, but all SAN files are retained.
- Full Uninstall - SANavigator will be uninstalled and all SAN files are deleted.

In order to retain access to your previous SAN files, be sure to reinstall SANavigator in the same location that the software was previously installed.

If you must reinstall in a new location, be sure to move your SAN files from the old install directory to the new directory.

Note: SANavigator 3.1 allows you to import and open SAN files that were created using version 2.7. See “Starting SANavigator server and client” on page 109 for additional information.

Linux installation and uninstallation

This section describes how to install SANavigator for Linux from both a CD and from the Web as well as how to uninstall the software.

Note: To further enhance the SANavigator discovery engine, install the HBA API library. This library is part of the IBM FAStT HBA Driver install package (version 6.0 and above). The API library enables you to discover your SAN through the fibre channel medium in addition to the Fabric network. Review the readme_ibm.txt file located in the Linux/Redhat folder on the CD for additional information.

Installing from a CD

To install SANavigator for Linux from a CD, perform the following actions:

1. Insert the SANavigator CD that came with your FAStT storage server into the CD-ROM drive.
2. Login as root.
3. From the Linux\Redhat directory on the CD, copy the .bin file (for example, SANav31irh.bin) to your temp directory.
4. Start the installer (./temp/SANav31irh.bin or sh ./temp/SANav31irh.bin)
5. Follow the on-screen instructions.
6. If you want to install a SANavigator client only, clear the **SANavigator Client and Server** check box in the Select Components and Destination window and select **Client**. If you want this machine to be remotely In-Band managed select the **Remote Discovery Connector**. You will skip installation steps that are not required.
7. Review the readme_ibm.txt file located in the Linux/Redhat folder on the CD for additional information.

Installing from a Web download

To download SANavigator for Linux, go to the IBM Solution Support Web site

http://www.ibm.com/pc/support

A link to the SANavigator Web site is available to download the IBM version of SANavigator. You will need to have your FAStT storage server model number and serial number available. See the readme file on the IBM web site.

To install SANavigator from the Web, perform the following steps:

1. Download the bin file from the SANavigator Web site.
2. Open a terminal session in the GUI.
3. From the directory where you stored the bin file, type one of the following commands at the prompt:

   ```
   sh SANav31irh.bin
   ```

   or

   ```
   ./SANav31irh.bin
   ```

4. Wait for the introduction window to open.
5. Follow the instructions that the Installer presents.
6. If you want to install a SANavigator client only, clear the SANavigator **Client and Server** check box in the Select Components and Destination window and select **Client**. If you want this machine to be remotely In-Band managed select the Remote Discovery Connector. You will skip installation steps that are not required.
7. Review the readme file (located on the IBM Solution Support Web site).

Uninstalling SANavigator

Note: Before uninstalling SANavigator, the SANavigator Server needs to be terminated. Make sure that no other client is using the server prior to ending the process. To terminate the Server and Client click **Server -> Shutdown** from the menu bar. A dialog box displays asking you to confirm the Shutdown and whether or not you want to also exit the client. If you do not uncheck the **Shutdown Client also** box, both the Client and Server (on the local machine) will be terminated provided that no other remote clients are running.

To begin uninstalling, perform the following actions:

1. Open a terminal session in the GUI.
2. From the /usr/ directory, type one of the following commands at the prompt:

   ```
   sh Uninstall_SANavigator
   ```

   or

   ```
   ./Uninstall_SANavigator
   ```

   Note: Uninstall instructions assume that SANavigator was installed using the default selections.
3. Wait for the introduction window to open.
4. Follow the instructions the Uninstaller presents.

You are presented with the following two choices:

- Partial uninstall

  Retain Data and Preference Files - SANavigator will be uninstalled, but all SAN files are retained.
- Full uninstall

  Delete all files - SANavigator will be uninstalled and all SAN files are deleted.

In order to retain access to your previous SAN files, be sure to reinstall SANavigator in the same location that the software was previously installed.

If you must reinstall in a new location, be sure to move your SAN files from the old install directory to the new directory.

Note: SANavigator 3.1 allows you to import and open SAN files that were created using version 2.7. See “Starting SANavigator server and client” on page 109 for additional information.

SANavigator Help

SANavigator Help enables you to find subjects listed in the online table of contents or to search for specific keywords. The SANavigator documents are divided into three parts: HelpSet files, User Manual, and Reference Manual. All are listed in the table of contents and all are searched when you use the Find feature.

You can print the entire contents of the User Manual from the PDF file UserManual.pdf located in the SANavigator folder\directory.

For detailed information on how to use any of the following SANavigator features, start SANavigator and open the online help. Help topics are grouped as follows:

- **Reference**

  The Physical Map
  Use the Physical Map to display your SAN topology, devices, and their connections.

  The Mini Map
  Use the Mini Map to view your entire SAN domain and to move within that view.

  Device Tree/List
  The Device Tree/List displays a list of all discovered devices and their properties.

  Event Log
  The Event Log displays SAN events.

- **Tasks**

  - Configuring Your SAN for Best SANavigator Performance Monitoring (Premium feature)
  The configuration of your SAN can affect the functionality and performance of SANavigator.

  - Compatibility with Other Applications
  SANavigator is designed to operate smoothly with other Enterprise applications and network monitoring programs. Because SANavigator has fully configurable SNMP trap listening and forwarding functions, it can act as a primary or secondary network manager.

  - Log-in and Log-out to/from a SAN

  - Discovering Your SAN
  SANavigator uses a unique process to discover devices on your SAN.

  - Monitoring Your SAN
  SANavigator provides three methods of monitoring your SAN devices: Physical Map, Event Log, and Event Notification.

  - Monitoring the Performance of Your SAN (Premium feature)
  SANavigator provides animated, real-time performance information. You can set thresholds and be notified when they are exceeded.

  - Planning a New SAN (Premium feature)
  SANavigator provides the means to graphically plan and evaluate a new SAN.

  - Setting Up E-Mail Notification
  Configure event notification so that you can receive messages when events you want to know about occur.

- **- Exporting Maps and Information**

  You can import or export SANavigator SAN files, performance data, Physical Map, Device Tree, or reports. This process is very useful when transmitting files to your support center or when capturing network status at local or remote locations.

- **Glossary**

  Many SAN-specific names and terms are described. See “Glossary” on page 287.

Starting SANavigator server and client

This section provides instructions on how to start SANavigator in Windows and Linux operating systems.

Starting in Windows

To start both the SANavigator Server and Client in Windows, perform one of the following actions:

- Click **Start -> Programs -> SANavigator x.x -> SANavigator**.
- Double-click the SANavigator x.x desktop icon.

To start the SANavigator Client in Windows, perform one of the following actions:

- Click **Start -> Programs -> SANavigator x.x -> SANavigator Client**.
- Double-click the SANavigator x.x desktop icon.

If you installed the Remote Discovery Connector on a remote Host, click **Start -> Programs -> SANavigator Remote Discovery**. Although the process starts, no user interface displays.

Note: To run Remote Discovery Connector, the server must be configured. See “Setting up SANavigator Remote Discovery Connection for in-band management of remote hosts” on page 185 and the online help provided.

Further problem determination information can be found on the IBM Support Web site.

Starting in Linux

To start both the SANavigator Server and Client in Linux, open a terminal session and type one of the following commands from the /usr directory:

```
sh SANavigator
```

or

```
./SANavigator
```

To start the SANavigator Client in Linux, open a terminal session and type one of the following commands from the /usr directory:

```
sh SANavClient
```

or

```
./SANavClient
```

If you installed the Remote Discovery Connector on a remote Host, open a terminal session and type one of the following commands from the /usr directory:

```
sh SANavRemote start
```

or

```
./SANavRemote start
```

To stop the process, type one of the following commands:

```
sh SANavRemote stop
```

or

```
./SANavRemote stop
```

Note: To run Remote Discovery Connector, the server must be configured. See "Setting up SANavigator Remote Discovery Connection for in-band management of remote hosts" on page 185 and the online help provided.

Further problem determination information can be found on the IBM Support Web site.

Configuration wizard

The first time SANavigator is started the Welcome Wizard displays. The Wizard allows you to configure SANavigator.

Import Data and Settings

This dialog box allows you to select whether or not you want to import SANavigator Version 2.7 data and settings into this new version. If you select **Yes**, enter the location (path) where the exported .zip files are located.

Note: You need to export the SAN files from a 2.7 SANavigator session before uninstalling 2.7. When uninstalling the older version, make sure that you select **Partial Uninstall** so that the SAN files are preserved.

SANavigator Server Name

SANavigator servers are given a name. The name helps you identify different servers. SANavigator automatically assigns the OS Network Identification computer name to the server as a default.

SANavigator Administrator

Users are identified and validated in SANavigator by a User ID and Password. In this dialog box, enter your User ID and Password information.

SANavigator Win32 Service

If you run SANavigator as a Win32 service, you can log off the network without closing SANavigator. Click the check box to run SANavigator as a Service.

Note: Running SANavigator as a Win32 service is not recommended unless you are familiar with Win32 service behavior.

SANavigator Server License

This dialog box allows you to enter the license key. Once entered, a summary of the server configuration displays as well as the features that were enabled by the license key.

To register SANavigator, perform one of the following actions::

If you have an Internet connection, you can register on the Registration window. The completion of all fields is required for registration. Free Web e-mail addresses are not accepted.

If you do not have an Internet connection, the Registration window contains contact information. Your new license key will be e-mailed to you. Follow the instructions in the e-mail to enter the license key in the application after it is running.

Note: The license key is required to enable the premium features. These include the following features:

- SAN Planning
- SAN Performance Monitoring
- Zoning
- Policy Engine
- Greater than 32 Switch Ports
- Greater than five clients

Premium Features are available for a trial period of 30 days.

Initial discovery when client and server are on one computer

When you start SANavigator, the Login SAN dialog box displays. The Network Address field contains ″localhost″. If SANavigator detected the server, the informational message ″Server Available″ displays on the bottom left of the dialog box. The **Server Name** field contains the name of the local hardware server.

Perform the following steps to perform initial discovery when the client and server are on the same computer:

1. Type the user ID and the password specified during the SANavigator configuration. Select ″Save Password″ if you want to save the Password.
2. Click **OK**. SANavigator automatically conducts an out-of-band discovery on your local subnet and displays any SAN devices that it finds.

Initial discovery when client and server are on different computers

When you start the SANavigator Client to connect to a remote SANavigator Server the Log-in SAN dialog box displays. You can enter the IP address of the remote Host in the Network Address field. If SANavigator connected to the remote server the informational message ″Server Available″ displays on the bottom left of the dialog box. Perform the following steps to perform initial discovery when the client and server are on different computers:

1. Enter the IP address in the Network field.
2. Type the user ID and the password for the Server on the remote Host.
3. Click **OK**. The SANavigator Client gathers the topology information from the remote Server and automatically displays the SAN devices discovered by the remote Server.

Viewing an existing SAN

Perform the following steps to view a discovered SAN on an existing server:

1. Click Log-in. The Log-in SAN dialog box displays.
2. Type the IP address of the server in the Network Address field and click **OK**.
3. Type the user ID and password. Click **OK**. The SAN is discovered and displayed.

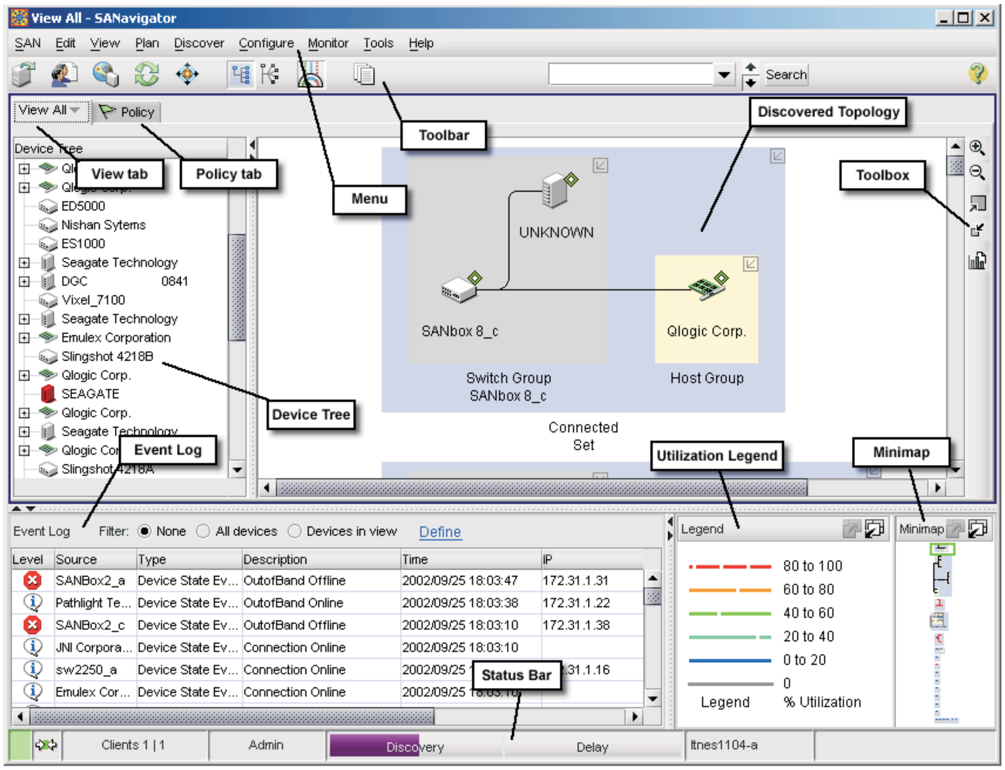
Setting up a new discovery

Perform the following steps to set up a new discovery:

1. If the Discover Setup dialog box is not open, click **Discover -> Setup**.
2. Click the **General** tab and verify that **Out-Of-Band** is selected.
3. Click the **Out-of-Band** tab.
4. Review entries in the Selected Subnets and Selected Individual Addresses tables. Click any entries you do not want to discover now, and move them back to the Available Addresses table by clicking the appropriate arrow button.
5. To add new addresses to the Available Addresses table, click **Add**; the Domain Information dialog box displays.
6. Type a description of the IP subnet where your SAN devices are located in the **Description** field.
7. Type the **IP Address** and **Subnet Mask** of a device (for example, a switch) on the SAN you want to discover.
8. Click **OK** to return to the Discover Setup dialog box.
9. In the Available Addresses table, click the address you entered and use the arrow button to move the address to the Selected Subnets table on the right.
10. If you want to enable In-band discovery, check the In-Band box in the General Tab dialog box and select the available HBAs. If no HBA is available, make sure the HBA API library is installed. See “In-band discovery” on page 119.
11. Click **OK** to save the settings and to begin the discovery process.

SANavigator main window

The SANavigator main window, shown in Figure 34 on page 113, displays when you start SANavigator. By using the drop-down menus, you issue commands to the SANavigator software. To see how each command works, click the menu, note the name of the command, and search for the command in the help.



Event Log Filter: ● None ○ All devices ○ Devices in view Define

Level	Source	Type	Description	Time	IP
☒	SANBox2_a	Device State Ev...	OutofBand Offline	2002/09/25 18:03:47	172.31.1.31
ⓘ	Pathlight Te...	Device State Ev...	OutofBand Online	2002/09/25 18:03:38	172.31.1.22
☒	SANBox2_c	Device State Ev...	OutofBand Offline	2002/09/25 18:03:10	172.31.1.38
ⓘ	JNI Corpora...	Device State Ev...	Connection Online	2002/09/25 18:03:10	
ⓘ	sw2250_a	Device State Ev...	Connection Online	2002/09/25 1	.31.1.16
ⓘ	Emulex Cor...	Device State Ev...	Connection Online	2002/09/25	

Figure 34. SANavigator main window

The desktop consists of the following five sections.

Physical Map
: The Physical Map displays your SAN topology, devices, and their connections. For more information, see “Physical Map” on page 121.

Mini Map/Utilization panel

Use the Mini Map to view your entire SAN domain and to move within that view. For more information, see “Mini Map and Utilization Legend” on page 125.

The Utilization legend displays when the Utilization option is selected in the **View -> Connection** menu. It depicts the percent of the data bandwidth that is utilized when I/Os are in progress. This is a Premium feature.

Event Log
: The Event Log displays SAN events. For more information, see “Event Log” on page 126.

Device Tree/List
: The Device Tree/List displays a list of all discovered devices and their properties. For more information, see “Device List” on page 128.

Working with SAN files

From the **SAN** menu, you can perform the following actions:

- Log in to a new SAN
- Log out of an existing SAN
- Change user information
- Gain remote access

- Export a SAN
- Import a SAN
- Plan a new SAN
- Open an existing SAN

These tasks are described in the following sections.

Log in to a new SAN

To log into a new SAN, perform the following steps:

1. Click **SAN -> Log in** The Log in SAN dialog box appears.

   The SANavigator application automatically discovers and opens the local SAN when you log in.
2. The server's address displays in the Network Address field. You can specify a new address by typing it in the field, or selecting one from the list.

   Note: In version 3.1, localhost is the default value. The SANavigator application automatically determines your local IP address and uses that value as your local host address. If you had previously connected to another IP address, you can select localhost from the Network Address drop-down field.
3. Enter your user ID and password.
4. Select whether you want the SANavigator application to remember your password for the next time you log in.
5. Click **OK**. SANavigator will perform out-of-band discovery on your local subnet and display any SAN devices that it finds.

Log out from a current SAN

To log into a different server, you must first log out of the current server.

Select **Log out** from the SAN menu. You will be logged out of the current server. Selecting **Shutdown** shuts down the SANavigator server and client.

Change user information

Click **SAN -> SANavigator -> Users** to open the SANavigator Server Users dialog box, where you can add, delete, or change user information. In the Add User dialog box, you can set access to any of the following levels of permission:

None User has no server access. Use this level to restrict access without deleting a user's account, or when a user only needs to receive e-mail.

Browse
User can view almost all information, but cannot make changes to or configure SAN devices.

Admin

User has access to all SANavigator functions.

You can also determine whether a user receives e-mail notifications of events by performing the following steps:

1. Select the **Enable check box** (located under the Email column).
2. Click **Filter** to set the parameters for e-mail notification.
3. Click **Setup** to open the Event Notification Setup dialog box.

You enable all user management on a single dialog box. See SANavigator Server Users in the help file for specific instructions about adding, defining, and removing users.

Notes:

1. Two users cannot have the same ID.
2. Each user's e-mail address and preferences for event notification are stored with the user's account.
3. All user actions are logged into either the SAN log file or the server log file.
4. You cannot delete all users. There must always be at least one user.

Remote access

A SANavigator server can be accessed by multiple clients. The Remote Access menu function allows you to control whether or not you want multi-client connections, or select which client is permitted to connect to your server.

From the SAN menu, select **SANavigator Server -> Remote Access**. The Remote Access dialog box displays.

Remote Access Dialog

Allow remote management sessions. Select this option to allow remote management sessions.

Maximum number of remote sessions. Select the number of remote sessions you want to allow.

Allow Any network address to connect. Select to allow any network address to connect.

Only network addresses below to connect. Select to allow only the network addresses specified below to connect.

All network addresses EXCEPT those below to connect. Select to allow all network addresses except those you specify.

Add button. Click to add network addresses.

Remove button. Click to remove network addresses.

Server Properties

Click **SAN -> Properties** to open the Server Properties dialog box. You can use the Name field to change the name of your server. The dialog box displays information about the server that the client is currently logged onto.

Name

Name assigned by the user to the portion of the SANavigator program acting as a server. This property can be set by users with administrative privileges. This name need not correspond to any other names, including the host name.

IP Address

Determined by the machine that the SANavigator server program is running on

Subnet Mask

Determined by the machine that the SANavigator server program is running on

Java VM Version
Version of the Java Runtime Environment that is currently running the SANavigator server that you are talking to

Java VM Vendor
Vendor of the Java Runtime Environment that is currently running the SANavigator server that you are talking to

Java VM Name
Name of the Java Runtime Environment that is currently running the SANavigator server that you are talking to

OS Architecture
The SANavigator determines the hardware architecture if available

OS Name and Version
The SANavigator determines the operating system and its version if available

Region
The SANavigator server program determines the geographical region of your operating system

Time Zone
The SANavigator server program determines the world time zone of your server

Free Memory
Unused memory within the total memory

Total Memory
Total memory assigned to your Java Runtime Environment

Exporting a SAN

This feature enables you to capture the current state of a SAN and, at a later time, *replay* the SAN in your SANavigator machine or in a remote system that has SANavigator installed. This is useful in providing a view of the SAN to allow for remote diagnosis of problems. The following items are exported when you click **SAN -> Export**:

- SAN files: These are XML files that define your SAN.
- Physical Map: The Physical Map is exported to a JPEG file.
- Device List: The Device List is exported to a tab-delimited text file.
- Performance Data (Premium feature): This file contains the performance information that was gathered during the SAN monitoring.

All of these files are automatically zipped when you select the **Save to Disk** check box in the Export dialog box. A folder is generated that contains three files. See the following example:

```
san011107105249

san011107105249.zip

san011107105249.jpeg

san011107105249.txt
```

You can also e-mail all three files by selecting the Mail To dialog box. (You need to have e-mail configured for your system.)

Importing a SAN

Click **SAN -> Import** to import a previously exported SAN into any SANavigator system. This enables you to see the exported SAN, including any problems that were present at the time of the capture.

In the Import dialog box, either type the SAN file name (for example, san011107105249.zip) or click **Browse** to search for the file.

The SAN displays with a time stamp, giving the date and time of capture in the background. At this point, discovery is disabled until you enable it. If this is the system from which the SAN was exported, the discovery detects any changes from the exported SAN to the current view of the SAN.

Important: Turning on discovery replaces the currently-discovered SAN with the imported data. Only one SAN can be viewed or saved at a time.

Planning a new SAN (premium feature)

You can plan a New SAN or use the current topology as the basis for a planned SAN. You can add, remove, arrange. and connect planned devices to help you envision the SAN before implementing it. Perform the following steps to plan a new SAN:

1. From the SAN menu, select New Plan (or CTRL+N). The New Plan dialog box displays.
2. In the New Plan field, enter a name for the new plan.
3. Select whether you want to start with a discovered topology or start with an empty plan.
4. Click **OK**. The plan displays.

Opening an existing plan

Perform the following steps to open an existing plan

1. From the SAN menu, select **Open Plan**. The Open Plan dialog box displays.
2. Select a plan from the Open Plan list.
3. Click **OK**. The plan will be displayed.

Configuring your SAN environment

Two aspects of your SAN configuration can affect the functionality and performance of SANavigator: LAN configuration and SNMP configuration.

LAN configuration and integration

SANavigator relies on LAN connectivity with the SAN devices to gather information about the devices and connectivity of the SAN. LAN connectivity implies the following:

- All switches, hubs, and bridges have been configured with valid and specific IP addresses.
- The devices are properly cabled and integrated into a functional LAN topology.
- The computer where SANavigator runs has access to the LAN and to the IP addresses of the SAN devices.

SNMP configuration

SNMP is a communications protocol used to remotely monitor, configure, and control network systems. SANavigator acts as a network manager and generates requests and processes responses from SAN devices. SANavigator also listens for event reports or traps from SAN devices.

Subnet discovery

There are two methods of subnet discovery that you can use in your SAN environment:

- Broadcast
- Sweep

The Broadcast method of discovery is the most efficient discovery method, and it is the default method. However, a network administrator can disable this method on the network router. If broadcasting has been disabled on a network, and SANavigator has been configured to block the broadcast method, no devices will be discovered.

The Sweep method of discovery enables SANavigator to broadcast a request to all the devices on a network simultaneously; this improves SNMP communication efficiency. When broadcasting is disabled, sending the request to each device on the network (sweeping) is the only method available to discover SAN devices across an entire subnet. However, sweeping an entire network can take half an hour or more. If broadcasting has been disabled, the best method of discovery is to type the individual IP addresses of the SAN devices into the selected individual addresses area of the Configure Discovery dialog box. This method produces good results without unnecessarily waiting for responses from every IP address in the subnet, especially for IP addresses where no devices are present. However, there might be times when a full subnet sweep produces valuable diagnostic information about the configuration of a network or a device.

Trap configuration

In addition to the request–response cycle of communication, SAN devices can generate event reports or SNMP traps. Most network devices can be configured to send their traps to port 162 on one or two IP addresses. By default, SANavigator listens for SNMP traps on port 162 and lists the traps in the Event Log. To make traps visible in the SANavigator Event Log, configure the SAN devices to send their trap event notices to the IP address of the computer running SANavigator. If you want multiple network management applications to receive trap events, see the SANavigator help topic Compatibility with Other Applications.

Click **Monitor -> Trap Forwarding** to open the Trap Forwarding dialog box, where you can specify the IP addresses and ports of other computers to which you want to forward SNMP traps received by SANavigator. If you select the **Enable Trap Forwarding** check box, all traps received by SANavigator are forwarded to the recipients listed in the Selected Recipients table.

Discovering devices with SANavigator

SANavigator is able to discover devices using out-of-band or in-band discovery processes, or both. Out-of-band discovery is required when the SAN configuration contains switches and managed hubs (a Fabric environment). In-band discovery is required when no switch or managed hub is present (that is, when the host bus adapter is connected to a FAStT storage server either directly or through an unmanaged hub).

In the Discover dialog box, you can select which of these two processes to use. To enhance the discovery of your SAN, it is suggested that you use both processes.

There are two methods for In-band Discovery:

- Local Server (default) - Only HBAs on the local server are discovered through in-band. Any devices on the same subnet (connected through switches) are discovered out-of-band. HBAs from remote hosts cannot be in-band managed from the local machine but are discovered if connected to the Fabric.
- Local Server and Remote Discovery Connector - The local server communicates with the Remote Discovery Connector (SANavRemote.exe) installed in the remote host. A user can now have In-Band management of the Remote Host from the local machine.

  See “In-band discovery”for additional information.

Out-of-band discovery

SANavigator uses an out-of-band process to discover SAN devices. During discovery, the SANavigator logo on the right side of the menu bar is active. If discovery is turned off, a red circle with a diagonal bar through it appears over the logo.

Familiarize yourself with the information in the help topic ″Configuring Your SAN″ before you proceed.

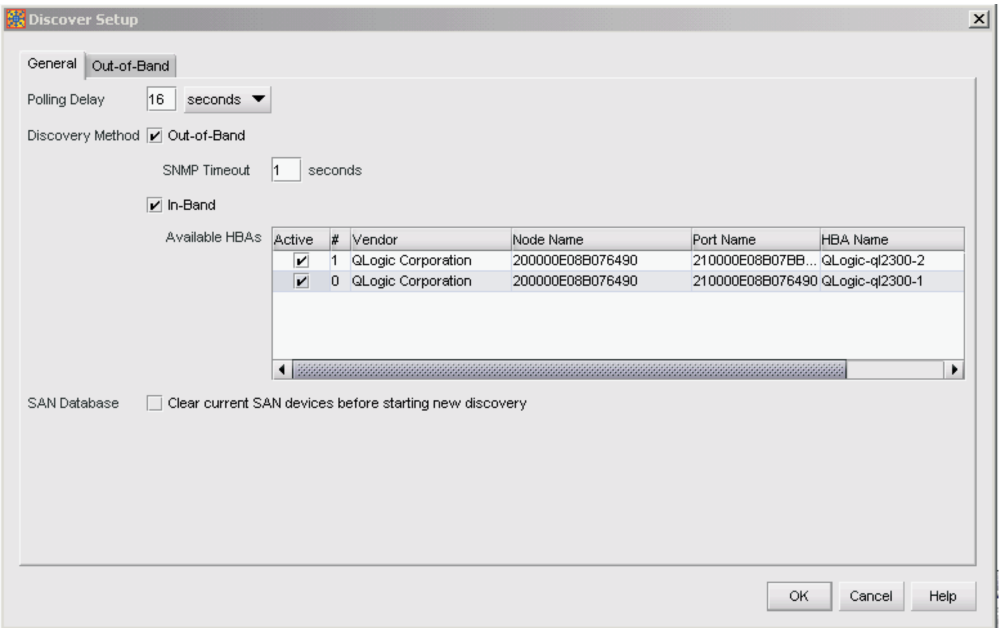
To discover devices on your SAN, use the Out-of-Band tab in the Discover Setup dialog box to select the TCP/IP subnets or individual IP addresses. When you connect to a server and set up discovery, SANavigator performs a discovery of devices on your SAN. At any time during a SANavigator session, you can turn the discovery feature off or back on by clicking **Discover -> Off** or **Discover -> On**, or by clicking the Discovery button.

SANavigator servers can run discovery on only one SAN at a time. If you turn discovery off and another client turns it on, discovery continues to run on the other client. If you turn discovery on, SANavigator issues a message to the other client that you are taking over the discovery process. You need to negotiate with other users about who should use discovery and when.

In-band discovery

In-band discovery requires that the IBM FAStT HBA SNIA API library be installed on your system. This library is part of the IBM FAStT HBA driver installation package. When in-band discovery is enabled from the Discover Setup dialog box (see Figure 35 on page 120), the supported host bus adapters will be displayed in the Available HBAs panel. Select the HBA or HBAs that you want to discover using the in-band process.

Note: In-band discovery is only enabled on the system on which the HBA SNIA API library is installed and where the host bus adapter or adapters reside. Both the local host and a remote host (with the Remote Discovery Connector installed) can be in-band managed. A SANavigator server must be running in order to perform Remote Discovery (for example, the localhost server can be used to connect to the remote host). See “Setting up SANavigator Remote Discovery Connection for in-band management of remote hosts” on page 185 for In-band management of remote hosts.



Polling Delay 16 seconds

Discovery Method ☑ Out-of-Band

SNMP Timeout 1 seconds

☑ In-Band

Available HBAs

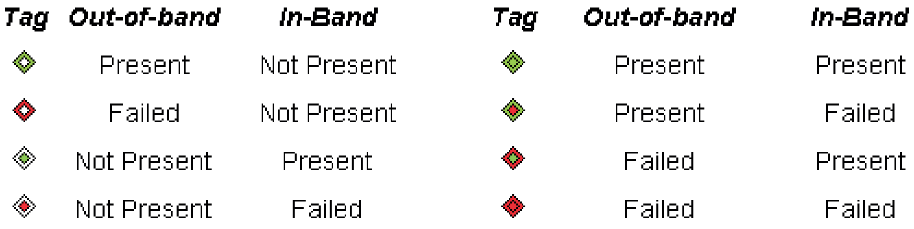
Active	#	Vendor	Node Name	Port Name	HBA Name
☑	1	QLogic Corporation	200000E08B076490	210000E08B07BB...	QLogic-ql2300-2
☑	0	QLogic Corporation	200000E08B076490	210000E08B076490	QLogic-ql2300-1

SAN Database ☐ Clear current SAN devices before starting new discovery

Figure 35. Discover Setup dialog window

Discovery indicators

You can determine the discovery method by inspecting the diamonds that are adjacent to the device icons in the physical map. Figure 36 shows the diamond legend.



Tag	Out-of-band	In-Band	Tag	Out-of-band	In-Band
🟩◇	Present	Not Present	🟩🟩	Present	Present
🟥◇	Failed	Not Present	🟩🟥	Present	Failed
◇🟩	Not Present	Present	🟥🟩	Failed	Present
◇🟥	Not Present	Failed	🟥🟥	Failed	Failed

Figure 36. Diamond legend

SAN database

The SAN database is updated continuously by the discovery engine. Thus, when you change your discovery method, the devices and links that were previously discovered are maintained.

For example, if you had in-band and out-of-band discovery enabled, and you subsequently disabled in-band discovery, all devices and connections that were in-band discovered would be shown in red. You can avoid this by selecting the **Clear Current SAN Devices** check box before starting a new discovery. However, be aware that this will cause any previous configurations to be reset. If you want to keep a copy of the original SAN, export your SAN (see “Exporting a SAN” on page 116).

Community strings

You can either specify custom community strings to communicate with SAN devices or let SANavigator use standard defaults. SNMP protocol enables you to set community strings for both read and write requests. For most SAN devices, the default string for read requests is public, and the default for write requests is private. SANavigator treats custom community strings as secure information, protecting it during entry and encrypting it for storage in the program.

If you have changed the SNMP community strings on your SAN devices, you need to use the Community Strings tab in the Domain Information dialog box to enter your custom strings. SANavigator supports one custom read and one custom write community string per individual IP address or subnet.

Polling timing and SNMP time-out intervals

The polling rate is the delay between successive discovery processes or how long discovery waits for responses from the devices on your SAN. To change the polling rate, click the General tab in the Discover Setup dialog. The polling delay determines the responsiveness of the map in terms of displaying changes in your SAN. Short times (3-10 seconds) give an almost real-time indication of the SAN status. Extended periods reduce network load, but show changes only after each polling period.

If you have a large number of devices, you might want to extend the polling delay so the discovery and mapping processes are completed before another discovery is initiated. Heavy data loads might reduce the responsiveness of SAN devices. You can edit the SNMP time-out interval to provide more time for the devices to respond. (The time setting is for one retry only; SANavigator retries three times for each device.) If SANavigator receives an SNMP trap message, a discovery is initiated immediately.

Note: Short polling delays (less than 10 seconds) might tax the CPU resources, especially on slower processors and in larger SANs.

Monitoring the SAN environment

This section discusses the following tools that are available in SANavigator for monitoring SAN devices:

- Physical Map
- Mini Map and Utilization Legend
- Event Log
- Device Tree
- Device List
- Event Notification

Physical Map

The Physical Map, shown in Figure 37 on page 122, displays devices, their connections, and connection failures. SANavigator discovers devices, displays them on the Physical Map, and monitors communications with the devices. If communication is lost with any device, the device and its connections turn red. For instance, if a device is disconnected from the SAN, its icon turns red and its connections appear red until communications are reestablished with the device or the device is deleted from the map. If a fabric or group is collapsed to an icon and a device in the fabric or group is disconnected from the SAN, the icon appears red. If you click **Delete All** in the **Edit** menu of the desktop, all red devices are deleted.

Note: See “Physical Map” on page 172 for more detailed information about using the Physical Map.

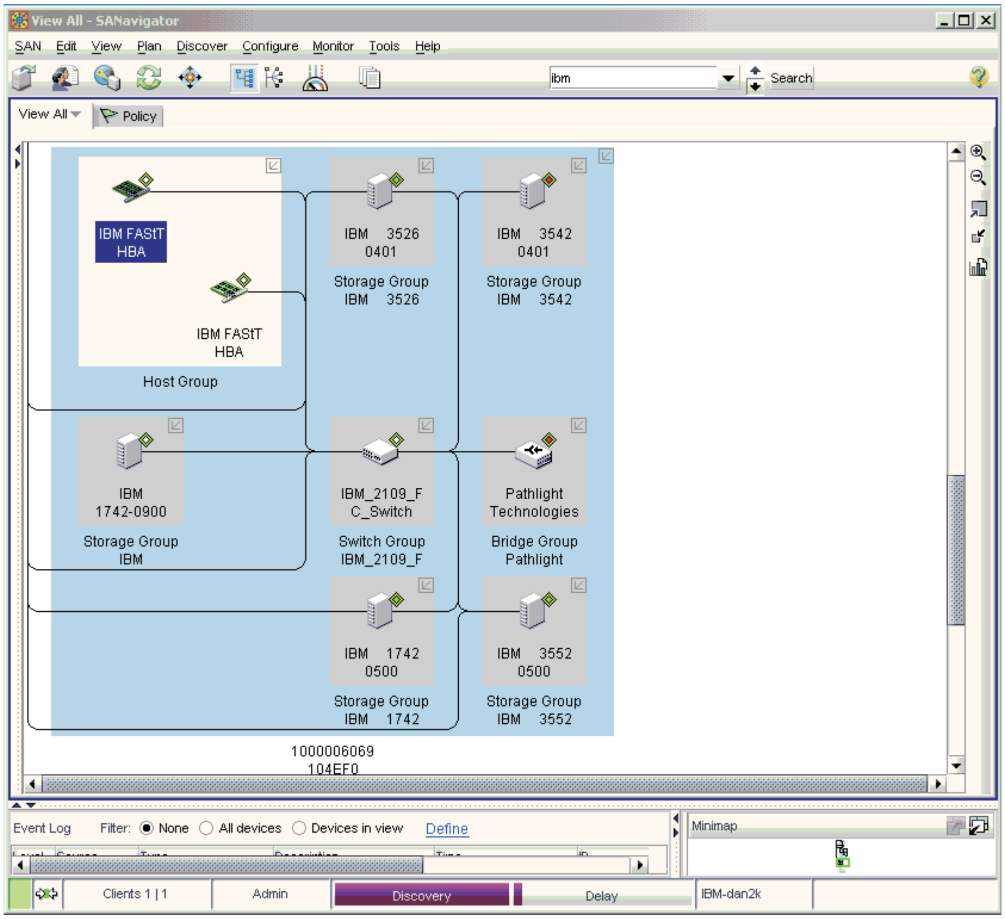
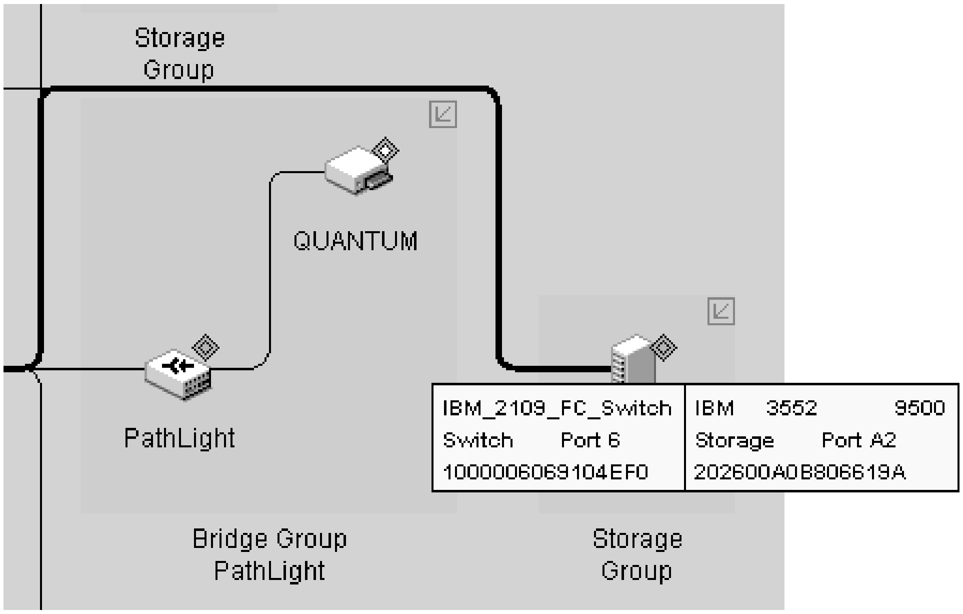


Figure 37. Physical map

From the Physical Map, you can perform the following actions:

- Determine the source and destination of a connection through the Device Tip. The Device Tip, shown in Figure 38 on page 123, pops up when you place the cursor over the selected connection.

  Note: You can disable the Device Tip feature by clicking **View -> Device Tips** and unselecting the Device Tips check box.



IBM_2109_FC_Switch	IBM 3552 9500
Switch Port 6	Storage Port A2
100006069104EF0	202600A0B806619A

Figure 38. Device tip

- Expand multi-port devices to show the port assignments. Right-click the device and select **Ports** from the pop-up menu to view the ports. See Figure 39.

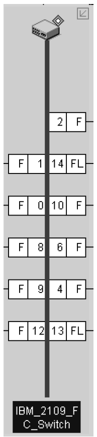


Figure 39. Port assignments

- Launch device-specific applications and utilities such as the IBM Storage Manager and IBM FAStT MSJ diagnostics. You can also go directly to the IBM Support Web site to access the latest information about IBM FAStT SAN devices, including firmware updates, drivers, and publications. You can also add other applications or tools through the Tools dialog box. Right-click the device and the pop-up menu shown in Figure 40 on page 124 displays.

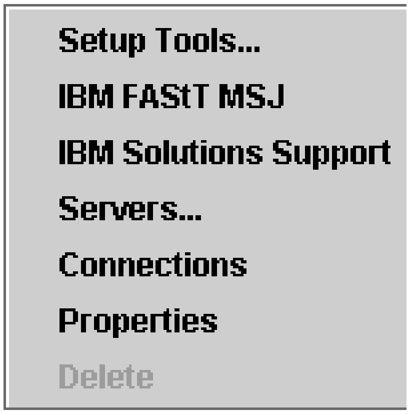


Figure 40. Device right-click menu

Click **Setup Tools** to add or modify tools and applications.

Physical Map view buttons

On the right-hand toolbar of the Physical Map, the following buttons allow you to view the Physical Map in different formats.

Zoom Buttons

The two buttons with the magnifying glass icon allow you to change the scale of the topology. You can zoom in by clicking on the + magnifying glass button and zoom out by clicking on the - button. You can also scale your topology view on a percentage basis. Select **View -> Zoom** in the Menu bar and a pop-up menu will be displayed (see Figure 41). Select the desired scaling factor. You can also invoke this menu by right-clicking anywhere outside of the Topology frame and selecting **Zoom** from the pop-up menu.

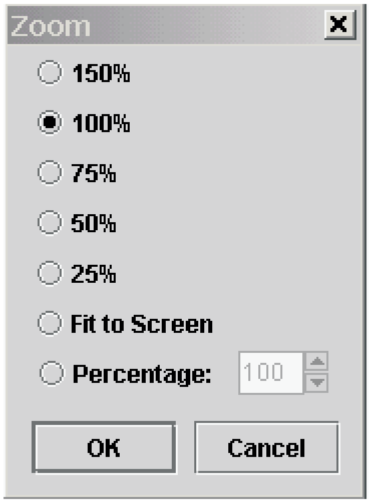


Figure 41. Zoom dialog window

Expand/Collapse buttons

You can expand and collapse the topology view by clicking these buttons. For each click of the Expand button, the topology will expand from Fabric Only to Groups Only to All Devices and finally to All Ports. The Collapse button reverses this sequence. You can also select the **View -> Show** in the Menu bar to expand/collapse the map.

Report Button

This button allows you to generate a report of the Physical Map. See “Generating, viewing, and printing reports” on page 129 for more information.

Mini Map and Utilization Legend

Use the Mini Map to view your entire SAN at a glance and to navigate the more detailed map views. This option can be especially helpful if you have many devices connected to your SAN.

The Mini Map appears in the lower right-hand corner of the SANavigator main window.

To facilitate the navigation of your SAN, the Mini Map displays switches as squares and storage devices as circles. Triangles are reserved for other devices, such as host bus adapters or routers. See Figure 42.

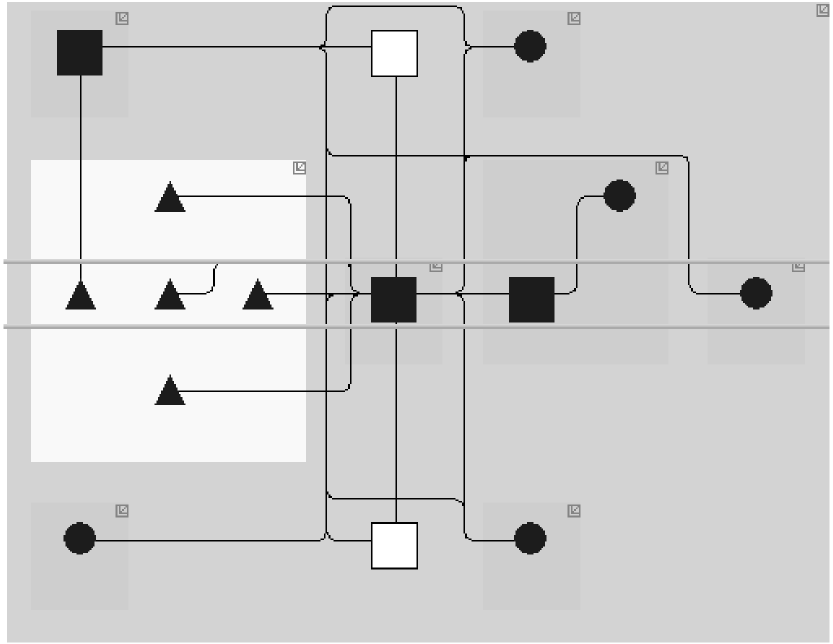


Figure 42. Mini Map

To move within the view of a map, perform one of the following actions:

- Click inside the green-outlined box, which represents the boundaries of the map window, and drag the box to the area you want to view.
- Click the area in the Mini Map that you want to view and the green-outlined box will automatically move to that area.

To change the size of the Mini Map, perform one of the following actions:

- Drag the adjoining dividers.
- Click the small triangles on the adjoining dividers.

You can also anchor or float the Mini Map to customize your desktop. To float the Mini Map and view it in a separate window, click the **Detach** button in the upper right-hand corner of the Mini Map. This will detach the Mini Map and place it on the desktop. At this time you can scale the Mini Map to the desired size to facilitate navigation of your SAN.

To return the Mini Map to its original location on the SANavigator desktop, click the **Attach** button in the upper right-hand corner of the Mini Map or click the **Close** button in the upper right-hand corner of the Mini Map. When in the Performance mode (Premium feature), the Utilization legend (shown in Figure 43) displays to the left of the Mini Map. The legend displays the percentage ranges indicated by the color of each dashed line in the Physical map. When I/Os are active, the path of the data flow displays in accordance with the bandwidth utilization legend for that path.

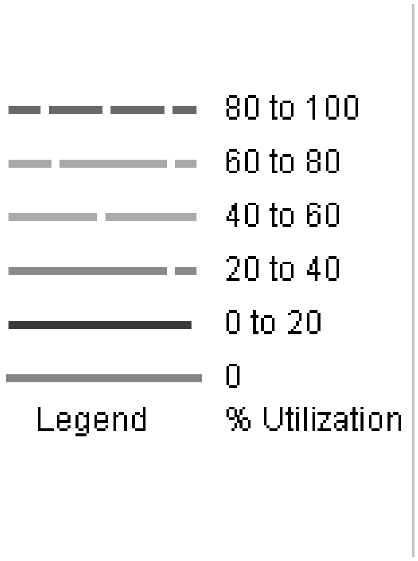


Figure 43. Utilization legend

In the same manner as the Mini Map, the Utilization legend box can be detached onto the desktop.

Event Log

All configuration actions made by users are listed as events in the Event Log. The Event Log appears in the lower left of the SANavigator main window.

The Event Log lists SNMP trap events and SANavigator server and device events (online, offline, user action, client/server, or performance). The log lists the following three levels of events:

- Fatal

- Warning

  ⚠

- Information

  ℹ

You can sort the Event Log on any column by clicking the column header.

You can filter the Event Log to include or exclude specific types and levels of events. Click the **Define** link to define the events you want to display. You can also define which device event log you want displayed depending on the View you selected (see “Physical Map view buttons” on page 124). You can select Devices in view (those on the current Physical Map) or All devices (those in the current Physical Map as well as those in all other Fabric for this SAN).

You can locate in the Physical Map the device logged in the Event Log. Click the device in the log and it will be highlighted automatically on the Physical Map.

If you are experiencing problems with the server, examine the server log for diagnostic information. The default location for the server event log is:
`..\SANavigator3.1\Server\Local_Root\`
`SANavigatorEventStorageProvider\event.log`).

To examine the event log for the SAN, look at the discovered SAN event log (the default location for the discovered SAN event log is:
`\SANavigator3.1\Server\Universe_Home\TestUniverse\_Working\`
`SANavigatorEventStorageProvider\event.log).`

Note: The date and time need to be reasonably accurate on PCs where SANavigator is deployed. If the client and server time differ significantly, there might be problems displaying real-time performance data. Consult your user manual to see how to set the time and date.

Clearing the Event Log

You can clear the event log by editing the file event.log. This file is located in

```
\SANavigator3.1\Server\Universe_Home\TestUniverse\_Working\
SANavigatorEventStorageProvider\
```

Attention: You lose all Event Log information if you delete the contents of this file. Make a backup copy of the log file for future reference.

Note: The Event Log shown on the desktop only displays events from the previous 48 hours. The file event.log includes information before this period.

Device Tree

The Device Tree, located on the **View** tab of the desktop, displays the names and properties of all discovered devices and ports. The Device Tree is a quick way to look up device and port information, including serial numbers and IP addresses. To display the Device Tree, select the **View** tab on the SANavigator desktop.

You can sort the Device Tree by clicking a column heading.

The Device Tree can be expanded into a Device List by clicking the expand/contract arrows on the separator bar (or by using the F9 function key).

Device List

The Device List displays a list of all discovered devices and their properties. To display the Device List, select the **Device List** tab in the upper portion of the main SANavigator display. A table appears with rows that list all devices and columns with the following information for each device:

- Label
- System Name
- Device Type
- WW Name
- IP Address
- FC Address
- Vendor
- Model
- Serial Number
- Fabric Name
- Port Count
- Firmware
- Status
- Comments
- Text 1
- Text 2
- Text 3
- Text 4

In these last four columns, you can create additional properties, such as physical location, storage capacity, capital cost, and scheduled maintenance.

Note: You can customize the Device List to remove, move, and add columns, Perform the following steps:

1. From the View menu, select **Create View**. Enter a name and description for the view.
2. From the Selected Columns list, select the Device List columns you want to move or that you do not want to view.

Editing properties

Editable properties can be edited directly within the device list by double-clicking the field. (A green triangle indicates that a field is editable.) The table is automatically updated with each discovery cycle.

Sorting properties

You can sort the list by clicking the title bar of the desired column. Each click will cycle through the following sort options: Ascending, Descending, Discovery sequence. You can sort on multiple columns by selecting the desired columns with the Control key pressed.

Locating devices in the Physical Map

With both the Device Tree and the Physical Map displayed, click a device name in the Device Tree and the device will be highlighted in the Physical Map.

Event Notification

SANavigator receives, monitors, and generates several types of events that it posts to the event log. To receive e-mail when events occur, perform the following actions:

1. Set up event notification to define the mail server, enter the reply to address, and set the frequency that e-mail is sent to users.
2. Create a SANavigator server user for each of the e-mail recipients and ensure that their e-mail addresses are correct.
3. Configure an event filter for each recipient so that they are notified only about the events of interest to them.

For more information, see the SANavigator Help.

Generating, viewing, and printing reports

SANavigator provides you with the capability to generate, view, and print reports. Generated reports are saved in \SANavigator3.1\Server\Reports\ folder. Exported reports are saved in the \SANavigator3.1\Client\Data\ folder.

Generating reports

To generate a report select **Monitor -> Reports -> Generate** in the Menu bar. The Select Template dialog box displays. Select the information you want to include in the report. Click **OK**. SANavigator will begin generating the report. The time it takes to generate a report is dependent on the size of the SAN.

Viewing a report

The Report Viewer is similar to the Java Help Viewer. The left frame displays a tree structure that you can use to navigate through reports. In the Menu bar, select **Monitor -> Reports -> View**. The SANavigator Reports dialog box displays.

Select one of the following options to view a report:

- Report Type

  Reports are grouped according to their report type (for example, ″Performance Data″, ″Plan Evaluation″).
- User

  Reports are grouped according to the user who generated the report.
- Time

  Reports are grouped according to the time and date that the report was generated.

Exporting reports

To export reports, perform the following steps

1. Select **Export** from the SAN menu. The Export dialog box displays a list of file types that can be exported along with their sizes.

   Note: Report files will be zipped for convenient e-mail and disk transfer. The zip file name will be preceded with ″rep″, followed by the export’s time stamp (for example, rep010904115344.zip). Report files will be in standard HTML format.
2. From the Export To list, select one of the following options:
   - Disk

     Saves the exported files to the disk on: ...\ SANavigator3.1\Client\Data\

- E-mail

  Mails the exported files as an e-mail attachment directly from the application
- Database

  Not available when exporting reports

3. Select the **Reports** option, then click **Select Reports**. The Selects Reports dialog box displays.
   a. Select the desired reports. To select multiple files, make sure the folders are fully expanded and press **<CTRL>** while selecting the reports.
   b. Click**OK**.
4. On the Export dialog box, click **OK**. To export to more than one destination, click **Apply** after configuring each option to save the changes.
5. Click **OK** when you are finished.

Deleting a report

To delete a generated report, perform the following actions:

1. Browse to the ...\SANavigator2.x\Client\Reports\ folder.
2. Select the files or folders you want to delete.

   Note: Images associated with a report will be stored in a folder that has the same name as the report.
3. Delete the files.

Printing a report

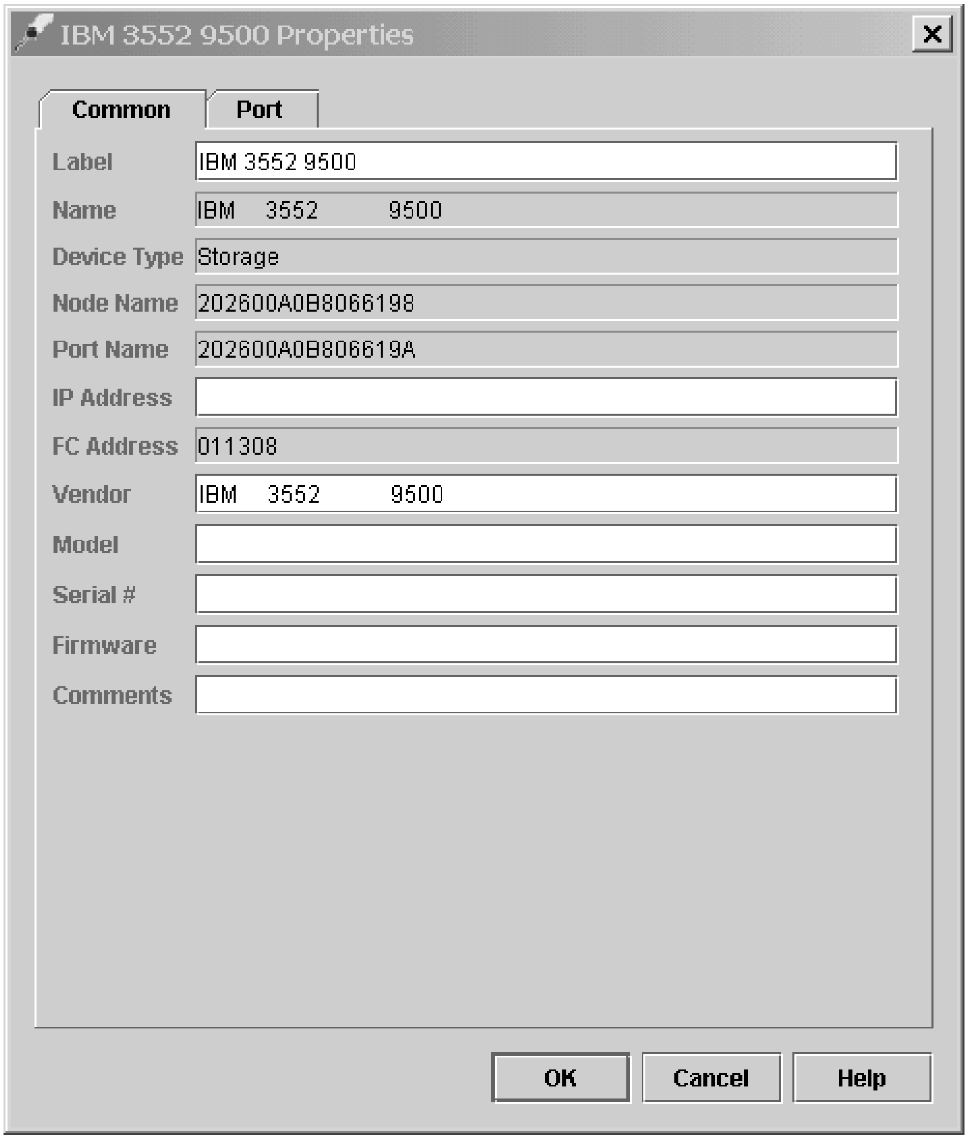
In the SANavigator Reports dialog box, click the **Show in Browser** button. In the Internet browser window, select **Print** from the File menu.

Note: Set up the printer to print in landscape format to ensure that all information fits on the page.

Device properties

Use the Device Properties dialog box (see Figure 44 on page 131) to view and edit the properties of a device. You can change the device type when the device is not directly discovered. Devices that are not directly discovered are usually reported to SANavigator by other SAN devices (such as a switch). However, some discovered properties are editable. The vendor can be discovered, but it is always still editable.

Important: Changing the Vendor field of a device disables the auto-launch of applications for that device.



IBM 3552 9500 Properties

Label	IBM 3552 9500
Name	IBM 3552 9500
Device Type	Storage
Node Name	202600A0B8066198
Port Name	202600A0B806619A
IP Address	
FC Address	011308
Vendor	IBM 3552 9500
Model	
Serial #	
Firmware	
Comments	

Figure 44. Device Properties window

Note: The vendor name in the Properties dialog box must match the vendor name in the Device Application command in order to launch applications.

To display device properties, right-click the device icon in the Physical Map panel and click **Properties** in the pop-up menu, or select the device and click **Edit -> Properties**. A dialog box appears with up to three tabs at the top: **Common**, **Adapter**, and **Port**.

Note: The Adapter and Port tabs are available only if In-Band discovery is performed; their properties cannot be edited.

Discovery troubleshooting guide

If the SANavigator tool is having difficulty discovering your SAN, or if you received an error message, there might be one of several problems. This section lists the most common problems and offers solutions on how to correct them. The list begins with the simplest problems and moves on to more complex ones.

- **Problem:** *Discovery is turned off.*

  Solution: Click **Discover -> On** from the desktop window.
- **Problem:** *Discovery not enabled.*

  Solution: Perform the following steps:
  1. Click **Discover -> Setup** from the desktop menu bar.
  2. Click the **General** tab on the Discover Setup dialog box.
  3. Select the **Out-of-Band Discovery** check box or the **In-Band Discovery** check box, or both.
  4. Click **OK**.
- **Problem:** *HBAs are not active for In-Band Discovery.*

  Solution: Perform the following steps:
  1. Click **Discover -> Setup** from the desktop window.
  2. Click the **General** tab on the Discover Setup dialog box.
  3. Select the **In-Band Discovery** check box.
  4. Click the **Active** column for each HBA you would like to discover.
  5. Click **OK**.

     Note: If you cannot set in-band discovery on, check to see whether the HBA API library has been installed. Click **Start -> Settings -> Control Panel -> Add/Remove Programs** and look for the Qlogic SAN/Device Management entry in the program list.
- **Problem:** *Server not found or server not available.*

  Solution: Verify that the server IP address is present and correct in the Out-of-band panel of the Discovery Set Up dialog box. All SAN devices should be on the same subnet as the server. If the server has multiple Network Interface Cards (NICs), then include their IP address in the Out-of-band panel.

  Note: Firewalls might prevent server discovery.
- **Problem:** *Switches not connected to LAN.*

  Solution: Check your physical cables and connectors.
- **Problem:** *Unable to detect tape devices attached to a SAN Data Gateway Router.*

  Solution: Verify that the SAN Data Gateway Router is connected to the network and that its IP address is set to the same subnet as your server.
- **Problem:** *No subnets or addresses selected.*

  Solution: Perform the following steps:
  1. Click **Discover -> Setup** from the desktop window.
  2. Click the **Out-of-Band** tab on the Discover Setup dialog box.
  3. Click the subnet or individual address you would like to discover in the Available Addresses pane.
  4. Click the right arrow (>) to move your choice to the Selected Subnets pane, or to the Selected Individual Addresses pane.
  5. Click **OK**.
- **Problem:** *The wrong IP addresses are selected.*

  Solution: Perform the following steps:
  1. Click **Discover -> Setup** from the desktop window.
  2. Click the **Out-of-Band** tab on the Discover Setup dialog box.

3. Verify that the IP addresses in the Selected Subnets and Selected Individual Addresses panes are the correct current addresses for your SAN.
4. Click **OK**.

- **Problem:** *The wrong community strings are selected.*

  Solution: Perform the following steps:

  1. Click **Discover -> Setup** from the desktop window.
  2. Click the **Out-of-Band** tab on the Discover Setup dialog box.
  3. Select an IP address.
  4. Click **Change**.
  5. Make your community strings selection.
  6. Click **OK**.
- **Problem:** *Broadcast request is blocked by routers.*

  Solution: Depending upon the information available about the required IP addresses, choose one of the following three solutions to this problem:

  – If you know the IP addresses and the addresses are not listed in the Available Addresses pane:

    1. Click **Discover -> Setup** from the desktop window.
    2. Click the **Out-of-Band** tab on the Discover Setup dialog box.
    3. Click **Add**.
    4. Type the required data in the dialog box.
    5. Click **OK**. Repeat as needed until all your addresses are available.
    6. Select the IP Addresses you want to discover in the Available Addresses pane.
    7. Click the right arrow (>) to move your choices to the Selected Individual Addresses pane.
    8. Click **OK**.

  – If you know the IP addresses and the addresses are listed in the Available Addresses pane:

    1. Click **Discover -> Setup** from the desktop window.
    2. Click the **Out-of-Band** tab on the Discover Setup dialog box.
    3. Select the IP Addresses you would like to discover in the Available Addresses pane.
    4. Click the right arrow (>) to move your choices to the Selected Individual Addresses pane.
    5. Click **OK**.

  – If you do not know the specific IP addresses:

    1. Click **Discover -> Setup** from the menu of the desktop window.
    2. Click the **Out-of-Band** tab on the Discover Setup dialog box.
    3. Click the **Method** column for the selected subnet in the Selected Subnets pane and choose **Sweep**.
    4. Click **OK**.

       The sweep method significantly increases your discovery time.
- **Problem:** *Discovery time is excessive.*

  Solution 1: Perform the following steps:

  1. Click **Discover -> Setup** from the desktop window.
  2. Click the **Out-of-Band** tab on the Discover Setup dialog box.

3. Click the **Method** column in the Selected Subnets pane and choose **Broadcast**.
4. Click **OK**.

Solution 2: In most cases, decreasing the SNMP time-out will decrease the discovery time.

- **Problem:** *The server does not seem to be starting.*

  Action: Examine the server log (\SANavigator2.x\Server\Data\SANs\server.log) for diagnostic information.

Chapter 6. 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 24.

In Figure 45, 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 as single path.

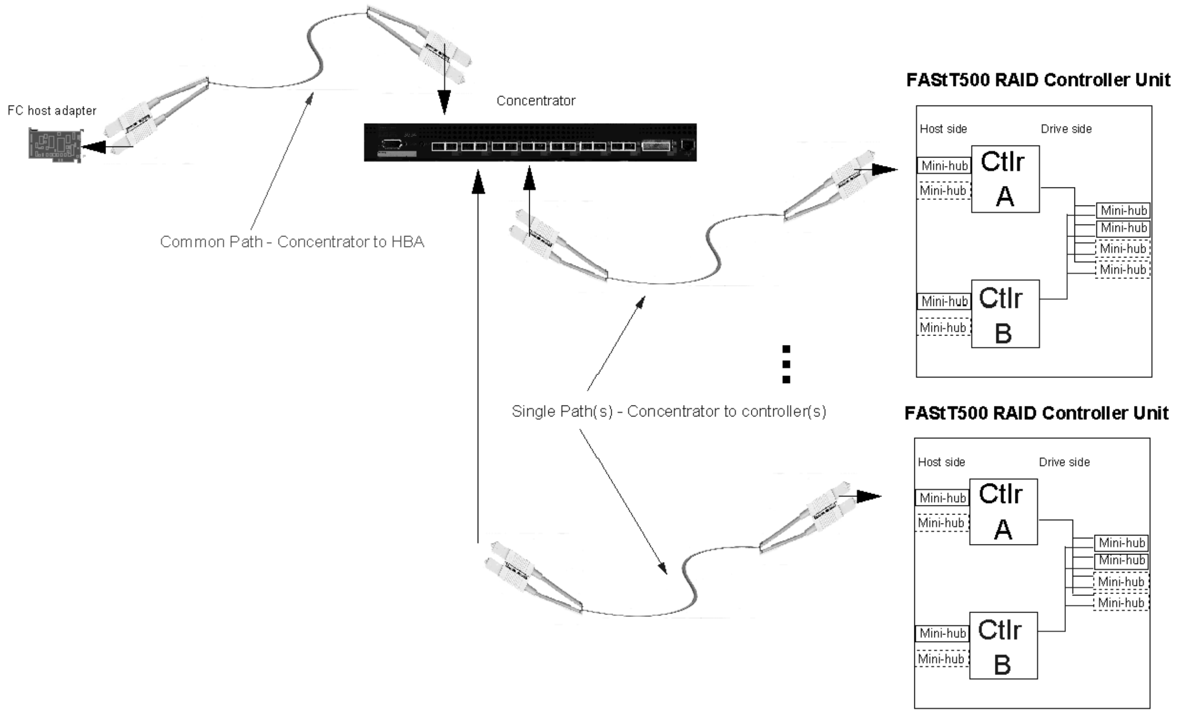


Figure 45. Common path configuration

Chapter 7. PD hints: RAID controller errors in the 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 11.

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 NT 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 NT event log**

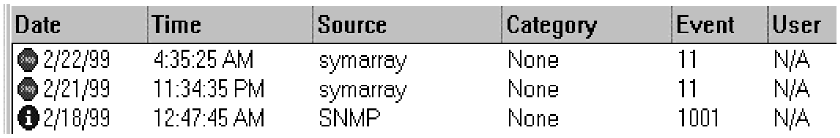
  Open and review the event log. A series of event ID 11s generally indicates LIPs (Loop resets). This generally indicates a bad fibre path. It could be an indication of a problem with a GBIC, an MIA, or an adapter.

  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 NT 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 NT event log, which is viewed in a GUI environment (see Figure 46). 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
ℹ 2/18/99	12:47:45 AM	SNMP	None	1001	N/A

Figure 46. Event log

Table 11 on page 138 lists the most common, but not necessarily the only, event IDs encountered in a SYMarray (RDAC) event.

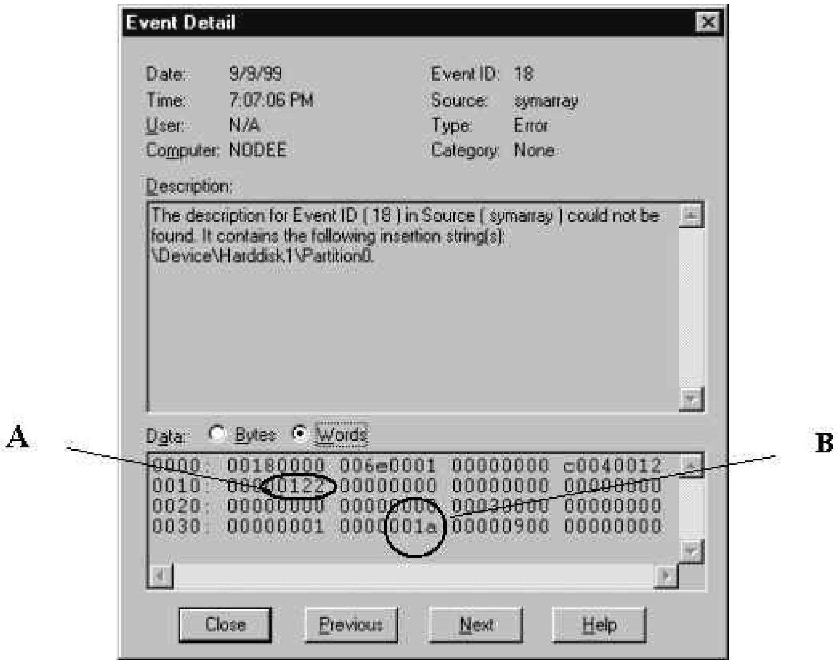
Table 11. Common SYMarray (RDAC) event IDs

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 47.



Date: 9/9/99
Time: 7:07:06 PM
User: N/A
Computer: NODEE

Event ID: 18
Source: symarray
Type: Error
Category: None

Description:

The description for Event ID (18) in Source (symarray) could not be found. It contains the following insertion string(s): \Device\Harddisk1\Partition0.

Data: ○ Bytes ● Words

```
0000: 00180000 006e0001 00000000 c0040012
0010: 00000122 00000000 00000000 00000000
0020: 00000000 00000000 00030000 00000000
0030: 00000001 0000001a 00000900 00000000
```

Figure 47. Event detail

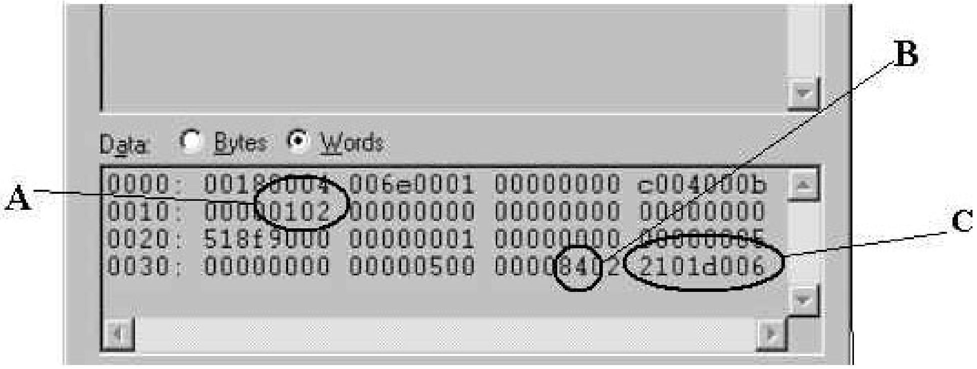
A. The last 4 digits (2 bytes) in this field indicate the unique error value. In this example, the error value shown indicates a Controller Failover Event.

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

Table 12. 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 48 is a recovered drive timeout error on drive 2, 1.



```
0000: 00180004 006e0001 00000000 c004000b
0010: 00000102 00000000 00000000 00000000
0020: 518f9000 00000001 00000000 0000000e
0030: 00000000 00000500 00008402 2101d006
```

Figure 48. Unique error value example

A. This error indicates (according to the error codes listed in Table 12) 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 13 lists Sense Key values and descriptions.

Table 13. 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 14. The sense keys most likely to be returned for each error are also listed in the table.

Table 14. 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 14. 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 14. 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 14. 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 14. 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 14. 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 14. 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 14. 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 14. 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 14. 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 15.

Table 15. 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 8. 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 10.

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 49) 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.

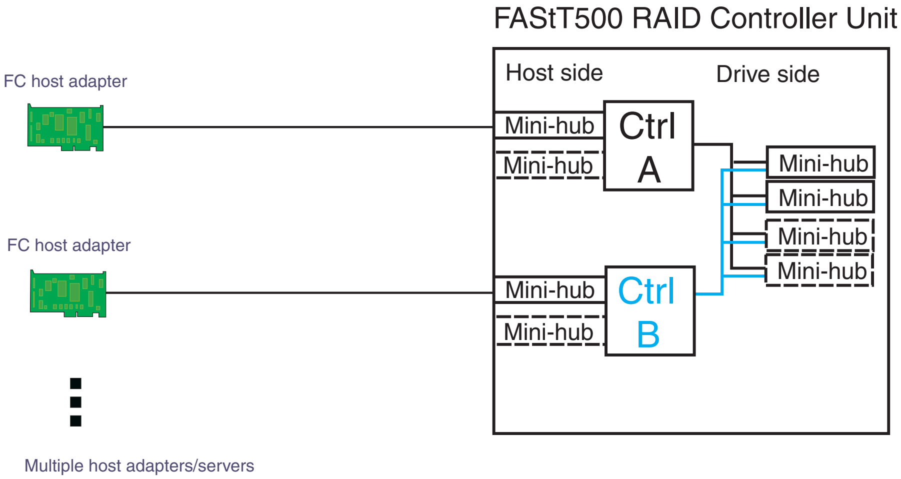


Figure 49. Type 1 configuration

Type 2 configuration

The type 2 configuration can occur with or without hubs and switches, as shown in Figure 50 and Figure 51.

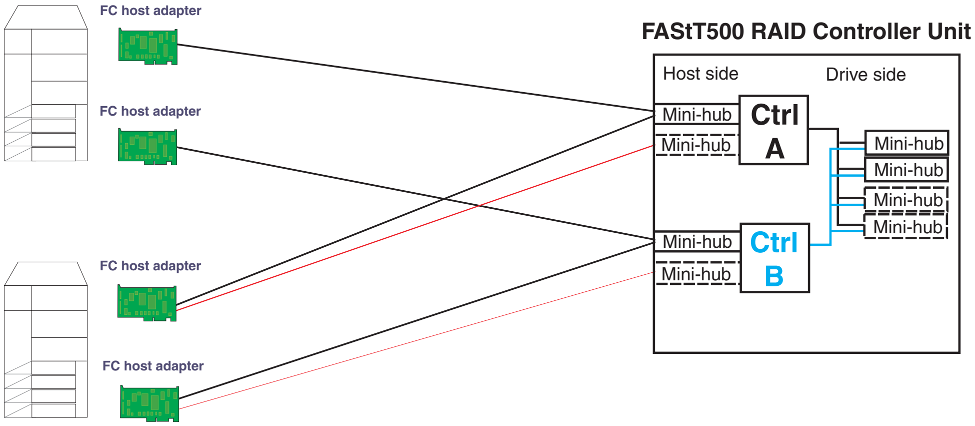


Figure 50. Type 2 configuration - With hubs

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).

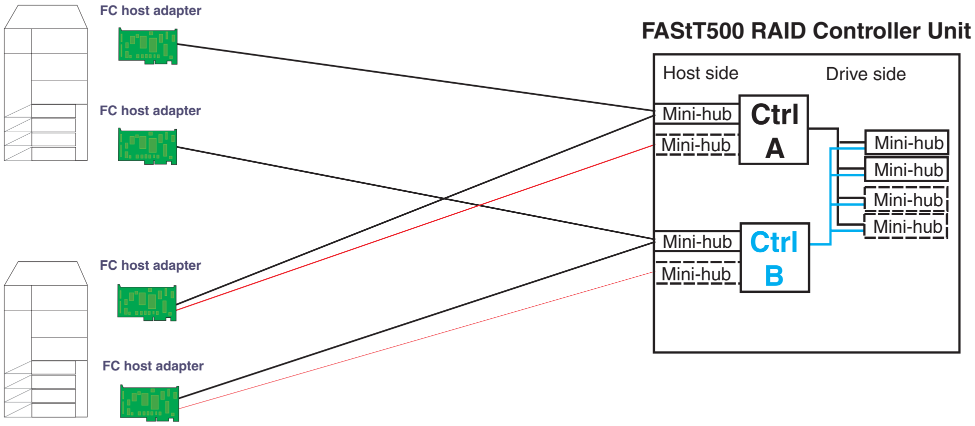


Figure 51. Type 2 configuration - Without hubs

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), the `sendEcho` command (from the RAID controller end), and SANavigator (with in-band management). 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 52 shows a type 2 configuration with multiple controller units.

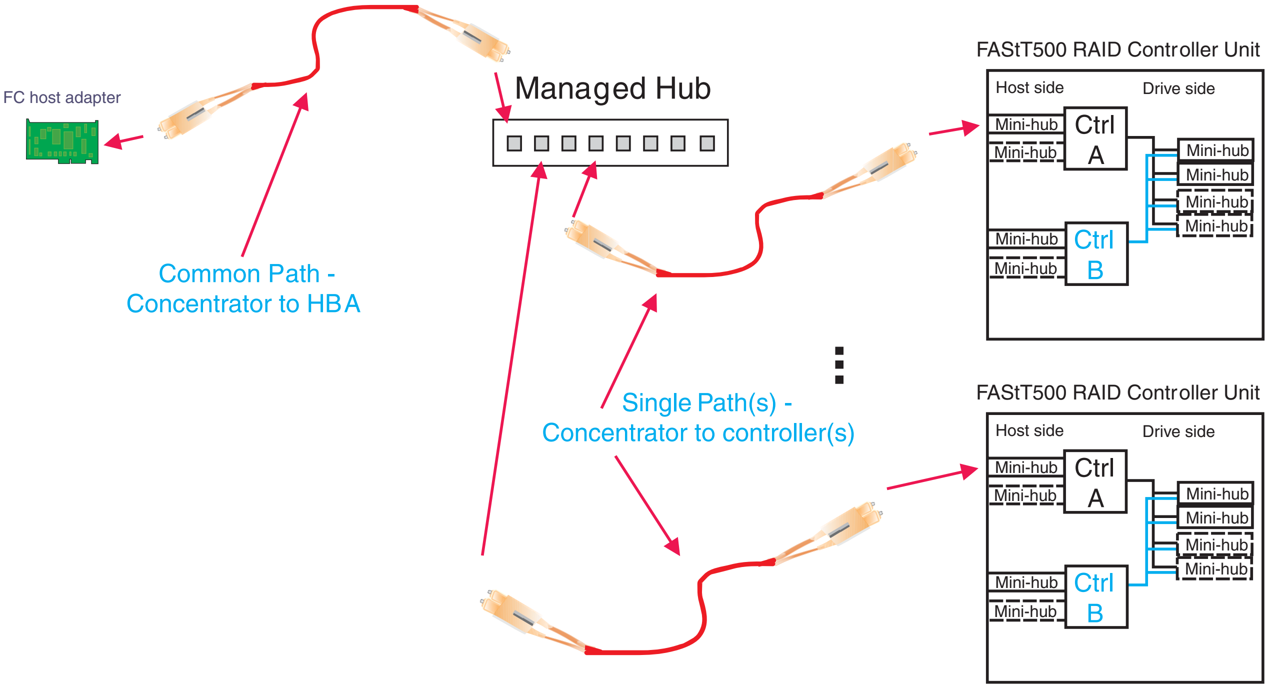


Figure 52. Type 2 configuration with multiple controller units

You can also use SANavigator to identify and isolate fibre path and device problems. SANavigator discovery for a configuration without concentrators requires that the HBA API Library be installed on the server where SANavigator is installed and in which the HBAs are located. This is referred to as in-band management.

For configurations with concentrators, the concentrator (a switch, hub, or router) must be connected to the same sub-network (through Ethernet) as the server in order for SANavigator to discover the devices. This is referred to as out-of-band management.

Both in-band and out-of-band management can be enabled for a particular SAN configuration. It is strongly suggested that you enable both management methods.

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 53, controller B is passive.

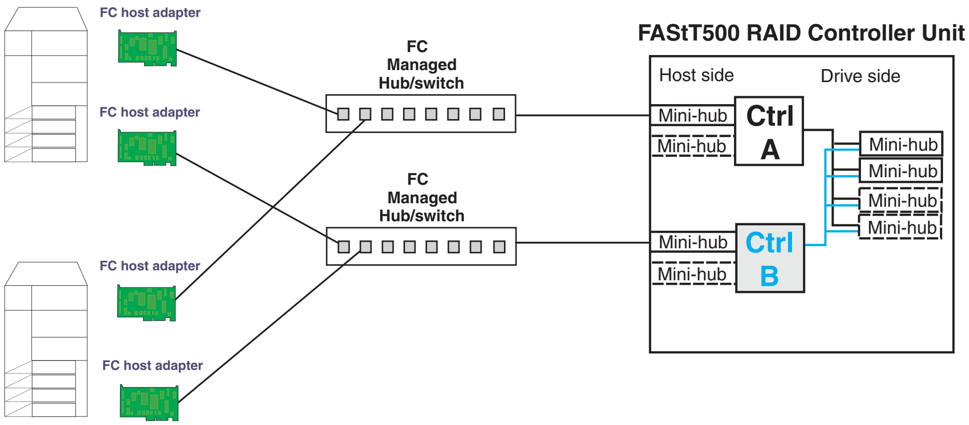


Figure 53. Passive controller B

2. All I/O is flowing through controller A. This yields the diagram shown in Figure 54 for debugging.

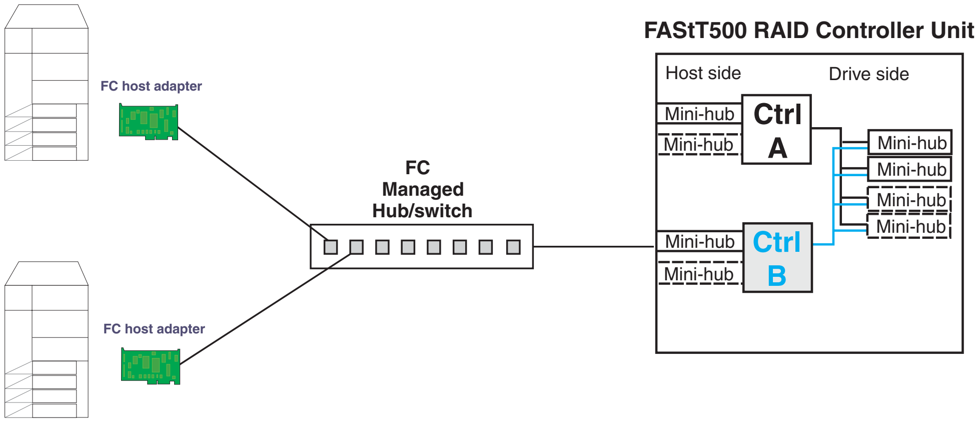


Figure 54. All I/O flowing through controller A

3. To see more clearly what is involved, redraw the configuration showing the path elements in the loop, as shown in Figure 55 on page 155.

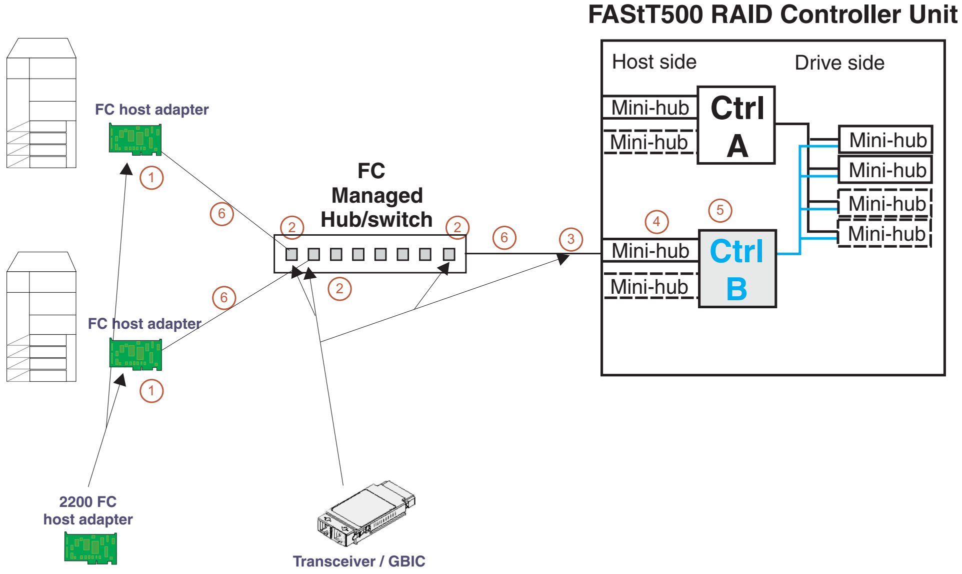


Figure 55. Path elements loop

The elements of the paths shown in Figure 55 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 9. 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 11.

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

As shown in Figure 56, right-click the dimmed controller icon and click **Properties**.

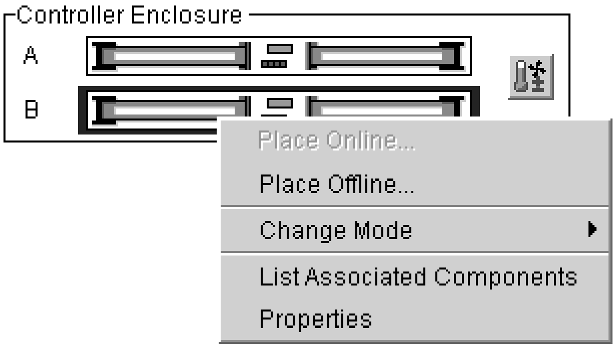
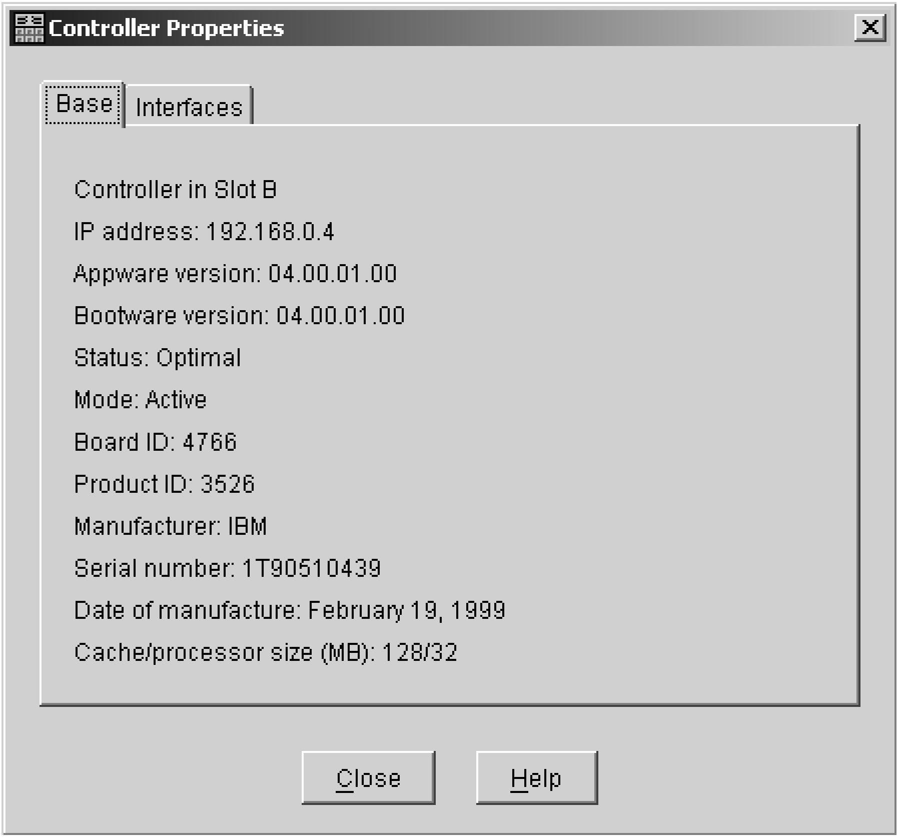


Figure 56. Controller right-click menu



Controller in Slot B

IP address: 192.168.0.4

Appware version: 04.00.01.00

Bootware version: 04.00.01.00

Status: Optimal

Mode: Active

Board ID: 4766

Product ID: 3526

Manufacturer: IBM

Serial number: 1T90510439

Date of manufacture: February 19, 1999

Cache/processor size (MB): 128/32

Figure 57. Controller Properties window

If the Controller Properties view (shown in Figure 57) 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 11) 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 138.)
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 20).
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 15 for helpful tools.

Chapter 10. 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 22.

The 3526 controllers use MIA copper-to-optical converters, while the 3542, 3552, and 1742 controllers use GBICs. 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, 3552, or 1742 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 58.

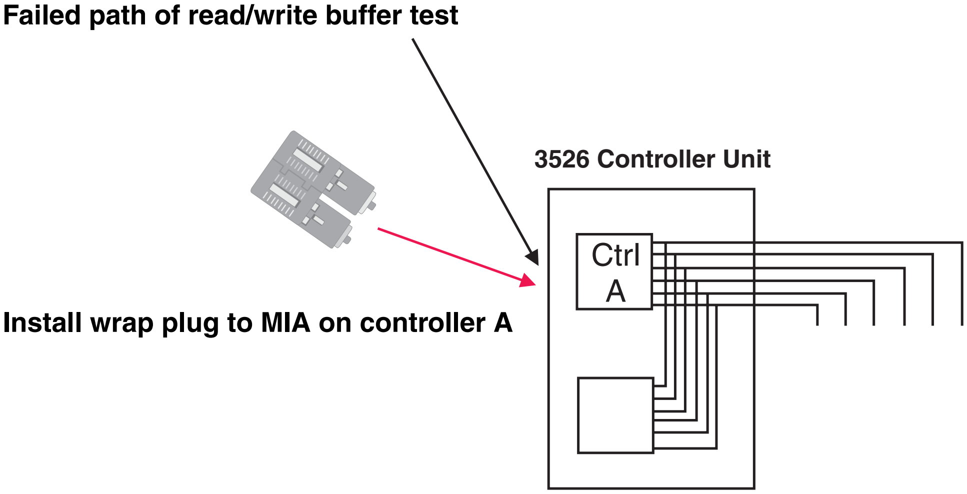

Failed path of read/write buffer test
3526 Controller Unit
Ctrl A
Install wrap plug to MIA on controller A

Figure 58. Install wrap plug to MIA on controller A

   b. For a Type 3552 or 1742 controller, install a wrap plug to the GBIC in the mini-hub on controller A. See Figure 59 on page 162.

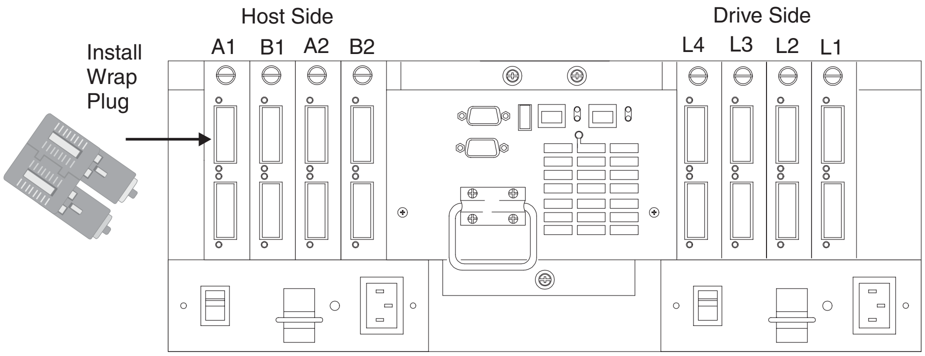


Figure 59. Install wrap plug to GBIC in mini-hub on controller A

3. Go to the appropriate Loopback Test section (either “Running the loopback test on a 3526 RAID controller” or “Running the loopback test on a FAStT200, FAStT500, or FAStT700 RAID controller” on page 163).

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 60.

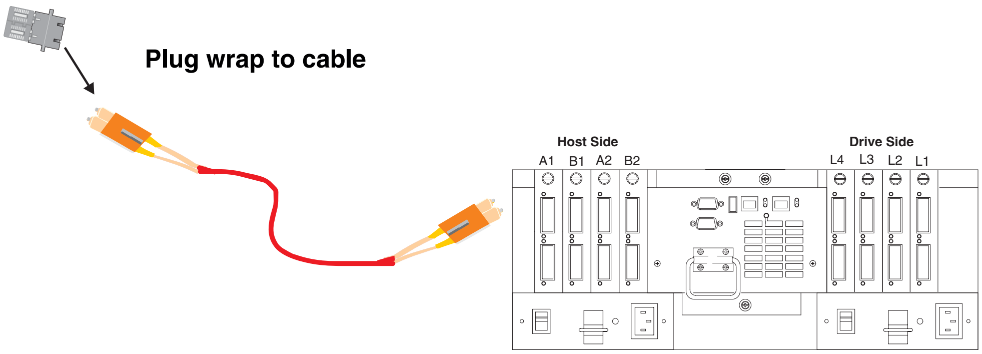


Figure 60. Install wrap plug

4. Go to the appropriate loopback test section (either “Running the loopback test on a 3526 RAID controller” or “Running the loopback test on a FAStT200, FAStT500, or FAStT700 RAID controller” on page 163).

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, or FAStT700 RAID controller

Perform the following steps for a loopback test on a FAStT200, FAStT500, or FAStT700 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 22.

Chapter 11. 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.

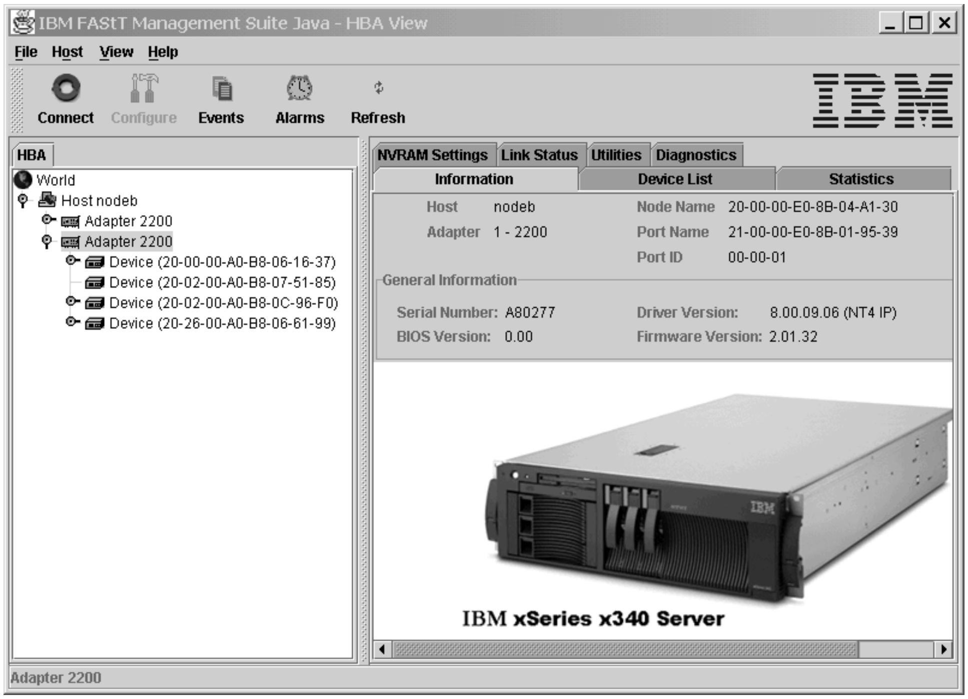
This chapter contains the following tool hints:

- “Determining the configuration”
- “Boot-up delay” on page 168
- “Controller units and drive enclosures” on page 170
- “SANavigator discovery and monitoring behavior” on page 172
- “Setting up SANavigator Remote Discovery Connection for in-band management of remote hosts” on page 185
- “Controller diagnostics” on page 186
- “Linux port configuration” on page 188

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 61 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.



World
Host nodeb
Adapter 2200
Adapter 2200
Device (20-00-00-A0-B8-06-16-37)
Device (20-02-00-A0-B8-07-51-85)
Device (20-02-00-A0-B8-0C-96-F0)
Device (20-26-00-A0-B8-06-61-99)

Host	nodeb	Node Name	20-00-00-E0-8B-04-A1-30
Adapter	1 - 2200	Port Name	21-00-00-E0-8B-01-95-39
		Port ID	00-00-01

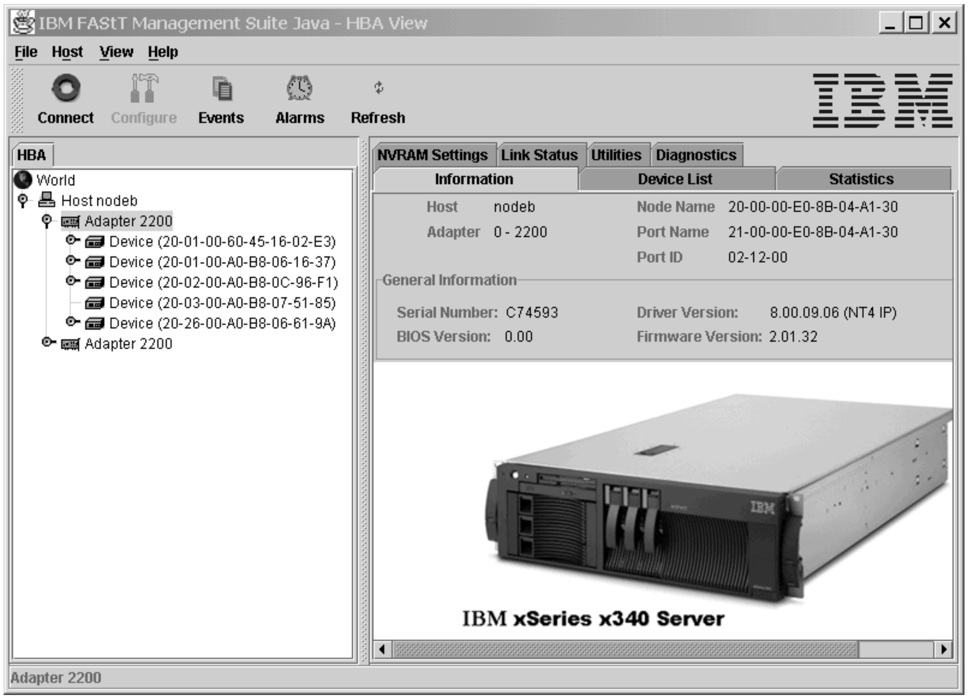
General Information

Serial Number:	A80277	Driver Version:	8.00.09.06 (NT4 IP)
BIOS Version:	0.00	Firmware Version:	2.01.32

Adapter 2200

Figure 61. FAStT MSJ window - Two 2200 host adapters

A different configuration is shown in Figure 62, which shows a 2200 adapter. Its World Wide Name is 20-00-00-E0-8B-04-A1-30 and it has five devices attached to it. When the first two bytes of the Port ID display (and they are other than 00), the configuration is Fabric (switch).



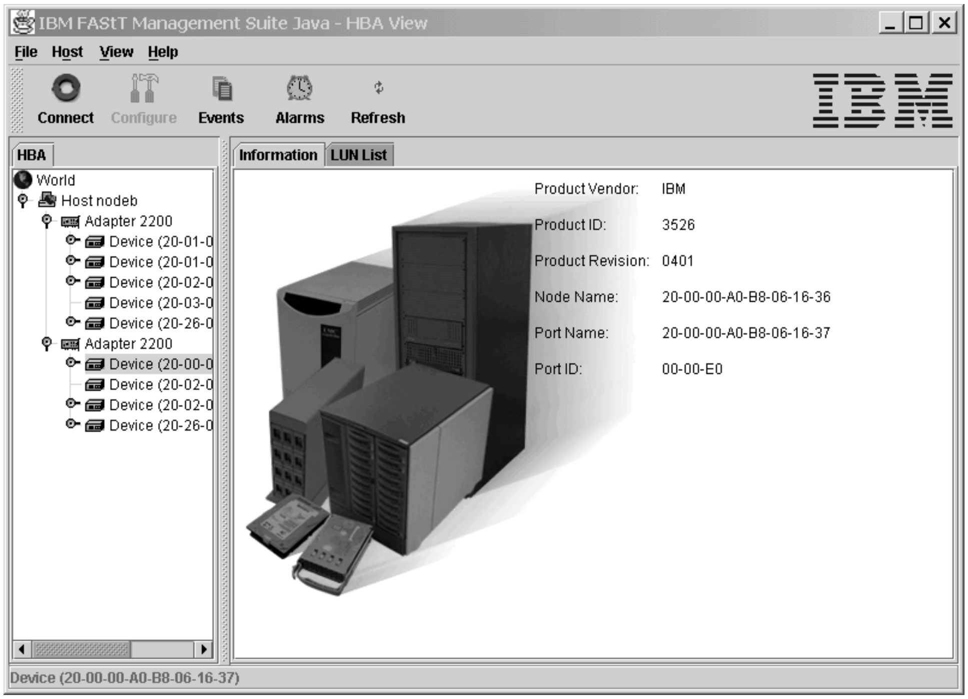
World
Host nodeb
Adapter 2200
Device (20-01-00-60-45-16-02-E3)
Device (20-01-00-A0-B8-06-16-37)
Device (20-02-00-A0-B8-0C-96-F1)
Device (20-03-00-A0-B8-07-51-85)
Device (20-26-00-A0-B8-06-61-9A)
Adapter 2200

Host nodeb
Adapter 0 - 2200
Node Name 20-00-00-E0-8B-04-A1-30
Port Name 21-00-00-E0-8B-04-A1-30
Port ID 02-12-00

General Information
Serial Number: C74593
BIOS Version: 0.00
Driver Version: 8.00.09.06 (NT4 IP)
Firmware Version: 2.01.32

Figure 62. FAStT MSJ window - One 2200 host adapter

As shown in Figure 63 on page 167, if you select one of the devices beneath a host adapter, you find that it is a controller in a 3526 controller unit.



Product Vendor: IBM

Product ID: 3526

Product Revision: 0401

Node Name: 20-00-00-A0-B8-06-16-36

Port Name: 20-00-00-A0-B8-06-16-37

Port ID: 00-00-E0

Device (20-00-00-A0-B8-06-16-37)

Figure 63. 3526 controller information

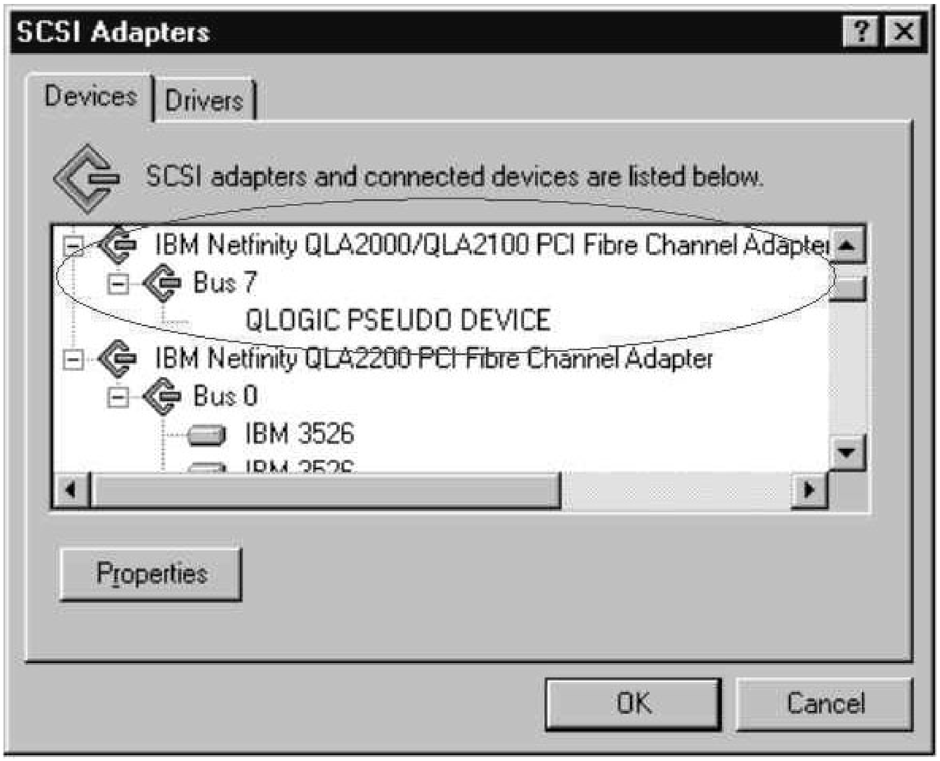
Boot-up delay

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 188 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 64 for the 2100.



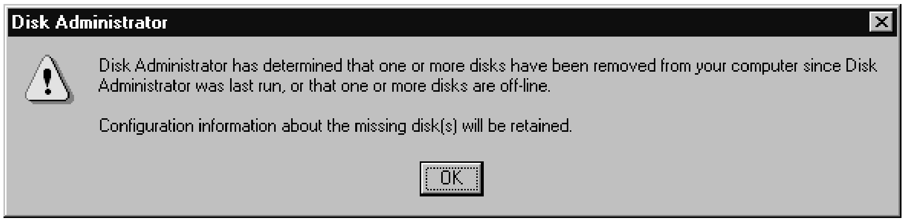
SCSI adapters and connected devices are listed below.

```
IBM Netfinity QLA2000/QLA2100 PCI Fibre Channel Adapter
  Bus 7
    QLOGIC PSEUDO DEVICE
IBM Netfinity QLA2200 PCI Fibre Channel Adapter
  Bus 0
    IBM 3526
    IBM 3526
```

Figure 64. 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 65.



Disk Administrator

Disk Administrator has determined that one or more disks have been removed from your computer since Disk Administrator was last run, or that one or more disks are off-line.

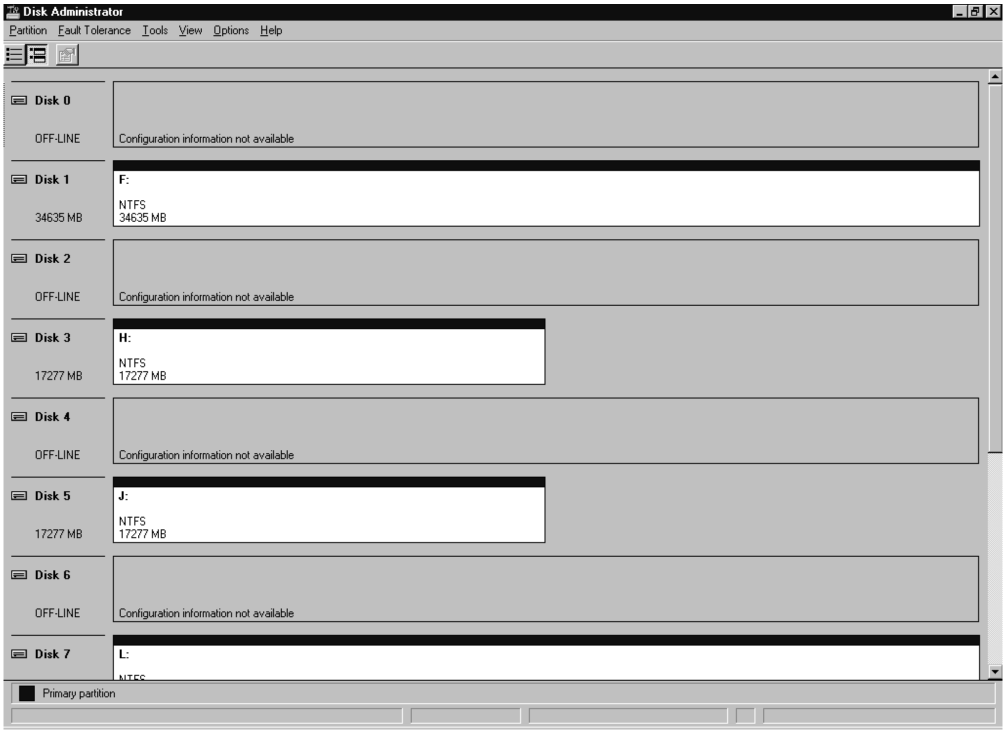
Configuration information about the missing disk(s) will be retained.

Figure 65. 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 66.



Disk 0 OFF-LINE — Configuration information not available

Disk 1 34635 MB — F: NTFS 34635 MB

Disk 2 OFF-LINE — Configuration information not available

Disk 3 17277 MB — H: NTFS 17277 MB

Disk 4 OFF-LINE — Configuration information not available

Disk 5 17277 MB — J: NTFS 17277 MB

Disk 6 OFF-LINE — Configuration information not available

Disk 7 — L: NTFS

Figure 66. Disk Administrator

4. **If Done:** Return to “Boot-up Delay PD map” on page 13.

Controller units and drive enclosures

In Figure 67 (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 box can be used with the 3552, 3542, and 1742 Controller Units.

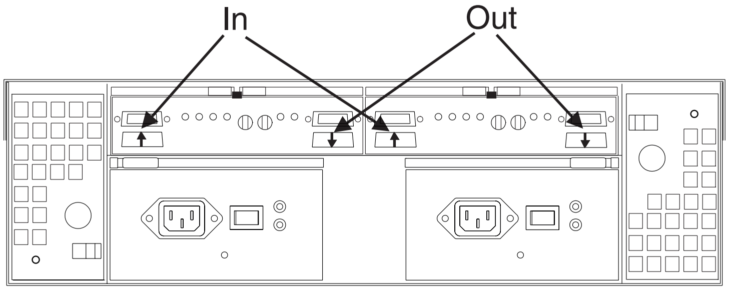


Figure 67. EXP500 fibre channel drive enclosure

Note: In the previous figure, the connections for the GBICs 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 68 shows the locations of the controller connections in a FAStT500 or FAStT700 Fibre Channel controller unit.

Note: In Figure 68, a FAStT500 controller unit is shown.

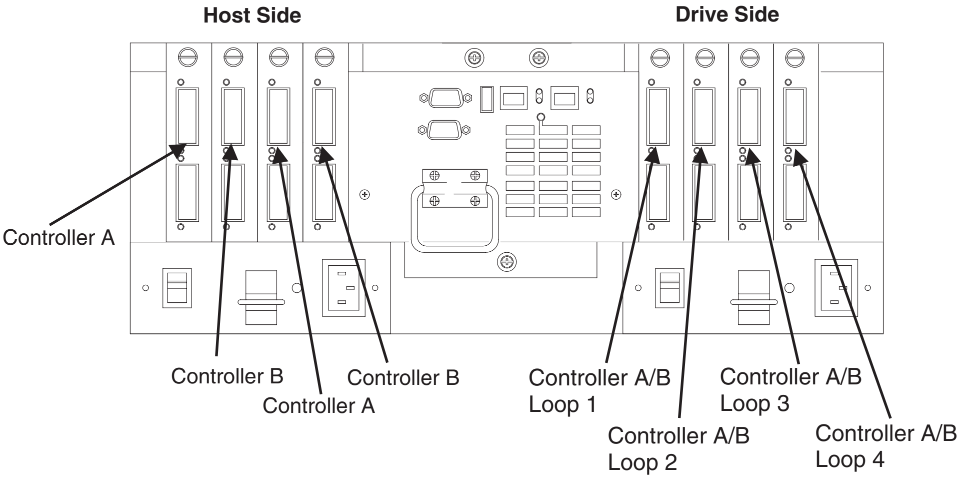


Figure 68. FAStT500 controller connection locations

Figure 69 on page 171 shows the locations of the controller units in a FAStT200 Fibre Channel controller and drive enclosure unit.

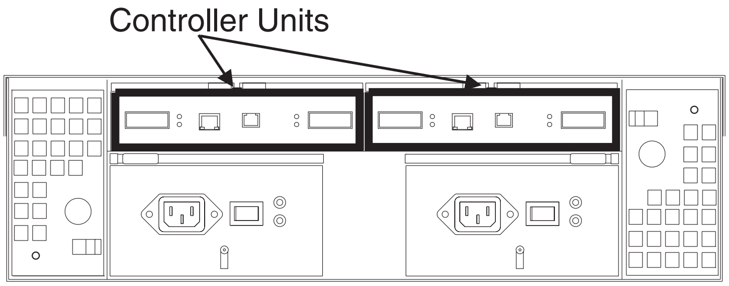


Figure 69. FAStT200 fibre channel controller unit locations

Figure 70 shows a configuration containing both controllers. It uses GBICs for the connection but does not have the mini-hub feature of the 3552. 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.

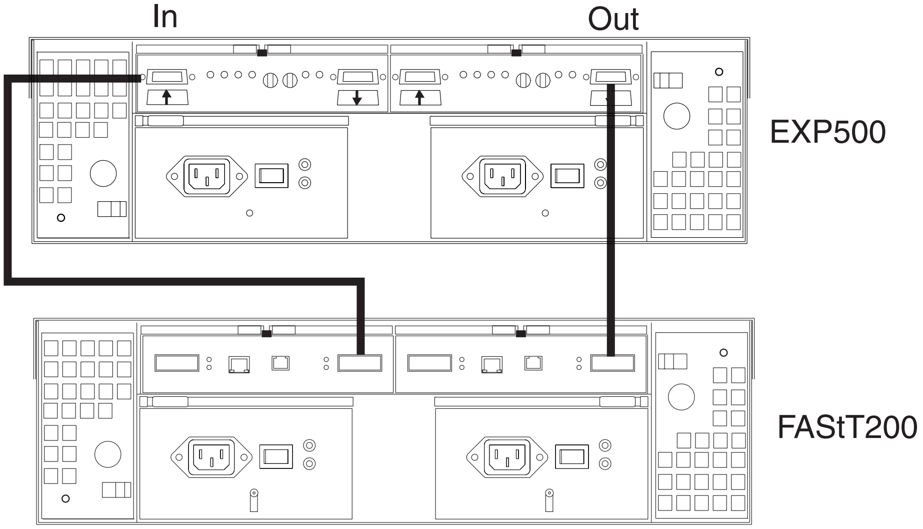


Figure 70. EXP500 and FAStT200 configuration

SANavigator discovery and monitoring behavior

This section provides examples and commentary explaining the use and interpretation of the SANavigator Physical Map and Event Log.

For more information about using SANavigator, see Chapter 5, “Introduction to SANavigator,” on page 103.

Physical Map

To simplify management, devices display in groups. Groups are shown with background shading and are labeled appropriately. You can expand and collapse groups to easily view a large topology. See Figure 71.

This section describes the groups shown on a typical SANavigator representation of a SAN. The following map shows devices bundled into four types of groups: Host, Switch, Storage, and Bridge.

Note: In version 2.7, SANavigator displayed the SAN topology as one single fabric. In version 3.x, each switch (and associated devices) is shown as an individual Fabric. If the switches are connected through Inter-Switch Link (ISL), then SANavigator displays the topology as a single fabric and assigns the WWNN of one of the switches to the fabric.

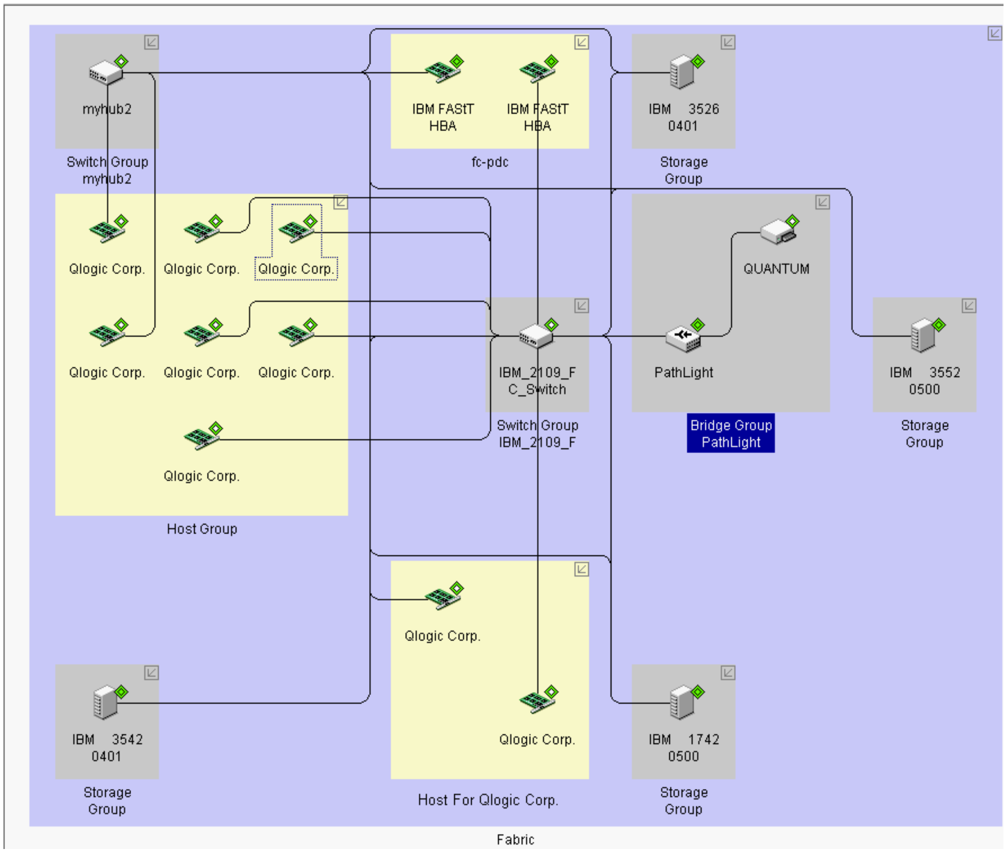


Figure 71. SANavigator Physical map

The four types of groups displayed in this Physical map are:

- **Host Groups**

  Three host groups are shown in this map: Host, Host For Qlogic Corp., and fc-pdc.

  The unassigned host bus adapters are contained within one group (Host). At the time this map was captured, the discovered HBAs were not associated with their respective servers.

  If a discovered server has identical HBA types (for example, two 2200s or two 2310s), then SANavigator reconciles these HBAs into their respective servers and assigns the HBA name (for example ″Host For Qlogic Corp.″) as the name of the server. This is shown in the second group on the topology (Server Host For Qlogic Corp.). This type of automatic association is valid only for Windows operating systems.

  Instructions are provided for changing the name of the server and assigning HBAs to other servers in "Associating unassigned HBAs to servers" on page 174.

  HBAs can also be associated automatically to the system on which they reside provided that in-band management for that system is enabled. A new feature of SANavigator 3.x is the ability to perform in-band management of remote hosts from a local management station. The local SANavigator server communicates with the Remote Discovery Connector (SANavRemote.exe) installed on the remote host. You need to choose Remote Discovery Connector when installing SANavigator on the remote Host.

  This method of Discovery requires that the HBA API library be installed on the system (local or remote or both). It is shown in the third group on the topology (Host fc-pdc). The inner and outer diamonds for each of the HBAs are green; this indicates that both in-band and out-of band discovery have occurred and are still active.

- **Switch Group**

  This group represents the switches that are required for SANavigator to perform out-of-band management. You can expand the switch icon to expose the ports by right-clicking the icon and selecting **Port** from the pop-up menu.

  Note: If switches or managed hubs are present, then out-of-band management must be enabled.

- **Storage Groups**

  These groups represent the FAStT storage servers or other storage devices. You can expand the storage server to expose the ports by right-clicking the icon and selecting **Port** from the pop-up menu.

  Both inner and outer diamonds for each of the storage servers are green; this indicates that both in-band and out-of-band discovery have occurred and are still active. The in-band discovery is accomplished by the HBAs in the fc-pdc server and is only applicable to that server.

- **Bridge Group**

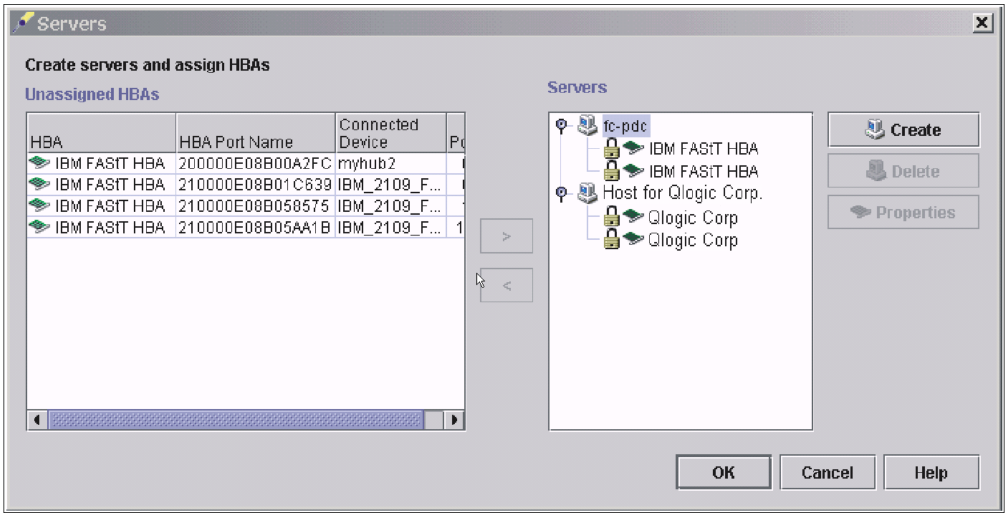
  The SAN Data Gateway router, like the IBM 2103-R03, displays as a Bridge Group. The Physical Map shown in this section shows a PathLight SAN Router connected to port 14 of a switch. The discovery diamond adjacent to the router shows that the router was discovered through both in-band and out-of-band discovery methods.

  Attached to the router is a Quantum Tape Library. Its discovery diamond shows that it was discovered only through out-of-band discovery. The out-of-band discovery was achieved because the router Ethernet port was connected to the SAN sub-network. Like the Storage Groups, fc-pdc is the only server in this SAN that can in-band manage the router.

Associating unassigned HBAs to servers

You can associate unassigned HBAs to their respective systems. To do this, you need to know in which system they reside and the HBA World Wide Node name. After you have this information, right-click anywhere in the Host Group box and select **Servers** from the pop-up menu.

Figure 72 shows the Server\HBA assignment dialog box. The left panel shows the unassigned HBAs and the right panel shows those HBAs that were assigned automatically to their servers. Once an HBA is assigned automatically, you cannot remove it from the server tree. You can add additional HBAs to the server tree, but SANavigator does not verify that the HBAs belong to that server.

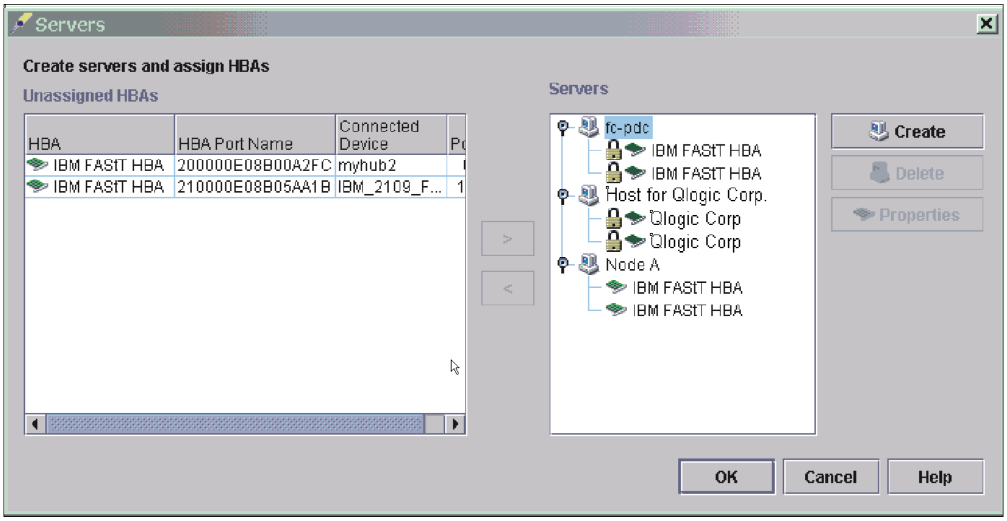


HBA	HBA Port Name	Connected Device	Po
IBM FAStT HBA	200000E08B00A2FC	myhub2	
IBM FAStT HBA	210000E08B01C639	IBM_2109_F...	
IBM FAStT HBA	210000E08B058575	IBM_2109_F...	
IBM FAStT HBA	210000E08B05AA1B	IBM_2109_F...	1

- fc-pdc
  - IBM FAStT HBA
  - IBM FAStT HBA
- Host for Qlogic Corp.
  - Qlogic Corp
  - Qlogic Corp

Figure 72. Server/HBA Assignment window

Figure 73 shows the creation of system Node A with the correct HBAs assigned to it. This was done by clicking **Create**, typing `Node A` in the **Name** field, and then moving the appropriate HBAs to the right panel under the newly created server (select the HBAs to be moved and click the appropriate arrow).



HBA	HBA Port Name	Connected Device	Po
IBM FAStT HBA	200000E08B00A2FC	myhub2	
IBM FAStT HBA	210000E08B05AA1B	IBM_2109_F...	1

- fc-pdc
  - IBM FAStT HBA
  - IBM FAStT HBA
- Host for Qlogic Corp.
  - Qlogic Corp
  - Qlogic Corp
- Node A
  - IBM FAStT HBA
  - IBM FAStT HBA

Figure 73. System node creation

As shown in Figure 74, the Physical Map now displays the following three types of association:

- Server fc-pdc (associated through in-band discovery)
- Server Host For Qlogic Corp. (associated through common HBA type)
- Node A (newly created)

Additional servers can be created because not all HBAs were assigned.

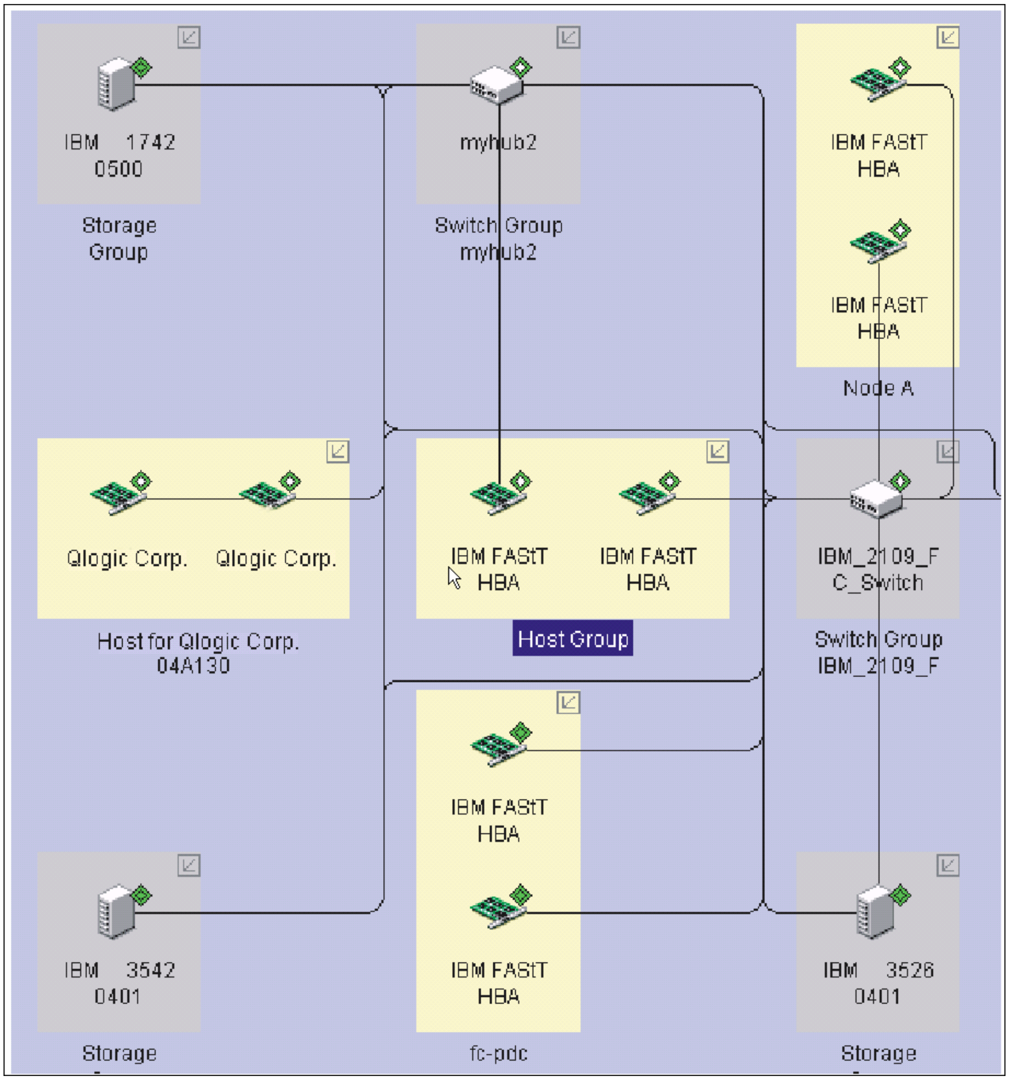


Figure 74. Physical map association

Displaying offline events

Figure 75 shows an example of the SANavigator method for displaying devices that go offline. The figure shows a FAStT Fibre Channel HBA connected to port 2 of a switch. The discovery diamond adjacent to the HBA shows that it was discovered through out-of-band (outer diamond is present).

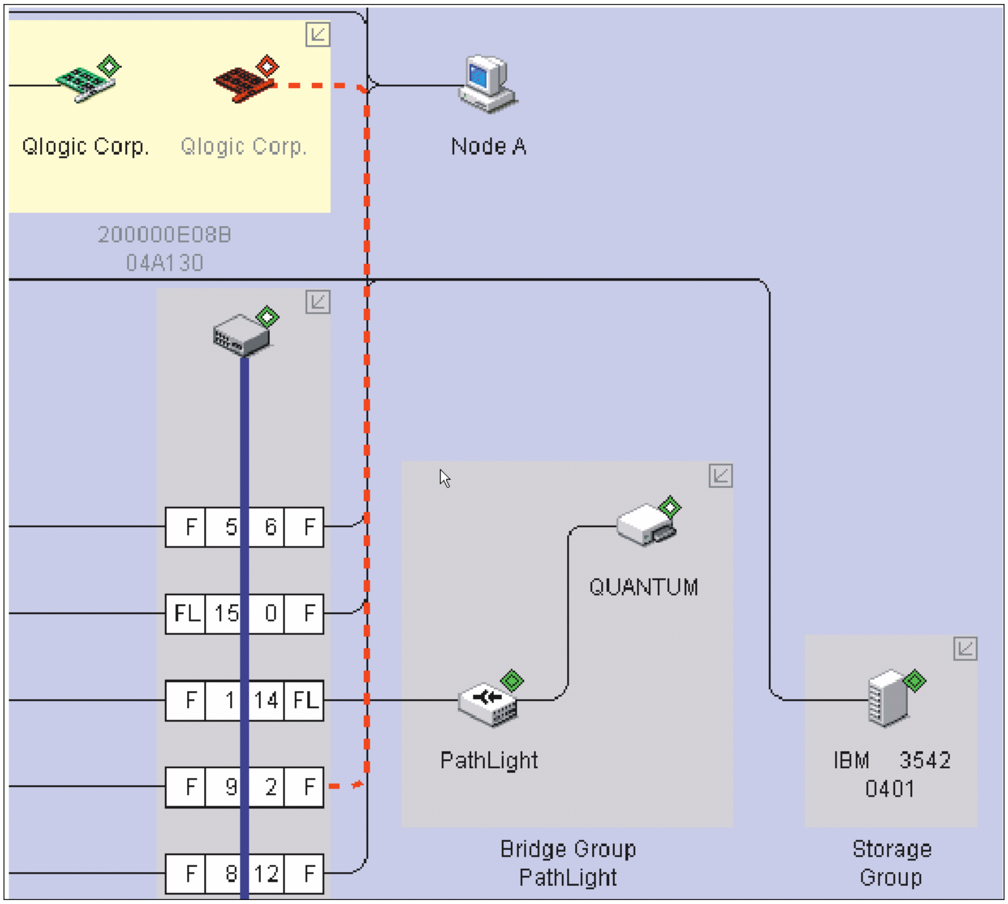


Figure 75. Offline HBA

In the scenario shown in Figure 75, a problem has occurred that caused the HBA to go offline. Note the HBA discovery diamond. The outer diamond is red and the inner diamond is clear (indicating no in-band management). The HBA icon and the connecting line to the port are also red, indicating that there is no communication through the out-of-band network. The loss of the out-of-band connection was most likely due to a Fibre Path problem.

In this scenario, if in-band discovery had been enabled, then the HBA icon and the inner diamond would have remained green. In this case, the problem probably lies in the fibre path between the HBA and the switch; this can be determined because the HBA is still being in-band managed (that is, it is still responding to SCSI commands). The cause of the problem might include the HBA (fibre channel circuitry or transceivers), the cable to the switch, the GBIC for that port, the switch port, or the switch itself.

As this example shows, enabling both discovery methods increases the power of SANavigator to isolate problems. If both diamonds had turned red, the HBA would have most likely been the cause of the problem.

See “Event Log behavior” for additional information on understanding the SANavigator discovery process.

Exporting your SAN for later viewing (Import)

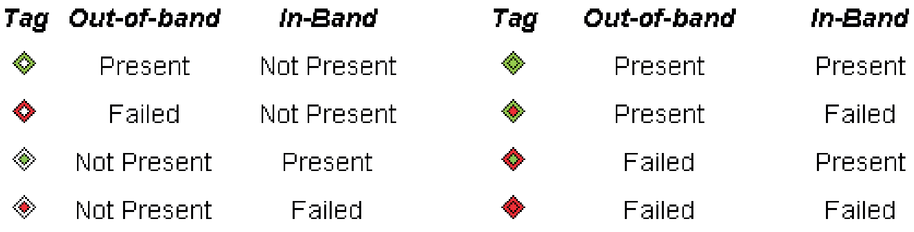
Exporting a SAN is useful when SAN problems are encountered and your Technical Support organization (level 2 for example) asks you to provide them with the SAN database to facilitate troubleshooting the failure. Chapter 5, “Introduction to SANavigator,” on page 103 provides information on how to Export/Import SANs.

In addition, Export/Import is the method by which you save your SAN in version 3.x. In previous versions, SANs could be saved as SAN files (Save, Save as...). This is no longer available in 3.x.

Event Log behavior

The tables in this section describe the SANavigator Event Log and associated GUI behavior when problems are encountered relating to the fibre path, controllers, host bus adapters, and storage servers.

A discovery diamond displays adjacent to each device in the Physical Map. Figure 76 shows the discovery diamond legend.



Tag	Out-of-band	In-Band	Tag	Out-of-band	In-Band
◇	Present	Not Present	◆	Present	Present
◇	Failed	Not Present	◈	Present	Failed
◈	Not Present	Present	◈	Failed	Present
◈	Not Present	Failed	◆	Failed	Failed

Figure 76. Discovery diamond legend

Table 16 displays the Event Log behavior for problems that involve host bus adapters.

Table 16. SANavigator Event Log behavior matrix for HBAs

	If the problem is in the Fibre Path, then the indicator is ...	**If the problem is the HBA, then the indicator is ...**
Out-of-band discovery		
Event Log entries (fatal events)		
Log entry #1	HBA - Out-of-band offline	HBA - Out-of-band offline
Log entry #2	Concentrator port for that HBA - Connection offline	Concentrator port for that HBA - Connection offline
Log entry #3	HBA - Connection offline	HBA - Connection offline
Physical Map		
HBA outer diamond	Red	Red
HBA inner diamond	Clear (no in-band)	Clear (no in-band)
HBA connection line	Red	Red
HBA icon	Red	Red
Out-of-band and in-band discovery		
Event Log entries (fatal events)		
Log entry #1	HBA - Out-of-band offline	HBA - Out-of-band offline
Log entry #2	Concentrator port for that HBA - Connection offline	Concentrator port for that HBA - Connection offline
Log entry #3	HBA - Connection offline	HBA - Connection offline
Log entry #4	All devices detected by HBA - In-band offline	HBA - In-band offline
Log entry #5		All devices detected by HBA - In-band offline
Log entry #6		All devices detected by HBA - Connection offline
Physical Map		
HBA outer diamond	Red	Red
HBA inner diamond	Green	Red
HBA connection line	Red	Red
HBA icon	Normal	Red
In-band discovery*		
Event Log entries (fatal events)		
Log entry #1	All devices detected by HBA - In-band offline	HBA - In-band offline
Log entry #2	All devices detected by HBA - Connection offline	HBA - Connection offline
Log entry #3	HBA - Connection offline (if connected to switch)	All devices detected by HBA - In-band offline
Log entry #4		All devices detected by HBA - Connection offline

Table 16. SANavigator Event Log behavior matrix for HBAs (continued)

	If the problem is in the Fibre Path, then the indicator is ...	If the problem is the HBA, then the indicator is ...
Physical Map		
HBA outer diamond	Clear (no out-of-band)	Clear (no out-of-band)
HBA inner diamond	Green	Red
HBA connection line (or lines)	Red (if connected to switch)	Red
HBA icon	Normal	Red
* The HBA inner diamond remains Green (for Fibre Path problems) or Red (for bad HBAs or In-band disabled).		

Notes:

1. The log entry sequence is based on the time events were logged; your sequence might differ from this table.
2. The term *concentrator* refers to a switch or managed hub.
3. You can determine the supported and configured link speed of the HBA by looking at the HBA Properties Port tab. The Device Tip also shows this information.
4. When in-band discovery is enabled, the HBA names are displayed as IBM FAStT HBA (for 2200 and above HBA types). If this does not occur, make sure you are running the latest drivers. Otherwise, suspect that the HBA is not an IBM part number.

Table 17 displays the Event Log behavior for problems that involve controllers in the fibre path.

Table 17. SANavigator Event Log behavior matrix for controllers

	If the problem is in the Fibre Path to one or more (but not all) controller ports, then the indicators are ...	**If the problem is in the Fibre Path to all controller ports, or if the storage server is not discovered, then the indicators are ...**
Out-of-band discovery		
Event Log entries (fatal events)		
Log entry #1	Concentrator port for that controller port - Connection offline	Concentrator ports for that storage server - Connection offline
Log entry #2	Controller port - Connection offline	Storage server - Out-of-band offline **Note:** Ignore Port WWN
Log entry #3		Controller ports - Connection offline
Physical Map		
Storage server outer diamond	Green	Red
Storage server inner diamond	Clear (no in-band)	Clear (no in-band)
Connection	Red (for that port)	Red
Storage server icon	Normal	Red
Out-of-band and in-band discovery		
Event Log entries (fatal events)		
Log entry #1	Concentrator port for that controller port - Connection offline	Concentrator ports for that storage server - Connection offline
Log entry #2	Controller port - Connection offline	Controller ports - Connection offline
Log entry #3	Controller port - In-band offline	Storage server - Out-of-band offline **Note:** Ignore Port WWN
Log entry #4		Storage server - In-band offline **Note:** Ignore Port WWN
Physical Map		
Storage server outer diamond	Green	Red
Storage server inner diamond	Red	Red
Connection	Red (for that controller port)	Red
Storage server icon	Normal	Red
In-band discovery*		
Event Log entries (fatal events)		
Log entry #1	Controller Port - Connection offline	Controller Ports - Connection offline
Log entry #2	Controller Port - In-band offline **Note:** Ignore Port WWN	Storage server - In-band offline **Note:** Ignore Port WWN
Log entry #3	HBA - Connection offline (if direct connect to HBA)	
Physical Map		
Storage server outer diamond	Clear (no out-of-band)	Clear (no out-of-band)
Storage server inner diamond	Red	Red

Table 17. SANavigator Event Log behavior matrix for controllers (continued)

	If the problem is in the Fibre Path to one or more (but not all) controller ports, then the indicators are ...	**If the problem is in the Fibre Path to all controller ports, or if the storage server is not discovered, then the indicators are ...**
Connection	Red (port to loop)	Red (all ports to loop)
Storage server icon	Normal	Red
* Devices that are in-band discovered have the inner diamond red. The inner diamond of the HBA that is connected to its respective controller port (or ports if connected to an unmanaged hub) remains Green (for Fibre Path problems) or Red (for bad HBAs or In-band disabled). See Table 16 on page 178.		
Notes: 1. The log entry sequence is based on the time events were logged; your sequence might differ from this table. 2. The term *concentrator* refers to a switch or managed hub.		

Table 18 displays the Event Log behavior for problems that involve SAN Data Gateway Routers.

Table 18. SANavigator Event Log behavior matrix for SAN Data Gateway Routers

	If the problem is in the Fibre Path, then the indicators are ...	**If the problem is in the Ethernet connection to SDG, then the indicators are ...**
Out-of-band discovery (Ethernet connection to Concentrator only)		
Event Log entries (fatal events)		
Log entry #1	SDG - Out-of-band offline	N/A
Log entry #2	Concentrator port - Connection offline	N/A
Log entry #3	SDG - Connection offline	N/A
Physical Map		
SDG outer diamond	Red	N/A
SDG inner diamond	Clear (no in-band)	N/A
Connection	Red	N/A
SDG icon	Red	N/A
Out-of-band discovery (Ethernet connection to SDG and Concentrator)		
Event Log entries (fatal events)		
Log entry #1	SDG - Connection offline	SDG - Out-of-band offline
Log entry #2	Concentrator port - Connection offline	Tape device - Out-of-band offline
Log entry #3		Tape device - Connection offline
Log entry #4		SDG - Connection offline
Physical Map		
SDG outer diamond	Green	Red
SDG inner diamond	Clear	Clear
Concentrator-to-SDG connection	Red	Normal
SDG-to-Tape connection	Normal	Red
SDG icon	Normal	Normal
Tape device outer diamond	Green	Red
Tape device inner diamond	Clear (no in-band)	Clear (no in-band)
Tape device icon	Normal	Red
Out-of-band and in-band discovery (Ethernet connection to Concentrator only)		
Event Log entries (fatal events)		
Log entry #1	SDG - Out-of-band offline	N/A
Log entry #2	Concentrator port - Connection offline	N/A

Table 18. SANavigator Event Log behavior matrix for SAN Data Gateway Routers (continued)

	If the problem is in the Fibre Path, then the indicators are ...	**If the problem is in the Ethernet connection to SDG, then the indicators are ...**
Log entry #3	SDG - Connection offline	N/A
Log entry #4	SDG - In-band offline	N/A
Physical Map		
SDG outer diamond	Red	N/A
SDG inner diamond	Red	N/A
Connection	Red	N/A
SDG icon	Red	N/A
Out-of-band and in-band discovery (Ethernet connection to SDG and Concentrator)		
Event Log entries (fatal events)		
Log entry #1	SDG - Connection offline	SDG - Out-of-band offline
Log entry #2	Concentrator port - Connection offline	Tape device - Out-of-band offline
Log entry #3	SDG - In-band offline	Tape device - Connection offline
Log entry #4		SDG - Connection offline
Physical Map		
SDG outer diamond	Green	Red
SDG inner diamond	Red	Green
Concentrator-to-SDG connection	Red	Normal
SDG-to-Tape connection	Normal	Red
SDG icon	Normal	Normal
Tape device outer diamond	Green	Red
Tape device inner diamond	Clear	Clear
Tape device icon	Normal	Red

Notes:

1. It is not necessary for the SAN Data Gateway (SDG) unit to be connected to the network for it to be discovered by SANavigator. However, if the SDG is not connected to the network, SANavigator will not be able to detect devices attached to the SDG. The devices attached to the SDG are only discovered through the out-of-band method (Ethernet cable plugged to the SDG)
2. The log entry sequence is based on the time events were logged; your sequence might differ from this table.
3. The term *concentrator* refers to a switch or managed hub.

Table 19 on page 184 describes the conventions for naming FAStT storage server ports.

Table 19. FAStT storage server port naming convention

Machine Type	Number of Ports	SANavigator Port Naming	Algorithm	Example
3526, 3542	2	A, B	Port A: Last character of the node WWN + 1 Port B: Fourth and last character of the node WWN +1	Node: 20-00-00-A0-B8-06-16-36 Port: 20-00-00-A0-B8-06-16-37 Node: 20-00-00-A0-B8-06-16-36 Port: 20-01-00-A0-B8-06-16-37
3552, 1742	4	A1, B1,A2, B2 (**Note:** The following figure shows the physical locations of these ports.)	Port A1: Last character of the node WWN + 1 Port B1: Fourth and last character of the node WWN +1 Port A2: Last character of the node WWN + 2 Port B2: Fourth character of the node WWN+1 and last character of the node WWN+2	Node: 20-26-00-A0-B8-06-61-98 Port: 20-26-00-A0-B8-06-61-99 Node: 20-26-00-A0-B8-06-61-98 Port: 20-27-00-A0-B8-06-61-99 Node: 20-26-00-A0-B8-06-61-98 Port: 20-26-00-A0-B8-06-61-9A Node: 20-26-00-A0-B8-06-61-98 Port: 20-27-00-A0-B8-06-61-9A

Figure 77 shows the physical locations of the ports described in Table 19.

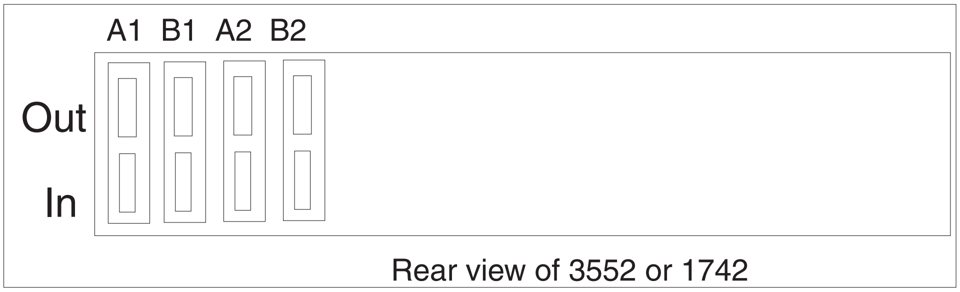


Figure 77. Rear view of 3552 or 1742

Setting up SANavigator Remote Discovery Connection for in-band management of remote hosts

Remote Discovery Connection

In order for Remote Discovery Connection (RDC) to function, install the Remote Discovery Connector on the host that you want to In-band manage remotely. The following modifications to the Deployment Property file on the local machine are required to enable RDC:

1. Navigate to `$\Program Files\SANavigator3.1\resources\Server` and edit the file Deployment.Properties:

   Comment out the first two sets of ″com.sanavigator″ and enable the third set, as the following examples show:

   - Set 1

```
# Use this for conventional discovery by the server
#com.sanavigator.plugsnpeers.plugs.IContainer = \
#com.sanavigator.server.plugdiscovery.ClassicDiscoveryContainer
```

   - Set 2

```
# Use this for discovery by all peers (remove the # comment char from the
# next 2 lines, delete or comment the lines above!)
#com.sanavigator.plugsnpeers.plugs.IContainer = \
#com.sanavigator.plugsnpeers.peers.rmi.Peer
```

   - Set 3

```
# Use this for discovery by server and all peers (remove the # comment char
# from the next 3 lines, delete or comment the first lines above!)
com.sanavigator.plugsnpeers.plugs.IContainer = \
com.sanavigator.server.plugdiscovery.ClassicDiscoveryContainer;\
com.sanavigator.plugsnpeers.peers.rmi.Peer
```

2. You should update the peer (Peer.Properties) file whenever a peer is providing remote discovery information and is not discovered through a broadcast discovery on the default subnet.

   Navigate to `$\Program Files\SANavigator3.1\resources\Server` and edit the file `Peers.Properties`. Scroll about half-way down the file to the following section.

```
 # Who you gonna call? (in addition to broadcast)
 # HOST:PORT separated by semi-colons
 # Example: PeerAddresses=172.23.2.2:333;fred.sanavigator.com
 PeerAddresses =
 Add each remote peer IP address as follows:
 PeerAddresses=172.31.1.3;172.31.3.5
```

   You can also enter the server name followed by the domain name, previously shown as `fred.sanavigator.com`. This is just an alternate method to enter the IP addresses.

Configuring only peers to discover

Important: This configuration is *not* recommended. The local server should be allowed to perform discovery as well.

This method will accept in-band and out-of-band discovery information from remote peers only. HBAs in the local server will not be displayed in the Discover Setup dialog box. Out-of-band discovery can still be performed using the local server. The peer file also needs to be updated for peers not discovered through the broadcast method.

1. Navigate to `$\Program Files\SANavigator3.1\resources\Server` and edit the file `Deployment.Properties`.
2. Comment out Set 1 and Set 3 and enable Set 2, as the following examples show:
   - Set 1

```
# Use this for conventional discovery by the server
#com.sanavigator.plugsnpeers.plugs.IContainer = \
#com.sanavigator.server.plugdiscovery.ClassicDiscoveryContainer
```

   - Set 2

```
# Use this for discovery by all peers (remove the # comment char from the
# next 2 lines, delete or comment the lines above!)
com.sanavigator.plugsnpeers.plugs.IContainer = \
com.sanavigator.plugsnpeers.peers.rmi.Peer
```

   - Set 3

```
# Use this for discovery by server and all peers (remove the # comment char
# from the next 3 lines, delete or comment the first lines above!)
#com.sanavigator.plugsnpeers.plugs.IContainer = \
#com.sanavigator.server.plugdiscovery.ClassicDiscoveryContainer;\
#com.sanavigator.plugsnpeers.peers.rmi.Peer
```

Controller diagnostics

The latest versions of the FAStT Storage Manager (7.2 and 8.x) include controller diagnostics. The 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 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 FAStT 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 FAStT Storage Manager to configure their associated Storage Subsystems. Instead, use FAStT MSJ to perform Device and LUN configuration on Linux operating systems. However, the FAStT Storage Manager is used to map the FAStT 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.

FAStT Storage Manager hints

Use the FAStT 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 15, “Heterogeneous configurations,” on page 229 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 (FAStT 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 189) for both device ports. The Device port names reflect the FAStT 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 FAStT 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
```

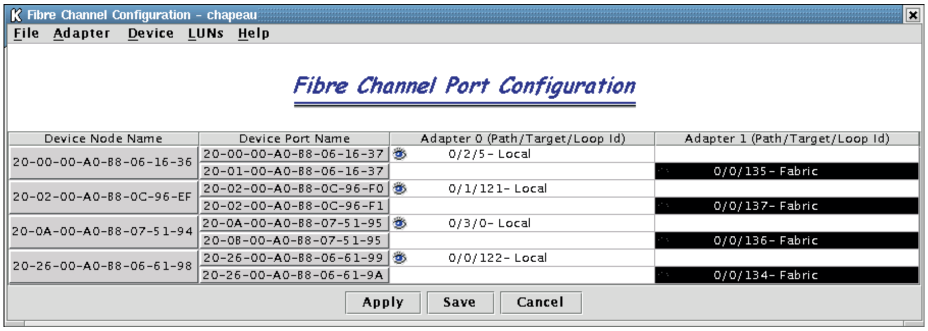
FAStT MSJ

Use FAStT MSJ to configure the driver for failover. See Chapter 4, “Introduction to FAStT MSJ,” on page 55 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:

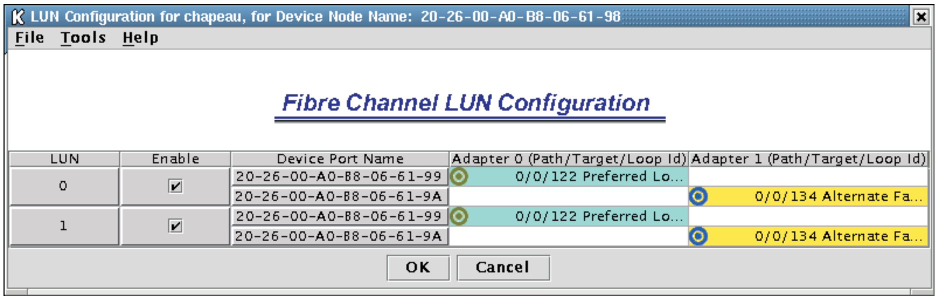
1. Open a new command window and type `qlremote`; then press Enter. This will run qlremote agent in this command window.
2. Open a new command window and run /usr./FAStT_MSJ.
3. Select CONNECT.
4. Enter the IP address of the server or select LOCALHOST.
5. Select CONFIGURE. You will then be presented with the Fibre Channel Port Configuration dialog box (see Figure 78).


Fibre Channel Configuration - chapeau
File Adapter Device LUNs Help
Fibre Channel Port Configuration
Apply
Save
Cancel

Device Node Name	Device Port Name	Adapter 0 (Path/Target/Loop Id)	Adapter 1 (Path/Target/Loop Id)
20-00-00-A0-B8-06-16-36	20-00-00-A0-B8-06-16-37	0/2/5- Local	
	20-01-00-A0-B8-06-16-37		0/0/135- Fabric
20-02-00-A0-B8-0C-96-EF	20-02-00-A0-B8-0C-96-F0	0/1/121- Local	
	20-02-00-A0-B8-0C-96-F1		0/0/137- Fabric
20-0A-00-A0-B8-07-51-94	20-0A-00-A0-B8-07-51-95	0/3/0- Local	
	20-0B-00-A0-B8-07-51-95		0/0/136- Fabric
20-26-00-A0-B8-06-61-98	20-26-00-A0-B8-06-61-99	0/0/122- Local	
	20-26-00-A0-B8-06-61-9A		0/0/134- Fabric

Figure 78. Fibre Channel Port Configuration window

6. Right-click the Device node name.
7. Click **Configure LUNs**. The LUN Configuration window opens (see Figure 79 on page 190).



LUN Configuration for chapeau, for Device Node Name: 20-26-00-A0-B8-06-61-98

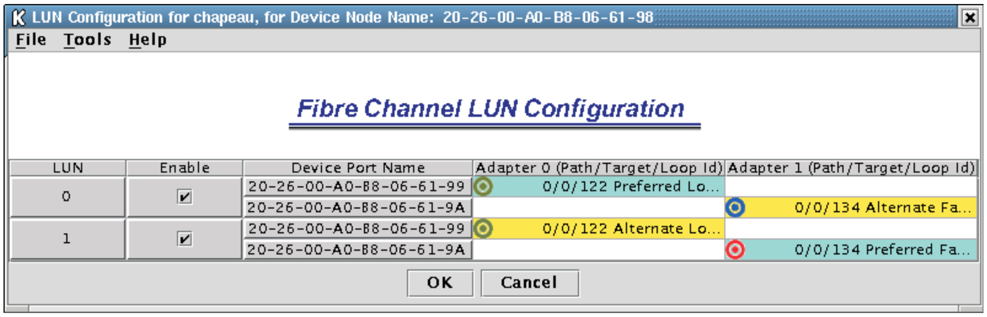
Fibre Channel LUN Configuration

LUN	Enable	Device Port Name	Adapter 0 (Path/Target/Loop Id)	Adapter 1 (Path/Target/Loop Id)
0	☑	20-26-00-A0-B8-06-61-99	◉ 0/0/122 Preferred Lo...	
		20-26-00-A0-B8-06-61-9A		◉ 0/0/134 Alternate Fa...
1	☑	20-26-00-A0-B8-06-61-99	◉ 0/0/122 Preferred Lo...	
		20-26-00-A0-B8-06-61-9A		◉ 0/0/134 Alternate Fa...

Figure 79. Fibre Channel LUN Configuration window

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

   Your configuration should then look similar to Figure 80, which shows the preferred and alternate paths alternating between the adapters.



LUN Configuration for chapeau, for Device Node Name: 20-26-00-A0-B8-06-61-98

Fibre Channel LUN Configuration

LUN	Enable	Device Port Name	Adapter 0 (Path/Target/Loop Id)	Adapter 1 (Path/Target/Loop Id)
0	☑	20-26-00-A0-B8-06-61-99	◉ 0/0/122 Preferred Lo...	
		20-26-00-A0-B8-06-61-9A		◉ 0/0/134 Alternate Fa...
1	☑	20-26-00-A0-B8-06-61-99	◉ 0/0/122 Alternate Lo...	
		20-26-00-A0-B8-06-61-9A		◉ 0/0/134 Preferred Fa...

Figure 80. 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=fffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffd\;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=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;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=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;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=ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff\;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 FAStT Storage Manager to point to the WWN name for the new adapter. You will then need to reconfigure your storage.

Chapter 12. PD hints: Drive side hints and RLS diagnostics

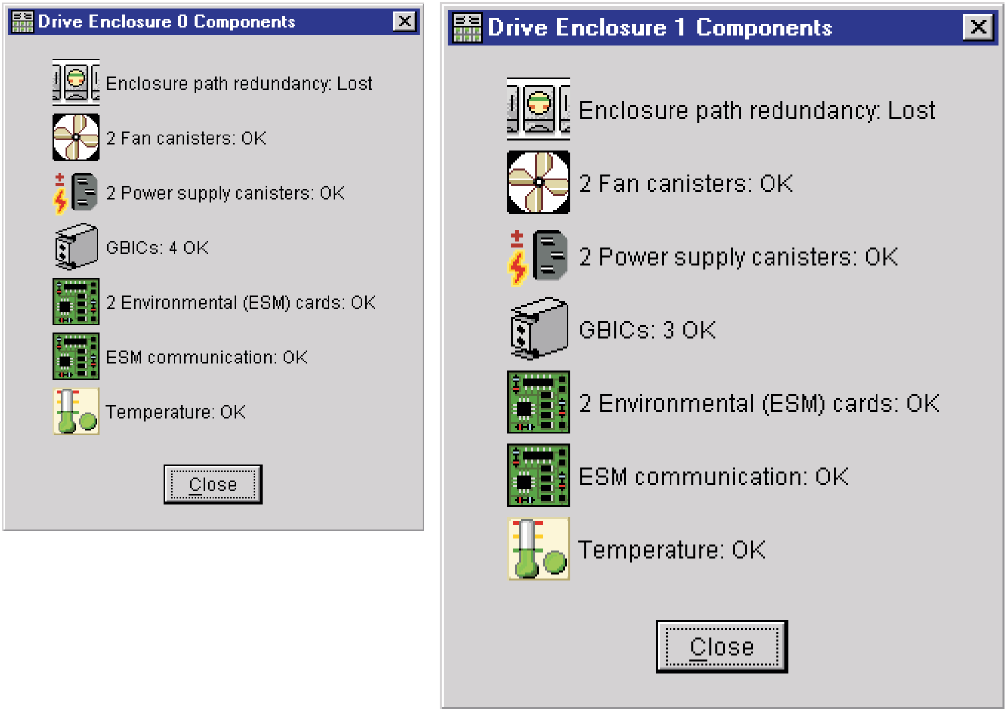
You should be referred to this chapter from a PD map or indication. If this is not the case, refer back to Chapter 2, “Problem determination starting points,” on page 3.

This chapter contains hints in the following PD areas:

- “Drive side hints”
- “Read Link Status (RLS) Diagnostics” on page 213

Drive side hints

When there is a drive side (device side) issue, looking at SM often helps to isolate the problem. Figure 81 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.



Drive Enclosure 0 Components

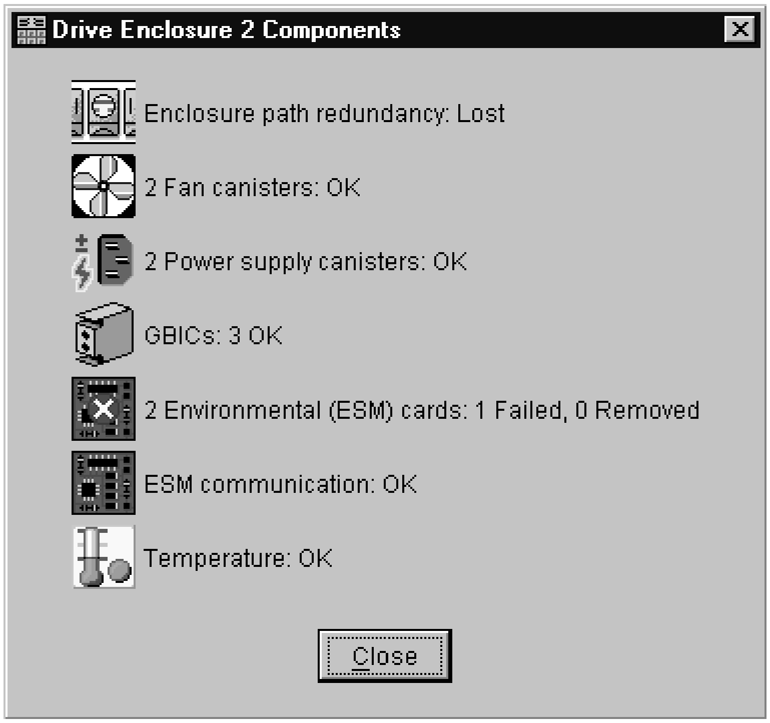
Enclosure path redundancy: Lost
2 Fan canisters: OK
2 Power supply canisters: OK
GBICs: 4 OK
2 Environmental (ESM) cards: OK
ESM communication: OK
Temperature: OK

Drive Enclosure 1 Components

Enclosure path redundancy: Lost
2 Fan canisters: OK
2 Power supply canisters: OK
GBICs: 3 OK
2 Environmental (ESM) cards: OK
ESM communication: OK
Temperature: OK

Figure 82 on page 194 shows that an ESM failed.

Figure 81. Drive enclosure components



Drive Enclosure 2 Components

Enclosure path redundancy: Lost

2 Fan canisters: OK

2 Power supply canisters: OK

GBICs: 3 OK

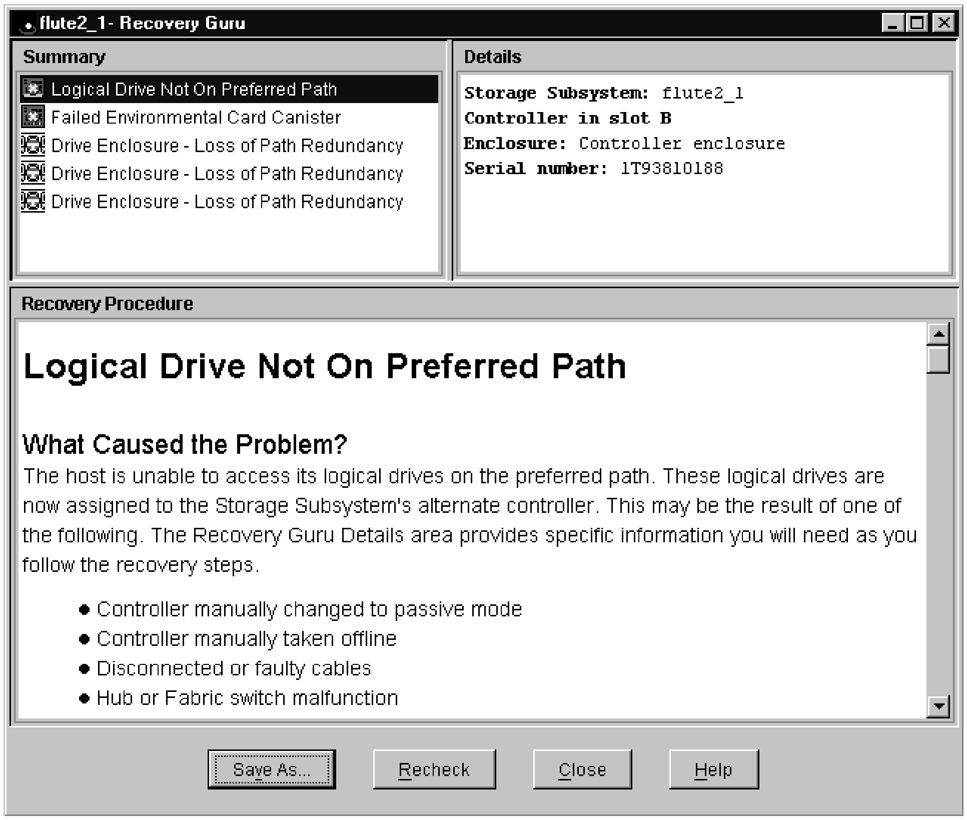
2 Environmental (ESM) cards: 1 Failed, 0 Removed

ESM communication: OK

Temperature: OK

Figure 82. Drive enclosure components - ESM failure

When an ESM fails, go to the Recovery Guru for suggestions on resolving the problem. See Figure 83 on page 195.



Logical Drive Not On Preferred Path
Failed Environmental Card Canister
Drive Enclosure - Loss of Path Redundancy
Drive Enclosure - Loss of Path Redundancy
Drive Enclosure - Loss of Path Redundancy

Storage Subsystem: flute2_1
Controller in slot B
Enclosure: Controller enclosure
Serial number: 1T93810188

Logical Drive Not On Preferred Path

What Caused the Problem?

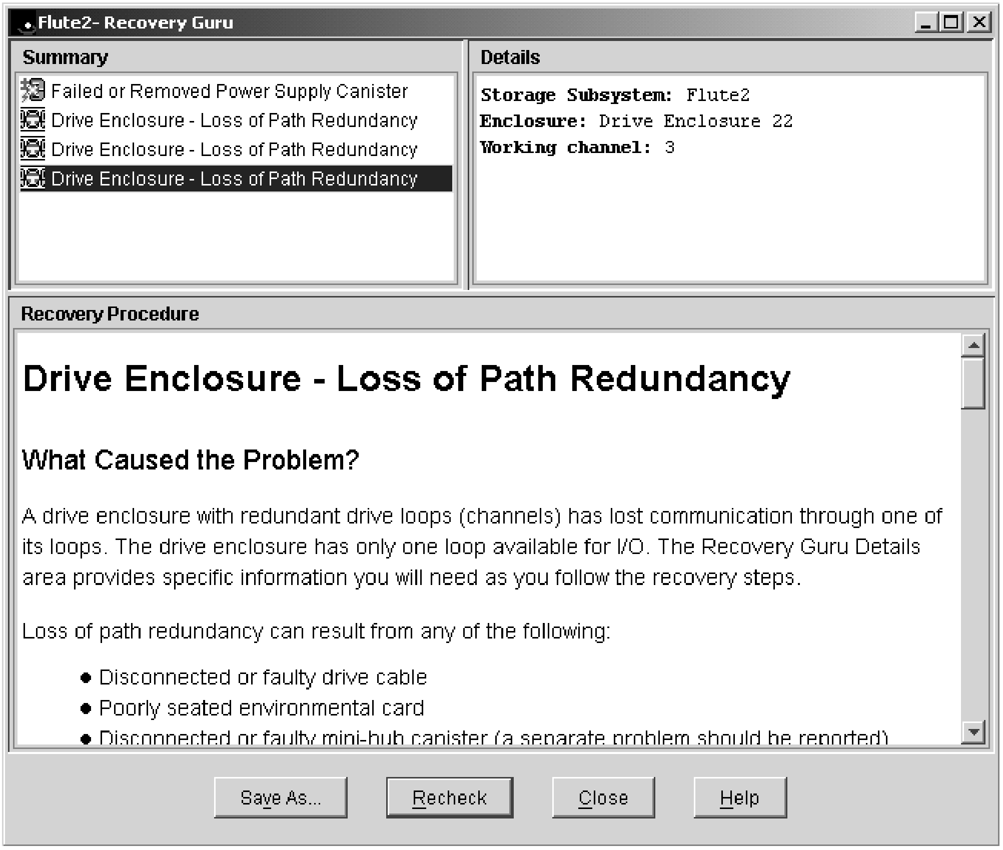
The host is unable to access its logical drives on the preferred path. These logical drives are now assigned to the Storage Subsystem's alternate controller. This may be the result of one of the following. The Recovery Guru Details area provides specific information you will need as you follow the recovery steps.

- Controller manually changed to passive mode
- Controller manually taken offline
- Disconnected or faulty cables
- Hub or Fabric switch malfunction

Figure 83. Recovery Guru window

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.

Note: Figure 84 on page 196 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.



- Failed or Removed Power Supply Canister
- Drive Enclosure - Loss of Path Redundancy
- Drive Enclosure - Loss of Path Redundancy
- Drive Enclosure - Loss of Path Redundancy

Storage Subsystem: Flute2
Enclosure: Drive Enclosure 22
Working channel: 3

Drive Enclosure - Loss of Path Redundancy

What Caused the Problem?

A drive enclosure with redundant drive loops (channels) has lost communication through one of its loops. The drive enclosure has only one loop available for I/O. The Recovery Guru Details area provides specific information you will need as you follow the recovery steps.

Loss of path redundancy can result from any of the following:

- Disconnected or faulty drive cable
- Poorly seated environmental card
- Disconnected or faulty mini-hub canister (a separate problem should be reported)

Figure 84. Recovery Guru - Loss of path redundancy

Use the following indicators for drive side problems.

- **FAStT200:**
  - Fault light per controller (1 on single controller model and 2 on redundant)
  - Loop bypass per controller (1 or 2)
  - Link status per SFP/GBIC port (2) per controller (2 or 4)
- **FAStT500, FAStT700, or FAStT900: (mini-hubs)**
  - Fault
  - Loop bypass
  - Link status
- **FAStT600:**
  - Fault light per controller 2
  - Loop bypass per controller 2
  - Link status per SFP port (2) per controller 4
- **EXP500:**
  - Fault per ESM (2)
  - Loop bypass per GBIC port per ESM (4)
  - Link status per ESM (2)
- **EXP700:**
  - Fault per ESM (2)
  - Loop bypass per SFP port per ESM (4)
  - Link status per ESM (2)

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 200.

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 85.

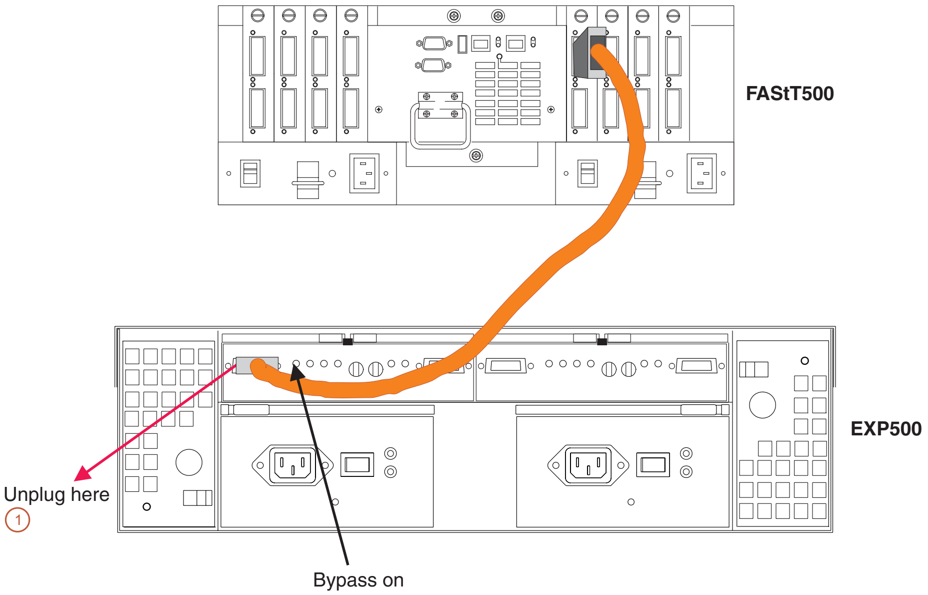


Figure 85. Disconnect cable from loop element

2. Insert a wrap plug in the element from which you disconnected the cable. See Figure 86 on page 198.
   a. Is the bypass light still on? Replace the element (for example, a GBIC). The procedure is complete.

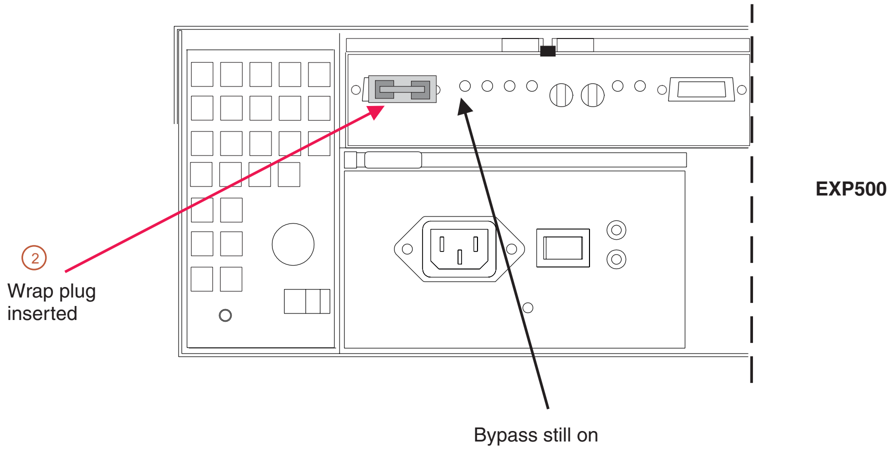


Figure 86. Insert wrap plug

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 87 on page 199.
   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.

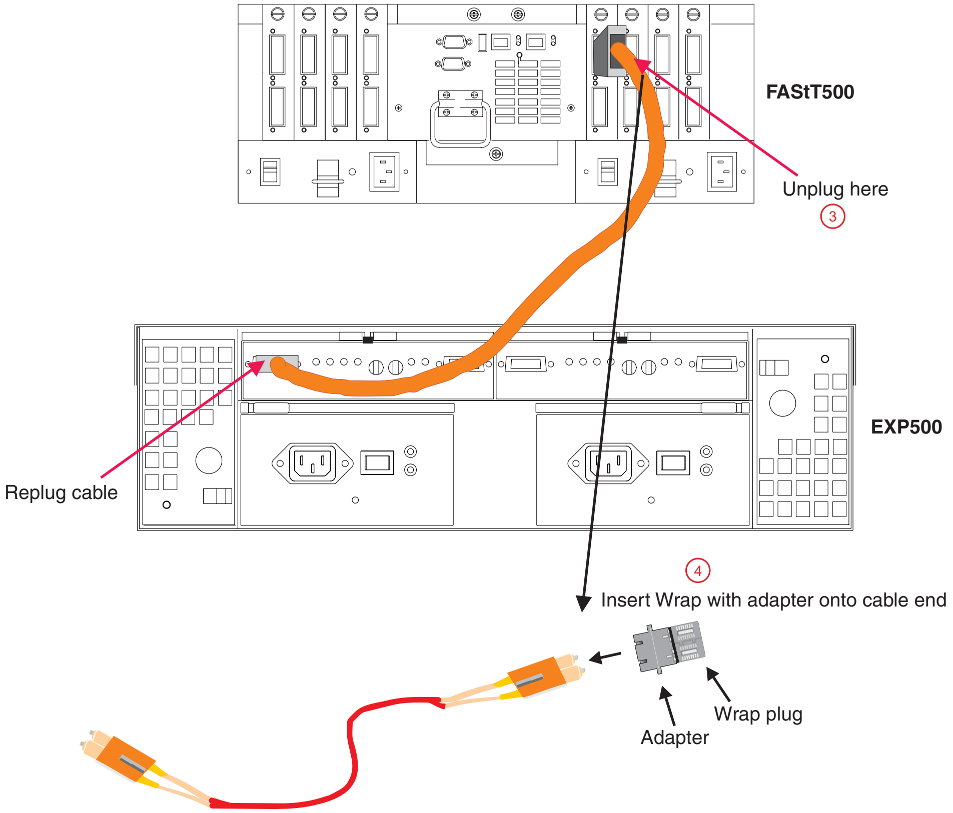


Figure 87. Insert wrap plug with adapter on cable end

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 88 on page 200.
   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.

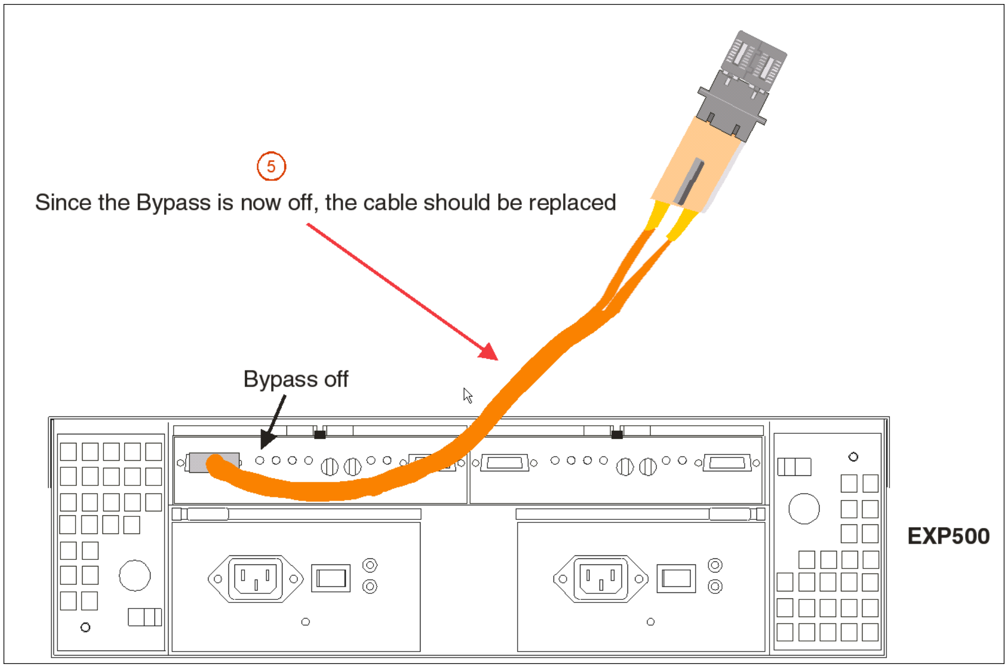


Figure 88. Insert wrap plug into element

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 89.

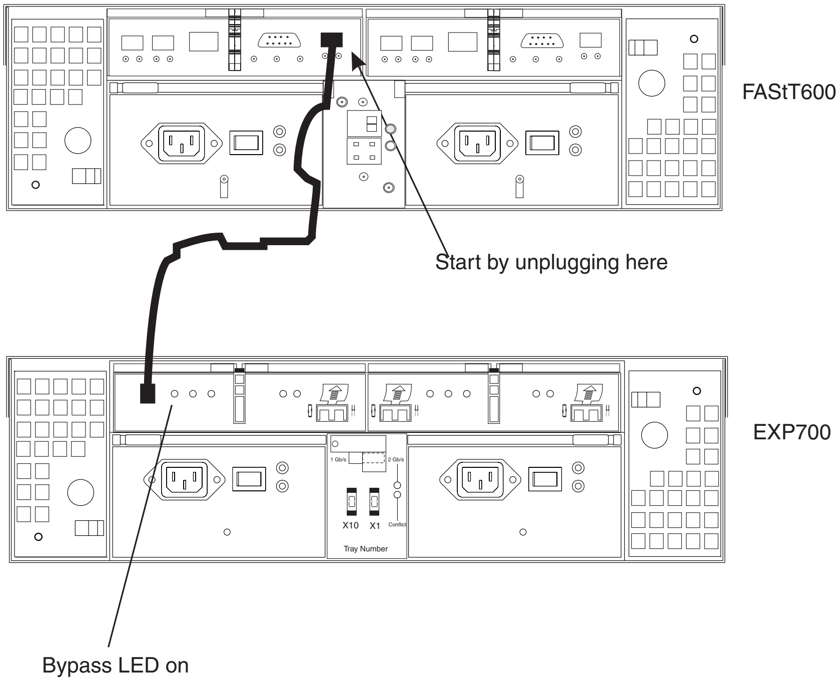
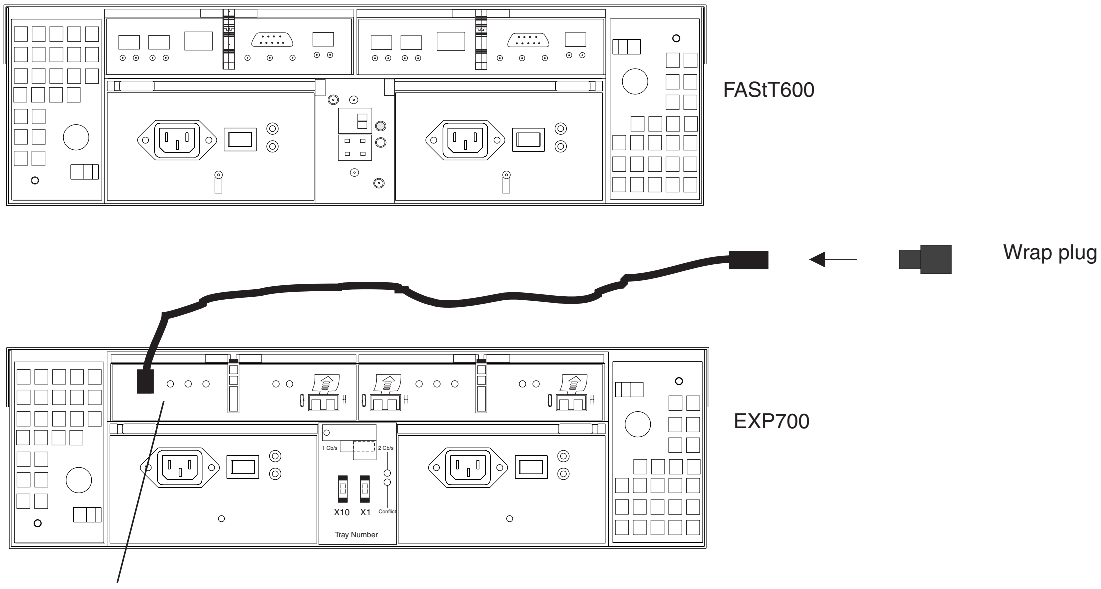


Figure 89. Copper cable and bypass light

2. Insert the FC copper cable wrap plug into the unplugged cable end. See Figure 90. Record the state of the port bypass light on the end where the FC copper cable is still inserted.



Record status of bypass light after wrap plug is inserted.

Figure 90. 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 20. 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.

Indicator lights and problem indications

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

FAStT200 RAID controller

Figure 91 shows the controller indicator lights for a FAStT200 controller.

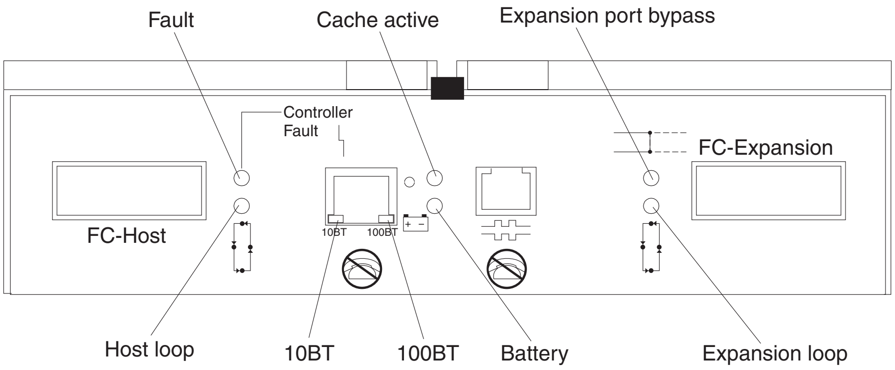


Figure 91. FAStT200 controller indicator lights

Table 21. 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 92 on page 203 shows the mini-hub indicator lights for the FAStT500 RAID controller.

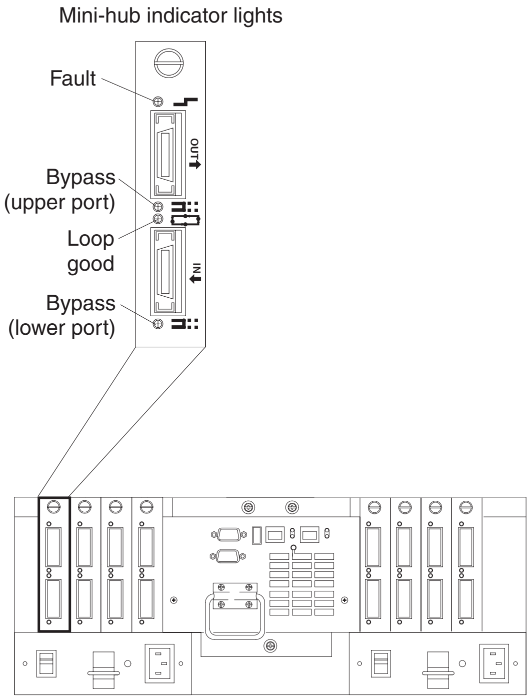


Figure 92. FAStT500 RAID controller mini-hub indicator lights

Table 22. 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.

FAStT700 RAID controller

Figure 93 shows the host-side indicator lights on the FAStT700 storage server.

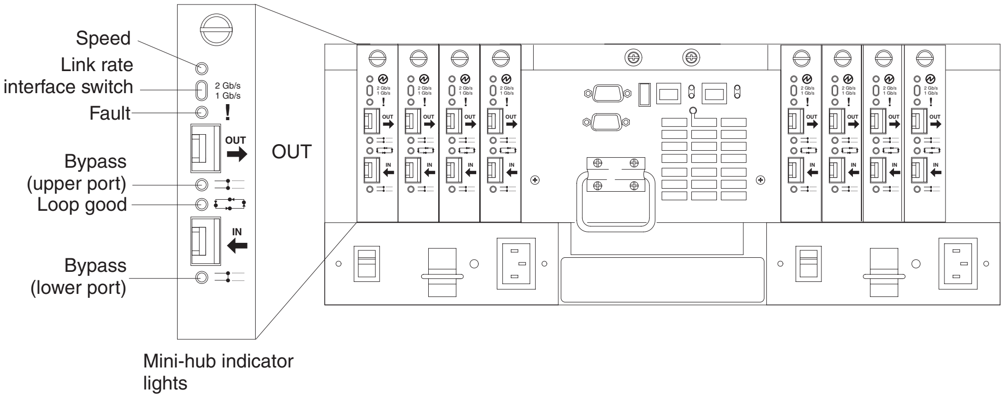


Figure 93. Type 1742 FAStT700 storage server mini-hub indicator lights

Table 23. Type 1742 FAStT700 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.

Table 23. Type 1742 FAStT700 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
	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.
	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)

Table 23. Type 1742 FAStT700 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
	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.

FAStT900 RAID controller

Figure 94 shows the host-side indicator lights.

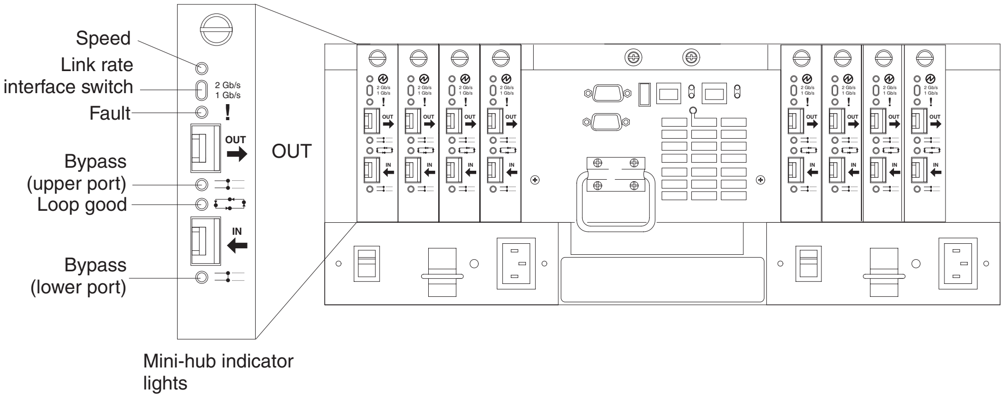


Figure 94. Type 1742 FAStT900 storage server mini-hub indicator lights

Table 24 on page 207 describes the indicator light status when there are fibre channel connections between host-side and drive-side mini-hubs.

Table 24. Type 1742 FAStT900 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 24. Type 1742 FAStT900 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.

FAStT EXP500 ESM

Figure 95 shows the indicator lights for the FAStT EXP500 ESM.

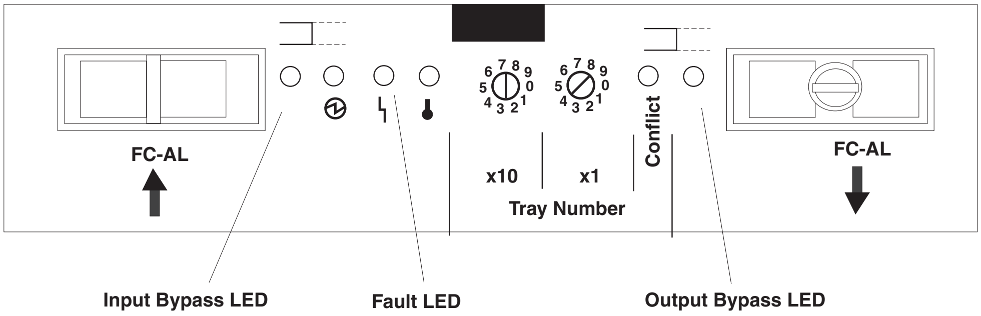


Figure 95. FAStT EXP500 ESM indicator lights

Table 25. 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

FAStT EXP700 ESM

The FAStT EXP700 ESMs and user controls are shown in Figure 96 on page 210.

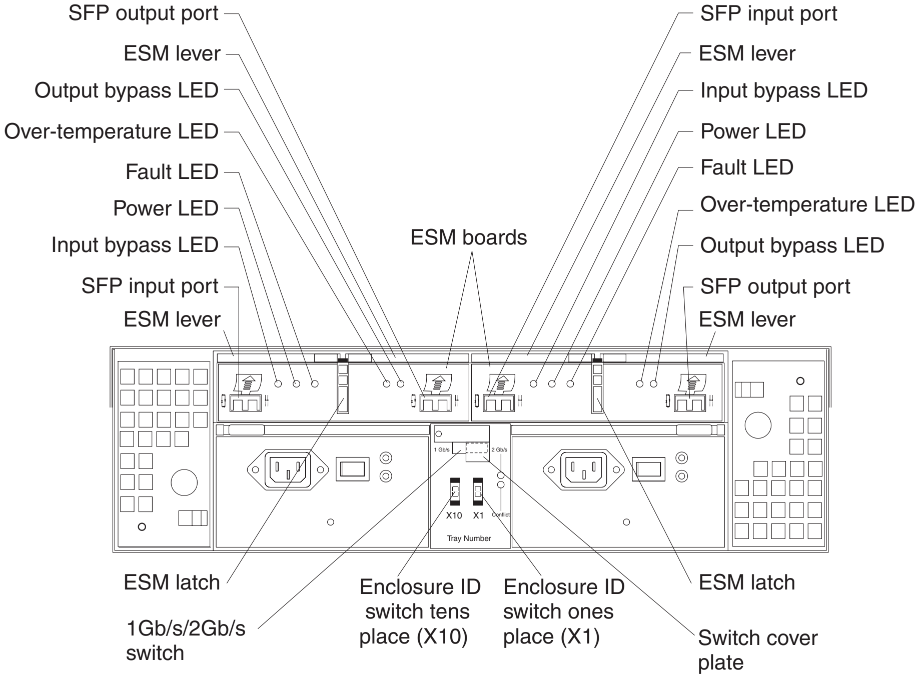


Figure 96. ESMs and user controls

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

Table 26. EXP700 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 (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 26. EXP700 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 26. EXP700 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.

Read Link Status (RLS) Diagnostics

A fibre channel loop is an interconnection topology used to connect storage subsystem components and devices. The IBM FAStT Storage Manager (version 8.x) 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 215.

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

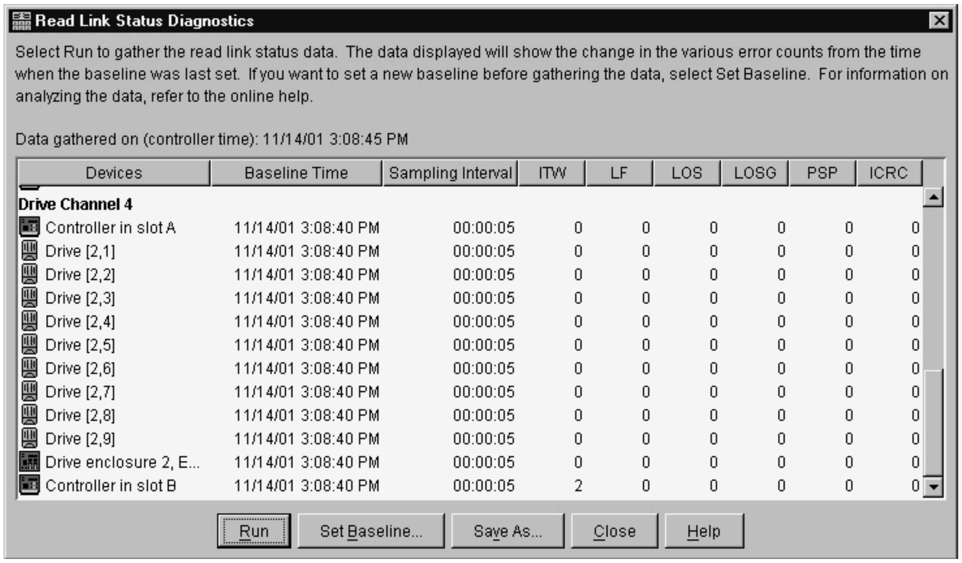
To interpret RLS results, perform the following actions:

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 97 shows the RLS Status after setting the baseline.



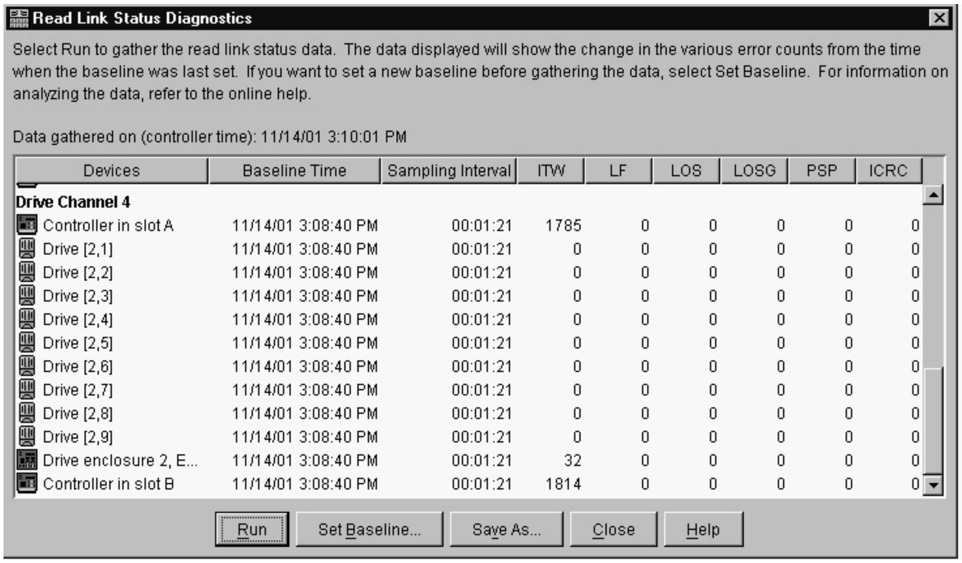
Select Run to gather the read link status data. The data displayed will show the change in the various error counts from the time when the baseline was last set. If you want to set a new baseline before gathering the data, select Set Baseline. For information on analyzing the data, refer to the online help.

Data gathered on (controller time): 11/14/01 3:08:45 PM

Devices	Baseline Time	Sampling Interval	ITW	LF	LOS	LOSG	PSP	ICRC
Drive Channel 4								
Controller in slot A	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,1]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,2]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,3]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,4]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,5]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,6]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,7]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,8]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive [2,9]	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Drive enclosure 2, E...	11/14/01 3:08:40 PM	00:00:05	0	0	0	0	0	0
Controller in slot B	11/14/01 3:08:40 PM	00:00:05	2	0	0	0	0	0

Figure 97. RLS Status after setting baseline

Figure 98 shows the RLS Status after running the diagnostic.



Select Run to gather the read link status data. The data displayed will show the change in the various error counts from the time when the baseline was last set. If you want to set a new baseline before gathering the data, select Set Baseline. For information on analyzing the data, refer to the online help.

Data gathered on (controller time): 11/14/01 3:10:01 PM

Devices	Baseline Time	Sampling Interval	ITW	LF	LOS	LOSG	PSP	ICRC
Drive Channel 4								
Controller in slot A	11/14/01 3:08:40 PM	00:01:21	1785	0	0	0	0	0
Drive [2,1]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,2]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,3]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,4]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,5]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,6]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,7]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,8]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive [2,9]	11/14/01 3:08:40 PM	00:01:21	0	0	0	0	0	0
Drive enclosure 2, E...	11/14/01 3:08:40 PM	00:01:21	32	0	0	0	0	0
Controller in slot B	11/14/01 3:08:40 PM	00:01:21	1814	0	0	0	0	0

Figure 98. 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 13. 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 17 or “Common Path PD map 2” on page 25.

Unmanaged hub

The unmanaged hub is used only with the type 3526 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 the type 3552, 3542, and 1742 controllers. The following sections describe tests that can be used with the switch and managed hub.

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.

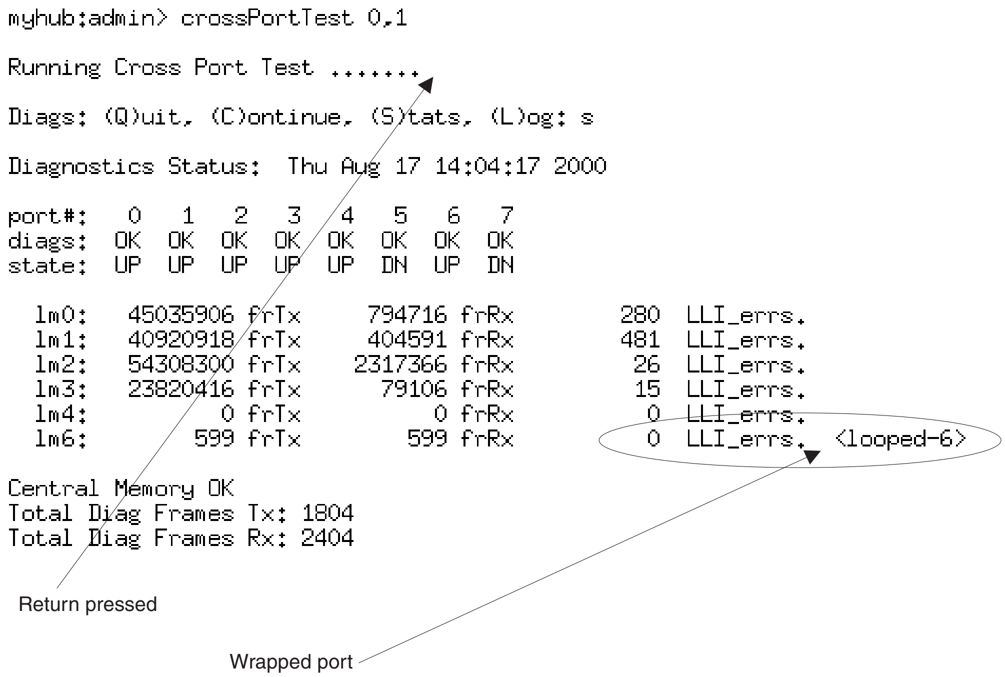
To run, the test must find at least one port with a wrap plug or two ports connected to each other. If one of these criteria is not met, the test results in the following message in the telnet shell:

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

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

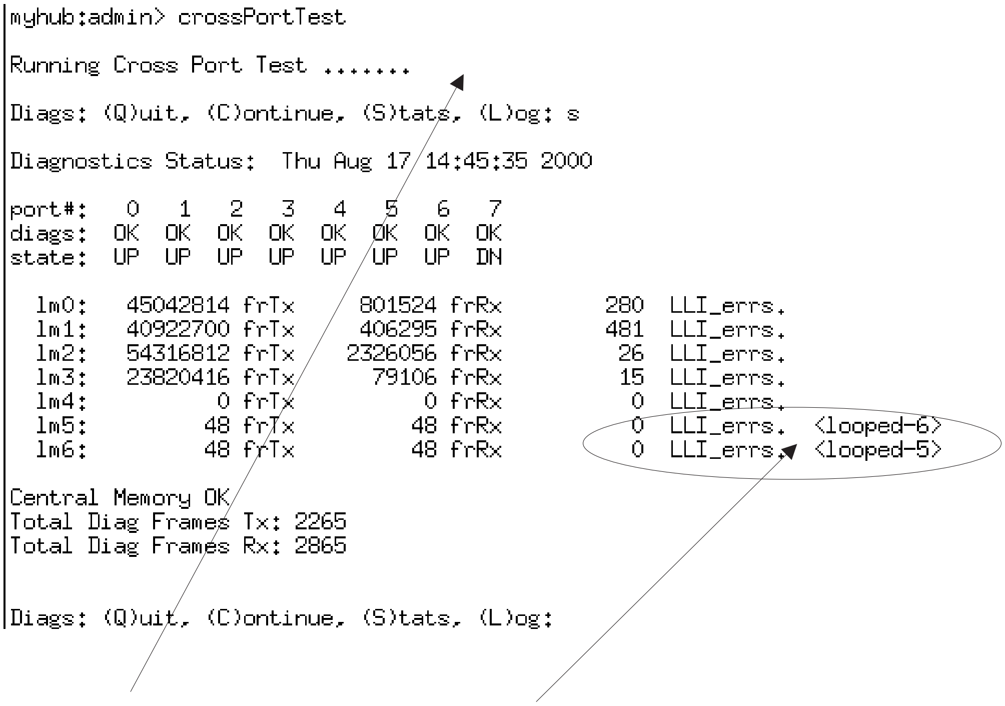
With `<nFrames>` set to 0, the test runs until you press Return.

With the second field set to 0, no single port wrap is allowed and two ports must be cross-connected. Figure 99 shows the preferred option, which works with either wrap or cross-connect. Figure 100 on page 221 shows the default parms, which work only with cross-connect.



```
myhub:admin> crossPortTest 0,1

Running Cross Port Test .......

Diags: (Q)uit, (C)ontinue, (S)tats, (L)og: s

Diagnostics Status:  Thu Aug 17 14:04:17 2000

port#:   0   1   2   3   4   5   6   7
diags:  OK  OK  OK  OK  OK  OK  OK  OK
state:  UP  UP  UP  UP  UP  DN  UP  DN

  lm0:   45035906 frTx     794716 frRx        280  LLI_errs.
  lm1:   40920918 frTx     404591 frRx        481  LLI_errs.
  lm2:   54308300 frTx    2317366 frRx         26  LLI_errs.
  lm3:   23820416 frTx      79106 frRx         15  LLI_errs.
  lm4:          0 frTx          0 frRx          0  LLI_errs.
  lm6:        599 frTx        599 frRx          0  LLI_errs.  <looped-6>

Central Memory OK
Total Diag Frames Tx: 1804
Total Diag Frames Rx: 2404
```

Figure 99. crossPortTest - Wrap or cross-connect



```
myhub:admin> crossPortTest

Running Cross Port Test .......

Diags: (Q)uit, (C)ontinue, (S)tats, (L)og: s

Diagnostics Status:  Thu Aug 17 14:45:35 2000

port#:   0   1   2   3   4   5   6   7
diags:  OK  OK  OK  OK  OK  OK  OK  OK
state:  UP  UP  UP  UP  UP  UP  UP  DN

  lm0:   45042814 frTx     801524 frRx       280  LLI_errs.
  lm1:   40922700 frTx     406295 frRx       481  LLI_errs.
  lm2:   54316812 frTx    2326056 frRx        26  LLI_errs.
  lm3:   23820416 frTx      79106 frRx        15  LLI_errs.
  lm4:          0 frTx          0 frRx         0  LLI_errs.
  lm5:         48 frTx         48 frRx         0  LLI_errs.  <looped-6>
  lm6:         48 frTx         48 frRx         0  LLI_errs.  <looped-5>

Central Memory OK
Total Diag Frames Tx: 2265
Total Diag Frames Rx: 2865


Diags: (Q)uit, (C)ontinue, (S)tats, (L)og:
```

Return pressed

Port 6 connected by cable to port 5

Figure 100. 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 101 on page 222 shows a typical connection path.

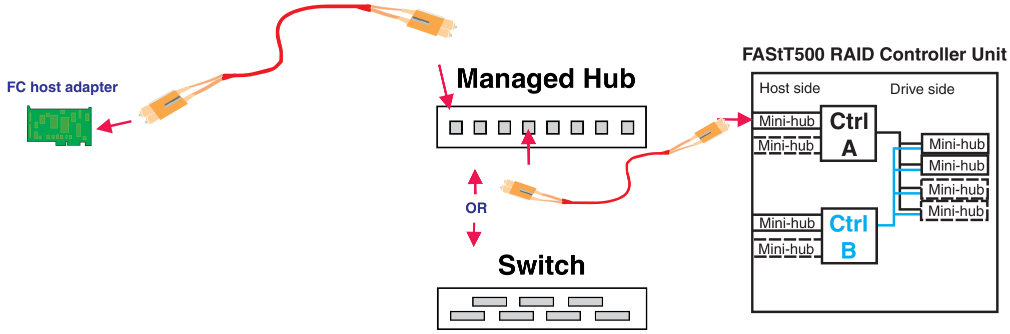


Figure 101. Typical connection path

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 102. 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.

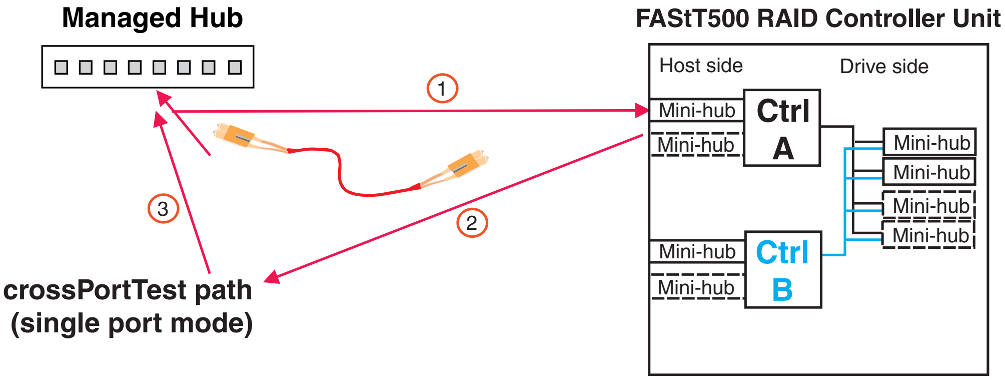
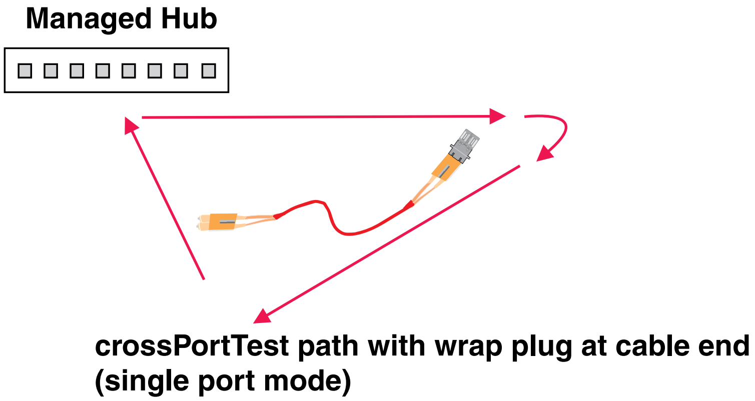


Figure 102. crossPortTest data path

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 103 on page 223 shows these alternative paths.



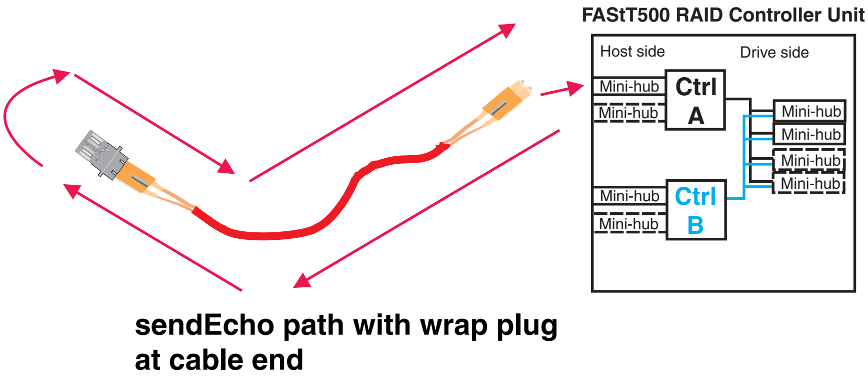


Figure 103. sendEcho and crossPortTest alternative paths

Chapter 14. 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 22.

The following sections illustrate the use of wrap plugs.

Running sendEcho and crossPortTest path to and from controller

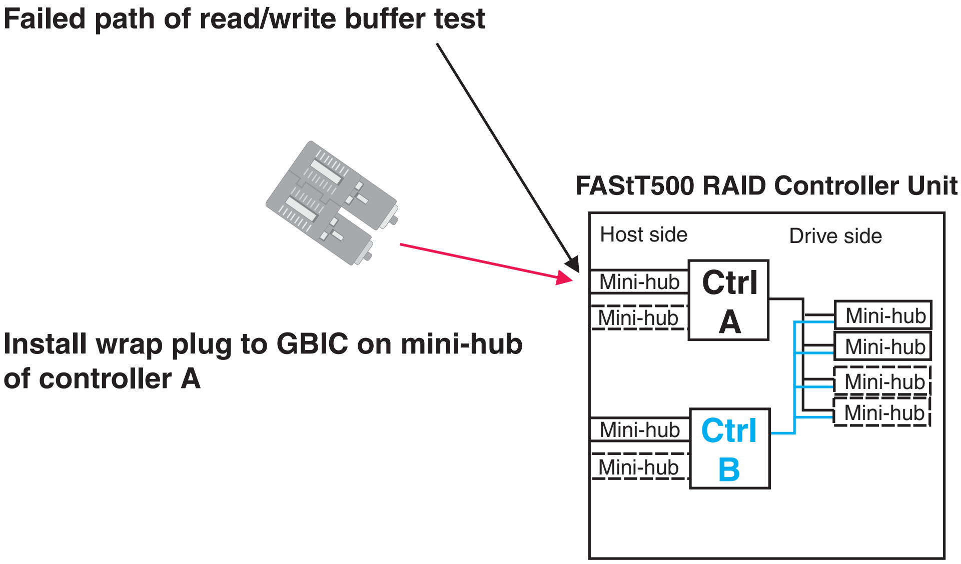

Failed path of read/write buffer test
FAStT500 RAID Controller Unit
Host side
Drive side
Mini-hub
Mini-hub
Ctrl A
Mini-hub
Mini-hub
Mini-hub
Mini-hub
Mini-hub
Mini-hub
Ctrl B
Install wrap plug to GBIC on mini-hub of controller A

Figure 104. Install wrap plug to GBIC

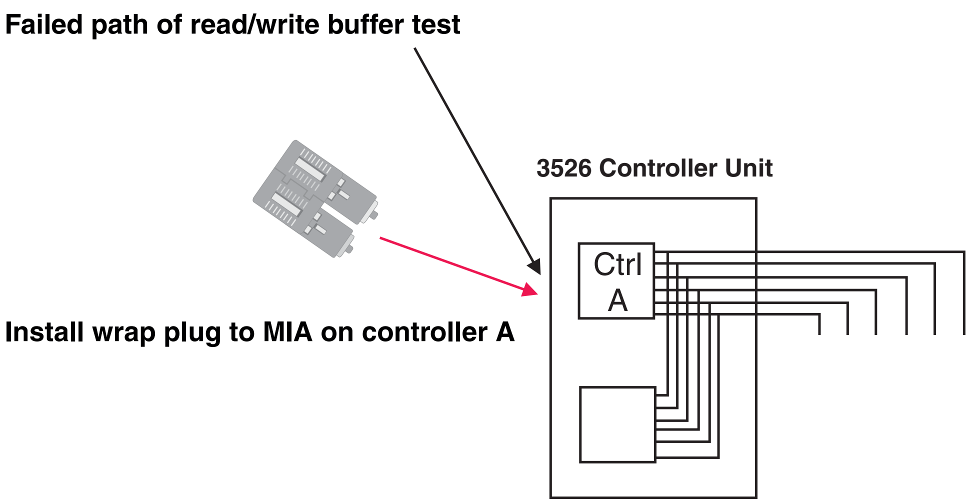

Failed path of read/write buffer test
3526 Controller Unit
Ctrl
A
Install wrap plug to MIA on controller A

Figure 105. 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 15 for the information on how to run the `crossPortTest`. Figure 106 and Figure 107 on page 227 show these alternative paths.

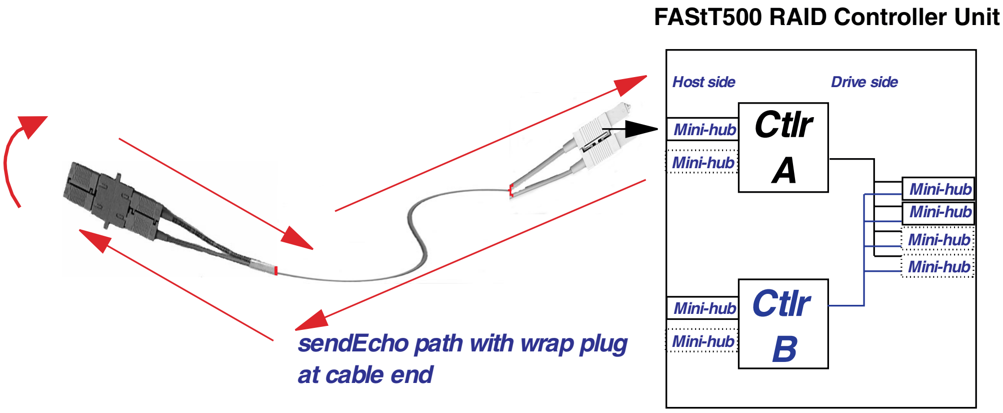


Figure 106. sendEcho path

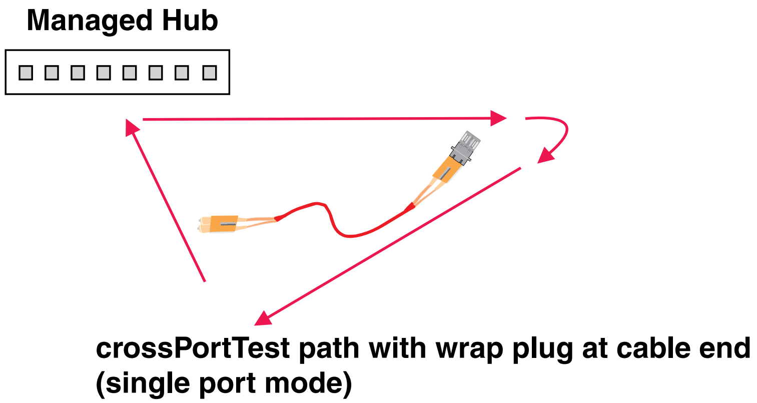


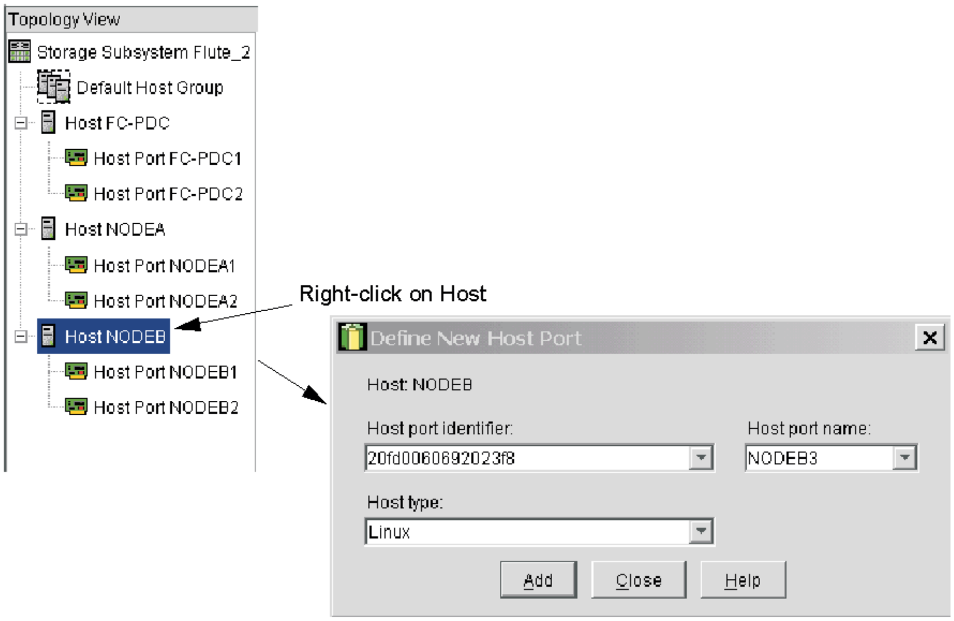
Figure 107. crossPortTest path

Chapter 15. 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.

The FAStT Storage Managers (version 7.x and 8.xx) provide 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 the FAStT 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 108). 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.



Host: NODEB

Host port identifier: 20fd0060692023f8

Host port name: NODEB3

Host type: Linux

Figure 108. Host information

Configuration examples

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

Windows cluster

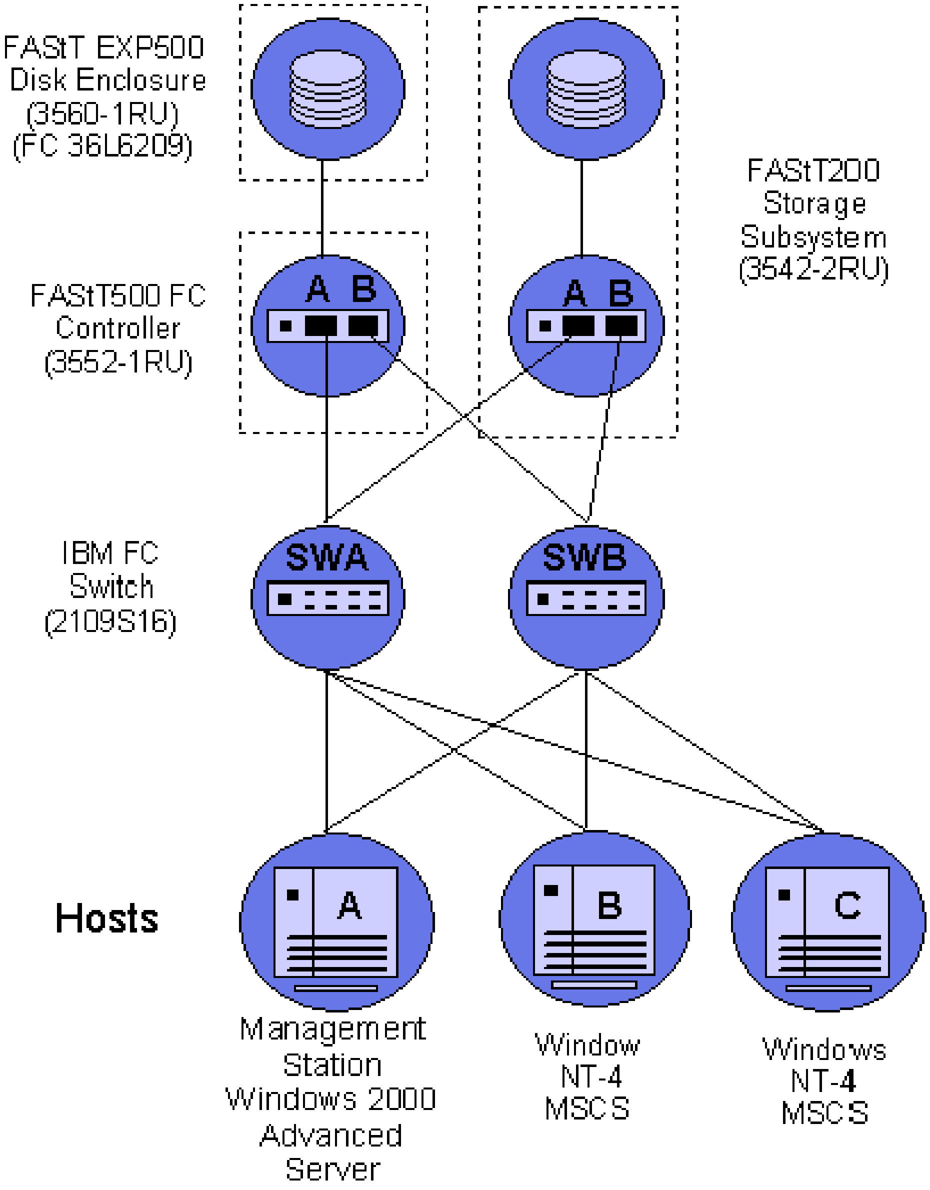


Figure 109. Windows cluster

Table 27. 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 27. 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

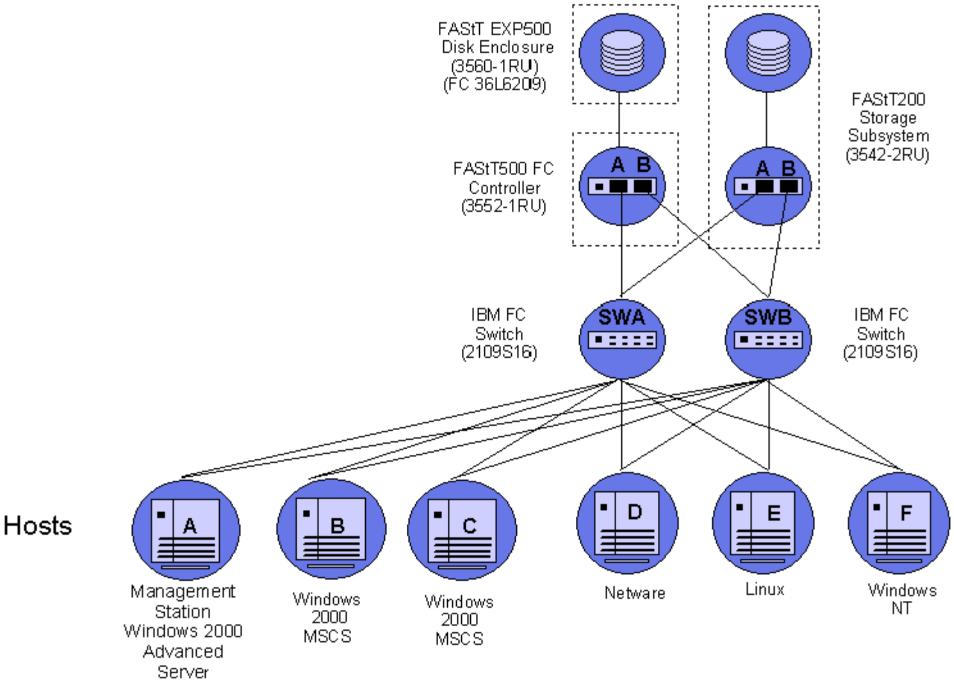


Figure 110. Heterogeneous configuration

Table 28. 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 28. 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 16. 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 FAStT host adapter (FRU 09N7292)
- IBM FAStT FC2-133 (FRU 24P0962) and FC2-133 Dual Port (FRU 38P9099) host bus adapters

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

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

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 29 on page 234). The FAStT host adapter (FRU 09N7292) and the FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099) offer additional settings available from the **Advanced Adapter Settings** menu option (see Table 30 on page 234 and Table 31 on page 234). Any settings for the fibre-channel PCI adapter (FRU 01K7354) not described in this section are described in "Advanced adapter settings" on page 235.

Table 29. IBM fibre-channel PCI adapter (FRU 01K7354) host adapter settings

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Enable LUNs	Yes or No	Yes
Execution throttle	1 - 256	256
Drivers load RISC code	Enabled or Disabled	Enabled
Frame size	512, 1024, 2048	2048
IOCB allocation	1-512 buffers	256 buffers
Loop reset delay	0-15 seconds	8 seconds
Extended error logging	Enabled or Disabled	Disabled
Port down retry count	0-255	30

Table 30. FAStT 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

Table 31. FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099) 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

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 FAStT host adapter [FRU 09N7292)] and FAStT FC2-133 host bus adapters [FRU 24P0962, 38P9099] 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.

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 FAStT host adapter (FRU 09N7292) (see Table 32 on page 236) and the FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099) (see Table 33 on page 236). All settings for the IBM fibre-channel PCI adapter (FRU 01K7354) are accessed from the **Host Adapter Settings** menu option.

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

Setting	Options	Default
Execution throttle	1-256	256
Fast command posting	Enabled or Disabled	Enabled
>4GByte addressing	Enabled or Disabled	Disabled
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
Drivers load RISC code	Enabled or Disabled	Enabled
Enable database updates	Yes or No	No
Disable database load	Yes or No	No
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

Table 33. FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099) advanced adapter settings

Setting	Options	Default
Execution throttle	1-256	256
>4GByte addressing	Enabled or Disabled	Disabled
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
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

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.

Fast command posting

This setting decreases command execution time by minimizing the number of interrupts. The default is Enabled for the FAStT host adapter (FRU 09N7292).

>4GByte addressing

Enable this option when the system has more than 4 GB of memory available. The default is Disabled.

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 FAStT host adapter [FRU 09N7292] and FAStT FC2-133 host bus adapters [FRU 24P0962, 38P9099])
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.

Drivers load RISC code:
When this option is set to Enabled, the adapter uses the RISC firmware that is embedded in the software device driver. When this option is set to Disabled, the software device driver loads the RISC firmware found in the adapter BIOS code. The default is Enabled.

Note: To load the embedded device driver software, the device driver being loaded must support this setting. If the device driver does not support this setting, the result is the same as if this option is set to Disabled, regardless of the setting. Leaving this option enabled ensures a certified combination of software device driver and RISC firmware.

Enable database updates
When this option is set to Enabled, the software can save the loop configuration information in flash memory as the system powers down. The default is No.

Disable database load
When this option is set to Enabled, the device database is read from the Registry during driver initialization. When this option is set to Disabled, the device database is created dynamically during device driver initialization. The default is No.

Note: This option usually applies to the Windows NT and Windows 2000 operating system environments.

IOCB allocation
This option specifies the maximum number of buffers from the firmware buffer pool that are allocated to any one port. The default setting is 256 buffers.

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.

Extended firmware settings

You can use this option to modify the extended firmware settings. The current default settings for the host adapter are listed in Table 34 and are described in this section.

Note: The **Extended Firmware Settings** menu option is available only for the FAStT host adapter (FRU 09N7292) and the FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099). Extended firmware settings are not available for the IBM fibre-channel PCI adapter (FRU 01K7354).

Table 34. Extended firmware settings for FAStT host adapter (FRU 09N7292) and FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099)

Setting	Options	Default
RIO operation mode	0, 5	0
Connection Options [for FAStT host adapter (FRU 09N7292)]	0, 1, 2, 3	3
Connection Options [for FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099)]	0, 1, 2	2
Fibre channel tape support	Enabled or Disabled	Disabled
Interrupt delay timer	0-255	0
Data rate [for FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099) only]	0, 1, 2	2

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 35). The default is 0.

Table 35. RIO operation modes for FAStT host adapter (FRU 09N7292) and FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099)

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

Connection options
This setting defines the type of connection (loop or point-to-point) or

connection preference (see Table 36). The default is 3 for the FAStT host adapter (FRU 09N7292) or 2 for the FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099).

Table 36. Connection options for FAStT host adapter (FRU 09N7292) and FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099)

Option	Type of connection
0	Loop only
1	Point-to-point only
2	Loop preferred; otherwise, point-to-point
3 (for FAStT 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.

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.

Data rate (for FAStT FC2-133 host bus adapters [FRU 24P0962, 38P9099] only): This setting determines the data rate (see Table 37). When this field is set to 2, the FAStT FC2-133 host bus adapters determines what rate your system can accommodate and sets the rate accordingly. The default is 2.

Table 37. Data rate options for FAStT FC2-133 host bus adapters (FRU 24P0962, 38P9099)

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

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 17. Frequently asked questions about FAStT Storage Manager

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

- “Global Hot Spare (GHS) drives”
- “Auto Code Synchronization (ACS)” on page 244
- “Storage partitioning” on page 247
- “Miscellaneous” on page 248

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?

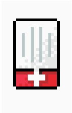
The controller will know which drive is being spared by the GHS, even in the event that the first GHS failed and a second GHS was used. When the original failed drive is replaced, the copy-back process will begin from the second GHS.

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 FAStT 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 FAStT Storage Manager versions 7 or 8 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 FAStT Storage Manager 7.x 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 FAStT 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).

FAStT Storage Manager shows the nodes in the enterprise window with either IP address or machine name. Why is this not consistent?

FAStT 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 FAStT 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 FAStT 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 18. 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.

- 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 19. MEL data format

After you have read the relevant information in this chapter, return to “RAID Controller Passive PD Map” on page 11.

Note: This chapter details MEL data formats for controller firmware versions 5.33 and 5.42. If data are applicable only to storage management version 5.33 or 5.42, they are noted as such.

The following table lists all the critical events for controller firmware releases 5.33 and 5.42. 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. 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
0x150E	Controller loop-back diagnostics failed
0x150F	Channel miswire
0x1510	ESM miswire
0x1513	Degraded drive channel (5.42 only)
0x1600	Uncertified drive detected (5.42 only)
0x1601	Reserved blocks on ATA drives cannot be discovered (5.42 only)
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

Critical Event Number	Critical Event Description (SYMsm Description)
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
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 (5.42 only)	Unsupported LHA SATA ESM detected

Critical Event Number	**Critical Event Description (SYMsm Description)**
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
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
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

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:

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>19</td><td colspan="2">Internal Flags</td><td colspan="2">Log Group</td><td colspan="4">Priority</td></tr>
<tr><td>18</td><td colspan="4">Event Group</td><td colspan="4">Component</td></tr>
<tr><td>17</td><td colspan="8">(MSB) Event Value</td></tr>
<tr><td>16</td><td colspan="8">(LSB)</td></tr>
</table>

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 Chapter 4. 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.
Read Failure: (SYMsm Description - Drive read failure - retries exhausted) Currently Not Logged.					
Drive (0x2)	Informational (0x0)	Error (0x1)	Drive (0x1)	0x1005	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
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
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.					

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x100C</td><td></td></tr>
<tr><td colspan="6"><b>Destination Timeout:</b> (SYMsm Description: Timeout on drive side of controller)
Logged when a command from controller to drive or ESM takes longer than expected.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Drive (0x1)</td><td>0x100D</td><td></td></tr>
<tr><td colspan="6"><b>Unexpected Interrupt:</b> (SYMsm Description: Unexpected interrupt on controller)
Logged due to an unexpected interrupt with no active device on chip.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x100E</td><td>Data Field Type: 0x0201</td></tr>
<tr><td colspan="6"><b>Bus Parity Error:</b> (SYMsm Description: Bus parity error on controller)
Logged when a Bus Parity error is detected by the destination driver.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x100F</td><td></td></tr>
<tr><td colspan="6"><b>Drive PFA:</b> (SYMsm Description: Impending drive failure (PFA) detected)
The logged device generated a PFA condition.</td></tr>
<tr><td>Controller (0x1)</td><td>Critical (0x1)</td><td>Error (0x1)</td><td>Drive (0x1)</td><td>0x1010</td><td>None</td></tr>
<tr><td colspan="6"><b>Chip Error:</b> (SYMsm Description: Chip error)
Currently Not Logged.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Chip (0XC)</td><td>0x1011</td><td></td></tr>
<tr><td colspan="6"><b>Destination Driver:</b> (SYMsm Description: Destination driver error)
Logged when the destination driver has an unrecovered error from the drive.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Drive (0x1)</td><td>0x1012</td><td>Origin: Contains the low level destination driver internal error.
Id: Contains the raw error logger error number.</td></tr>
<tr><td colspan="6"><b>Destination Diagnostic Failure:</b> (SYMsm Description: Destination driver level 0 diagnostic failed)
Logged when destination driver level 0 diagnostics failed for the specified channel.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x1013</td><td>Id: Contains diagnostic test that failed.
1: Read/Write registers
2: 64 byte FIFO
3: DMA FIFO
Data Field Type: 0x010B</td></tr>
</table>

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Destination Reassign Block:</b> (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.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x1014</td><td>Origin: Block List</td></tr>
<tr><td colspan="6"><b>Bad Mode Parameters:</b> (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.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x1015</td><td>Origin: FRU info
Id:
1: The QERR bit (mode page10) was successfully cleared.
2: The WCE bit (mode page 8) was successfully cleared.</td></tr>
<tr><td colspan="6"><b>Drv Medium Err:</b> (SYMsm Description: Hardware error – Unrecoverable read error on drive)
Logged when an unrecoverable read error is detected on a drive.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Drive (0x1)</td><td>0x1016</td><td></td></tr>
<tr><td colspan="6"><b>Dst Channel Down:</b> (SYMsm Description: Fibre Channel Link Down)
Logged when the destination channel is down.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Channel (0x6)</td><td>0x1017</td><td></td></tr>
<tr><td colspan="6"><b>Dst Channel Up:</b> (SYMsm Description: Fibre Channel Link Up)
Logged when the destination channel is up.</td></tr>
<tr><td>Controller (0x1)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Channel (0x6)</td><td>0x1018</td><td></td></tr>
</table>

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.

3.3 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	

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	

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Channel Miswire Clear:</b> (SYMsm Description: Channel miswire resolved)
Logged when the channel miswire is cleared.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Channel (0x6)</td><td>0x1511</td><td></td></tr>
<tr><td colspan="6"><b>ESM Miswire Clear:</b> (SYMsm Description: ESM miswire resolved)
Logged when the ESM miswire is cleared.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>ESM (0x7)</td><td>0x1512</td><td></td></tr>
<tr><td colspan="6"><b>Channel Failover:</b> (SYMsm Description: Individual drive - Degraded path)
Logged when drive fails.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Error (0x1)</td><td>Channel (0x6)</td><td>0x1513 (5.42 only)</td><td></td></tr>
<tr><td colspan="6"><b>Channel Failback:</b> (SYMsm Description: Drive channel changed to optimal)
Logged when drive channel is active.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Channel (0x6)</td><td>0x1514 (5.42 only)</td><td></td></tr>
</table>

Drive Signature Validation Failure events

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Drive Signature mismatch:</b> (SYMsm Description: Uncertified drive detected)
The signature was read successfully from the drive but the signature string was incorrect.</td></tr>
<tr><td>Drive (0x2)</td><td>Critical (0x1)</td><td>Error (0x1)</td><td>Drive (0x01)</td><td>0x1600 (5.42 only)</td><td>ID:
04=signature mismatch</td></tr>
<tr><td colspan="6"><b>Drive Signature read failure:</b> (SYMsm Description: Reserved blocks on ATA drives cannot be discovered)
Unable to read a valid signature sector from the drive.</td></tr>
<tr><td>Drive (0x2)</td><td>Critical (0x1)</td><td>Error (0x1)</td><td>Drive (0x1)</td><td>0x1601 (5.42 only)</td><td>ID:
01=create signature failed
02=disk read failed
03=format code 520</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>VDD Purge Begin:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2011</td><td>None</td></tr>
<tr><td colspan="6"><b>VDD Purge End:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2012</td><td>None</td></tr>
<tr><td colspan="6"><b>VDD Cache Recover:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2013</td><td>Origin: Contains the number of cache blocks recovered.</td></tr>
<tr><td colspan="6"><b>VDD Error:</b> (SYMsm Description: VDD logged an error)
Logged when VDD logs an error.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2014</td><td>Data Field Type: 0x0707</td></tr>
<tr><td colspan="6"><b>Uncompleted Write Count:</b> (SYMsm Description: Uncompleted writes detected in NVSRAM at start-of-day)
Logged at start-of-day when uncompleted writes are detected in NVSRAM.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2015</td><td>Origin: Contains the number of uncompleted writes found</td></tr>
<tr><td colspan="6"><b>Write Count:</b> (SYMsm Description: Interrupted writes processed)
Logged when VDD processes interrupted writes for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2016</td><td>Origin: Number of interrupted writes processed.</td></tr>
<tr><td colspan="6"><b>Log Write Count:</b> (SYMsm Description: Interrupted writes detected from checkpoint logs)
Logged when VDD creates a list of interrupted writes from the data/parity checkpoint logs.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2017</td><td>Origin: Number of interrupted writes processed.</td></tr>
<tr><td colspan="6"><b>VDD Wait:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2018</td><td>Data Field Type: 0x0700
Data: First 4 characters of the resource name.</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Reconfiguration End:</b> (SYMsm Description: Modification (reconfigure) completed)
Logged when reconfiguration operations for the specified unit have completed.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2029</td><td>Data Field Type: 0x0613</td></tr>
<tr><td colspan="6"><b>Reconfiguration Resume:</b> (SYMsm Description: Modification (reconfigure) resumed)
Logged when reconfiguration operations are resumed for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x202A</td><td>None</td></tr>
<tr><td colspan="6"><b>Parity Scan Begin:</b> (SYMsm Description: Redundancy check started)
Logged when parity scan operations are started for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x202B</td><td>None</td></tr>
<tr><td colspan="6"><b>Parity Scan End:</b> (SYMsm Description: Redundancy check completed)
Logged when parity scan operations for the specified unit have completed</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x202C</td><td>None</td></tr>
<tr><td colspan="6"><b>Parity Scan Resume:</b> (SYMsm Description: Redundancy check resumed)
Logged when parity scan operations are resumed for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x202D</td><td>None</td></tr>
<tr><td colspan="6"><b>Miscorrected Data:</b> (SYMsm Description: Read drive error during interrupted write)
Logged when an Unrecoverable Read Error is detected.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x202E</td><td>Origin: LBA of the LUN that caused the failure.</td></tr>
<tr><td colspan="6"><b>Auto LUN Transfer End:</b> (SYMsm Description: Automatic volume transfer completed)
Logged when an auto lun transfer operation has completed.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x202F</td><td>None</td></tr>
<tr><td colspan="6"><b>Format End:</b> (SYMsm Description: Initialization completed on volume)
Logged when a volume format has completed.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2030</td><td>None</td></tr>
</table>

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

Cache Manager events

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
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
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	

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>CCM Hardware Mismatch:</b> (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.</td></tr>
<tr><td>(0x0)</td><td>Critical (0x1)</td><td>(0x1)</td><td>Controller (0x8)</td><td>0x2109</td><td>None</td></tr>
<tr><td colspan="6"><b>Cache Disabled Internal:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x210A</td><td>None</td></tr>
<tr><td colspan="6"><b>Cache Synchronize Failed:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x210B</td><td>None</td></tr>
<tr><td colspan="6"><b>Cache Battery Failure:</b> (SYMsm Description: Controller cache battery failed)
Cache battery has failed. ASC/ASCQ of 0x0C/0x00 is also logged with this event.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Battery (0x9)</td><td>0x210C</td><td>None</td></tr>
<tr><td colspan="6"><b>Deferred Error:</b> (SYMsm Description: Controller deferred error)
Currently Not Logged.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x210D</td><td></td></tr>
<tr><td colspan="6"><b>Cache Data Loss:</b> (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.</td></tr>
<tr><td>Controller (0x1)</td><td>Critical (0x1)</td><td>Error (0x1)</td><td>Controller (0x8)</td><td>0x210E</td><td>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.</td></tr>
</table>

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
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 expiration) Currently Not Logged.					
System (0x0)	Informational (0x0)	Error (0x1)	Battery (0x9)	0x2115	

Event: Event Description					
Log Group	**Priority**	**Event Group**	**Component**	**Event Number**	**Optional Data**
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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Mark LUN Optimal:</b> (SYMsm Description: Volume marked optimal)
Currently Not Logged.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2201</td><td></td></tr>
<tr><td colspan="6"><b>Add Vdisk:</b> (SYMsm Description: Volume added)
Logged when a LUN is added to the subsystem.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2202</td><td>Data Field Type: 0x0612</td></tr>
<tr><td colspan="6"><b>Delete Vdisk:</b> (SYMsm Description: Volume group or volume deleted)
Logged when the specified virtual disk is deleted.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2203</td><td>None</td></tr>
<tr><td colspan="6"><b>Resume I/O:</b> (SYMsm Description: I/O is resumed)
Logged when vdResumeIo is called for specified device.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2204</td><td>None</td></tr>
<tr><td colspan="6"><b>Fail Copy Source:</b> (SYMsm Description: Source drive failed during copy operation)
Logged when the source drive of a copy type operation fails.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2205</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Reconstruction Device Complete:</b> (SYMsm Description: Reconstruction completed)
Logged when CFG manager has completed reconfiguring the specified device successfully.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2206</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Copy Device Complete:</b> (SYMsm Description: Device copy complete)
Logged when the configuration manager has completed the copy process to the specified device.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2207</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Reconfiguration Setup:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2208</td><td>Data Field Type: 0x0612</td></tr>
</table>

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>CFG Reconfiguration:</b> (SYMsm Description: Modification (reconfigure) completed)
Logged when the LUN has finished reconfigure process the new LUN state is in origin.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2209</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Copyback Start:</b> (SYMsm Description: Copyback started)
Logged when copy task is started.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x220A</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Copyback Restart:</b> (SYMsm Description: Copyback restarted)
Logged when copy task is restarted.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x220B</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Fail Delayed:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x220C</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Scrub Enabled:</b> (SYMsm Description: Media scan (scrub) enabled)
Logged when the configuration manager enables scrubbing for the specified device.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x220D</td><td>Origin: 0 – Scrub & parity check are turned off
1 - Scrub is enabled
2 - Parity check is enabled
3 - Scrub & parity check enabled</td></tr>
<tr><td colspan="6"><b>CFG Scrub Start:</b> (SYMsm Description: Media scan (scrub) started)
Logged when a scrub operation is started for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x220E</td><td>Origin: Actual buf address</td></tr>
<tr><td colspan="6"><b>CFG Scrub Complete:</b> (SYMsm Description: Media scan (scrub) completed)
Logged when a scrub operation is completed for the specified unit.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x220F</td><td>None</td></tr>
</table>

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>CFG Restore Begin:</b> (SYMsm Description: Restore started)
Logged when cfg manager begins a restore operation on specified unit and device number.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2210</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Restore End:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2211</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Parity Scan Restore:</b> (SYMsm Description: Parity repaired)
Logged when the configuration manager repairs the parity of specified unit and device.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x2212</td><td>Origin: Starting LBAs for the LUN</td></tr>
<tr><td colspan="6"><b>Zero LUN:</b> (SYMsm Description: Volume initialized with zeros)
Logged when zeros are written to the specified LUN.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2213</td><td>Data Field Type: 0x0706</td></tr>
<tr><td colspan="6"><b>CFG Copy Sundry:</b> (SYMsm Description: One or more Sundry regions created)
Logged when configuration manager creates 1 or more sundry drives.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x2214</td><td>Origin: The number of sundry drives created</td></tr>
<tr><td colspan="6"><b>CFG Post Fail:</b> (SYMsm Description: Drive marked failed)
Logged when configuration manager posts a UA/AEN for a failed drive.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2215</td><td></td></tr>
<tr><td colspan="6"><b>Piece Out of Service (OOS):</b> (SYMsm Description: Piece taken out of service)
Logged when the configuration manager take a piece of the specified LUN out of service.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2216</td><td>Origin: New LUN state</td></tr>
<tr><td colspan="6"><b>Piece Fail:</b> (SYMsm Description: Piece failed)
Logged when a piece of specified LUN is failed.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2217</td><td>Origin: Piece number</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Device Replace:</b> (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.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x222F</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Fail:</b> (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.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2230</td><td>Origin: Reason for Failure</td></tr>
<tr><td colspan="6"><b>Device Manager Removed:</b> (SYMsm Description: Drive marked removed)
Logged when the configuration manager state machine is going to mark a drive removed.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2231</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Removed 1:</b> (SYMsm Description: Removed drive marked removed)
Logged when the configuration manager is called to remove a drive that has already been removed.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2232</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Removed 2:</b> (SYMsm Description: Unassigned drive marked removed)
Logged when an unassigned drive has been marked as removed by the configuration manager.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2233</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Removed 3:</b> (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.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2234</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Removed 4:</b> (SYMsm Description: Optimal/Replaced drive marked removed)
Logged when an optimal or replaced drive has been removed.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2235</td><td>None</td></tr>
</table>

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Device Manager Copy Done:</b> (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.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2236</td><td>Origin: Internal device flags managed by the configuration manager, definition is unspecified.</td></tr>
<tr><td colspan="6"><b>Device Manager Copy Done 1:</b> (SYMsm Description: Replaced drive completed reconstruction)
Copy Done: Logged when a replaced drive has finished reconstruction.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2237</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager New:</b> (SYMsm Description: Drive added in previously unused slot)
Logged when a drive has been inserted in a previously unused slot in the subsystem.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2238</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager GHS Unassigned:</b> (SYMsm Description: Hot spare drive assigned internally)
Logged when an unassigned drive is marked as a global hot spare internally.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2239</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Delete:</b> (SYMsm Description: Drive marked deleted)
Logged when a drive is to be marked as deleted. Previously the drive was unassigned or failed.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x223A</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Replace:</b> (SYMsm Description: Failed/Replaced drive marked replaced)
Logged when a failed or replaced drive is marked as replaced.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x223B</td><td>None</td></tr>
<tr><td colspan="6"><b>Device Manager Replace 1:</b> (SYMsm Description: Drive reinserted)
Logged when a removed optimal drive or replaced drive has been reinserted or when a failed drive is reinserted.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x223C</td><td>Origin: Location where event is logged, value unspecified</td></tr>
<tr><td colspan="6"><b>Device Manager Replace 2:</b> (SYMsm Description: Unassigned drive replaced)
Logged when an unassigned drive has been replaced.</td></tr>
<tr><td>Drive (0x2)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x223D</td><td>Origin: Location where event is logged, value is unspecified</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>CFG Scrub Resume:</b> (SYMsm Description: Media scan (scrub) resumed)
Logged when a scrub operation is resumed for the specified unit or drive group.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2246</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Unrecovered Interrupted Write:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2247</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Unrecovered Write Failure:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Failure (0x2)</td><td>Drive (0x1)</td><td>0x2248</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>CFG Drive Too Small:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2249</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Wrong Sector Size:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x224A</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Drive Format Failed:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x224B</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Wrong Drive:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x224C</td><td>Origin: FRU info</td></tr>
</table>

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Drive No Response:</b> (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”.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x224D</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Reconstruction Drive Failed:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Failure (0x2)</td><td>Drive (0x1)</td><td>0x224E</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Partial Global Hot Spare:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x224F</td><td>None</td></tr>
<tr><td colspan="6"><b>LUN Down:</b> (SYMsm Description: Volume failure)
Logged when the configuration manager posts an UA/AEN of ASC/ASCQ = 0x3F/0xE0 indicating Logical Unit Failure.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Failure (0x2)</td><td>Volume (0xD)</td><td>0x2250</td><td>None</td></tr>
<tr><td colspan="6"><b>CFG Read Failure:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>State (0x5)</td><td>Drive (0x1)</td><td>0x2251</td><td>Origin: FRU info</td></tr>
<tr><td colspan="6"><b>Fail Vdisk Delayed:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>Drive (0x1)</td><td>0x2252</td><td>None</td></tr>
<tr><td colspan="6"><b>LUN Modified:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Volume (0xD)</td><td>0x2253</td><td>None</td></tr>
</table>

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

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

Event: Event Description					
Log Group	Priority	Event Group	Component	Event Number	Optional Data
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
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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Unsupported LHA SATA ESM Detected</b> (SYMsm: Unsupported LHA SATA ESM)
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.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Notification (0x4)</td><td>ESM (0x7)</td><td>0x282F (5.42 only)</td><td>Device: Tray number</td></tr>
</table>

Command Handler events

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Format Unit:</b> (SYMsm Description: Format unit issued)
Logged when the controller processes a format command. The LUN value indicates the LUN that the controller is formatting.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x3000</td><td>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.</td></tr>
<tr><td colspan="6"><b>Quiesce:</b> (SYMsm Description: Quiescence issued)
Logged for the quiescence command.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Controller (0x8)</td><td>0x3001</td><td>Id field: Indicates the state of the quiesce command :
0 - Quiescence is stopped.
1 - Quiescence was started.</td></tr>
<tr><td colspan="6"><b>Reassign Blocks:</b> (SYMsm Description: Reassign blocks issued from host)
Logged for a reassign blocks command that has been issued from the host.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x3002</td><td>Id: Total number of blocks to be reassigned.
Data Field Type: 0x0208</td></tr>
<tr><td colspan="6"><b>Reserve:</b> (SYMsm Description: Reserve issued)
Logged for the reserve command. Defined but not logged in this release.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x3003</td><td>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.</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Set Storage Array Media Scan Rate:</b> (SYMsm Description: Change media scan (scrub) settings of Storage Array)
Logged on entry to setSAMediaScanRate_1.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Unknown (0x0)</td><td>0x5020</td><td>Data Field Type: 0x0812</td></tr>
<tr><td colspan="6"><b>Clear Storage Array Configuration:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Unknown (0x0)</td><td>0x5021</td><td>None</td></tr>
<tr><td colspan="6"><b>Auto Storage Array Configuration:</b> (SYMsm Description: Automatic configuration on Storage Array)
Logged on exit from to autoSAConfiguration_1.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Unknown (0x0)</td><td>0x5022</td><td>None</td></tr>
<tr><td colspan="6"><b>RPC Function Return Code:</b> (SYMsm Description: Controller return status/function call for requested operation)
Logged on the return from RPC function returning ReturnCode.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Unknown (0x0)</td><td>0x5023</td><td>Data Field Type: 0x0814</td></tr>
<tr><td colspan="6"><b>Write Download Checkpoint:</b> (SYMsm Description: Internal download checkpoint)
Logged whenever the download checkpoint is updated.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Controller (0x8)</td><td>0x5024</td><td>Data Field Type: 0x0815</td></tr>
<tr><td colspan="6"><b>Controller Firmware Download Fail:</b> (SYMsm Description: Controller firmware download failed)
Logged when a controller firmware download fails.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Controller (0x8)</td><td>0x5025</td><td></td></tr>
<tr><td colspan="6"><b>Controller Firmware Download Complete:</b> (SYMsm Description: Controller firmware download completed)
Logged when a controller firmware download successfully completes.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Controller (0x8)</td><td>0x5026</td><td></td></tr>
<tr><td colspan="6"><b>Controller NVSRAM Download Fail:</b> (SYMsm Description: Controller NVSRAM download failed)
Logged when a controller NVSRAM download fails.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Controller (0x8)</td><td>0x5027</td><td></td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>SYMbol Vcopy Start Copy:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x503A</td><td>None</td></tr>
<tr><td colspan="6"><b>SYMbol Vcopy Stop Copy:</b> (SYMsm Description: Stop volume copy operation)
Logged when processing a user request (via SYMbol) to stop a copy.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x503B</td><td>None</td></tr>
</table>

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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Create LUN Mapping:</b> (SYMsm Description: Create volume-to-LUN mapping)
Logged on entry to spmCreateLUNMapping.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x520F</td><td>Data Field Type: 0x0908</td></tr>
<tr><td colspan="6"><b>Delete LUN Mapping:</b> (SYMsm Description: Delete volume-to-LUN mapping)
Logged on entry to spmDeleteLUNMapping.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x5210</td><td>Data Field Type: 0x0901</td></tr>
<tr><td colspan="6"><b>Move LUN Mapping:</b> (SYMsm Description: Change volume-to-LUN mapping)
Logged on entry to spmMoveLUNMapping.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Command (0x3)</td><td>Volume (0xD)</td><td>0x5211</td><td>Data Field Type: 0x0909</td></tr>
<tr><td colspan="6"><b>Write DACSTORE Error:</b> (SYMsm Description: Error writing configuration)
Logged when an error occurs when attempting to update the SPM DASCSTORE region.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Error (0x1)</td><td>Unknown (0x0)</td><td>0x5212</td><td>Data Field Type: 0x090A</td></tr>
<tr><td colspan="6"><b>SPM Cleared</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5213</td><td>None</td></tr>
</table>

SAFE events

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Feature Enabled:</b> (SYMsm Description: Premium feature enabled)
Logged when a feature is successfully enabled.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5400</td><td>Id: Feature Code</td></tr>
<tr><td colspan="6"><b>Feature Disabled:</b> (SYMsm Description: Premium feature disabled)
Logged when a feature is successfully disabled.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5401</td><td>Id: Feature Code</td></tr>
<tr><td colspan="6"><b>Non-Compliance:</b> (SYMsm Description: Premium feature out of compliance)
Logged when there are features enabled that have not been purchased.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5402</td><td>Id: Features not in compliance</td></tr>
<tr><td colspan="6"><b>Tier Non-Compliance:</b> (SYMsm Description: Premium feature exceeds limit)
Logged when the limits of a premium feature have been exceeded (e.g. 6 storage partitions when 4 have been purchased).</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5403</td><td>Id: Features not in tier compliance</td></tr>
<tr><td colspan="6"><b>ID Changed:</b> (SYMsm Description: Feature Enable Identifier changed)
Logged when a new SAFE ID is successfully generated and stored.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Unknown (0x0)</td><td>0x5404</td><td></td></tr>
</table>

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)	(0x2)	Controller (0x8)	0x560C	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)	(0x2)	Controller (0x8)	0x560D	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)	(0x2)	Controller (0x8)	0x560E	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)	(0x2)	Controller (0x8)	0x560F	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)	(0x2)	Controller (0x8)	0x5610	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.					

<table>
<tr><td colspan="6"><b>Event: Event Description</b></td></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x5611</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics error – loopback error on alternate:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x5612</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics error – bad channel:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x5613</td><td>Id: 1 if user initiated
Data Field Type : 0x0A02
Data Field Value: Number of bad channels</td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics error – Source link down:</b> (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.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Channel (0x6)</td><td>0x5614</td><td>Id: 1 if user initiated
Data Field Type : 0x0A01
Data Field Value: Channel ID</td></tr>
<tr><td colspan="4"><b>Not Used</b></td><td>0x5615</td><td></td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics error – Configuration error:</b> (SYMsm Description: Diagnostics rejected – configuration error on controller)
Logged when configuration error on this controller for running diagnostics.</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Failure (0x2)</td><td>Controller (0x8)</td><td>0x5616</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics error – Alternate controller configuration error:</b> (SYMsm Description: Diagnostics rejected - configuration error on this controller’s alternate)</td></tr>
<tr><td>System (0x0)</td><td>Critical (0x1)</td><td>Failure (0x2)</td><td>Controller (0x8)</td><td>0x5617</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
</table>

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.

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Runtime Diagnostics – Begin Diagnostics Controller:</b> (SYMsm Description: Running diagnostics on this controller)
Logged when Runtime Diagnostics is started on this controller.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x561E</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
<tr><td colspan="6"><b>Runtime Diagnostics – Download in Progress:</b> (SYMsm Description: Diagnostics rejected – download is in progress)
Logged when Runtime Diagnostics request is rejected because download is in progress.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x561F</td><td>Id: 1 if user initiated
Data Field Type : 0x0A00
Data Field Value: ID of test requested. 0 – all tests.</td></tr>
</table>

Stable Storage events

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>SSTOR Database Creation:</b> (SYMsm Description: Internal configuration database created)
Logged when an internal configuration database is created.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x6000</td><td>None</td></tr>
<tr><td colspan="6"><b>SSTOR Database Merge:</b> (SYMsm Description: Internal configuration database merged)
Logged when an internal configuration database is merged.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x6001</td><td>None</td></tr>
<tr><td colspan="6"><b>Not Used</b></td></tr>
<tr><td></td><td></td><td></td><td></td><td>0x6002</td><td></td></tr>
<tr><td colspan="6"><b>SSTOR To Few Sundry:</b> (SYMsm Description: Internal configuration database – not enough optimal drives available)
Logged when there are not enough optimal drives available.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x6003</td><td>None</td></tr>
<tr><td colspan="6"><b>SSTOR Re Synchronize:</b> (SYMsm Description: Internal configuration database is being resynchronized)
Logged when the internal configuration database is being resynchronized.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x6004</td><td>None</td></tr>
<tr><td colspan="6"><b>SSTOR SS IO Failed:</b> (SYMsm Description: Internal configuration database read or write operation failed)
Logged when an internal configuration database read or write operation fails.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>(0x4)</td><td>Controller (0x8)</td><td>0x6005</td><td>None</td></tr>
<tr><td colspan="6"><b>SSTOR Merge Failed:</b> (SYMsm Description: Internal configuration database – merge failed)
Logged when a stable storage database merge operation fails.</td></tr>
<tr><td>System (0x0)</td><td>Informational (0x0)</td><td>Notification (0x4)</td><td>Controller (0x8)</td><td>0x6006</td><td>None</td></tr>
</table>

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)		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)	(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

<table>
<tr><th colspan="6">Event: Event Description</th></tr>
<tr><th>Log Group</th><th>Priority</th><th>Event Group</th><th>Component</th><th>Event Number</th><th>Optional Data</th></tr>
<tr><td colspan="6"><b>Mirror Dual Primary:</b> (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.</td></tr>
<tr><td>System
(0x0)</td><td>(0x1)</td><td>Notification
(0x4)</td><td>Volume
(0xD)</td><td>0x6400</td><td>None</td></tr>
<tr><td colspan="6"><b>Mirror Dual Secondary:</b> (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.</td></tr>
<tr><td>System
(0x0)</td><td>(0x1)</td><td>Notification
(0x4)</td><td>Volume
(0xD)</td><td>0x6401</td><td>None</td></tr>
<tr><td colspan="6"><b>Mirror Unsynchronized:</b> (SYMsm Description: Data on mirrored pair unsynchronized)
Logged when the mirror state transitions to the unsynchronized state from either the synchronizing or optimal state.</td></tr>
<tr><td>System
(0x0)</td><td>(0x1)</td><td>Failure
(0x2)</td><td>Volume
(0xD)</td><td>0x6402</td><td>None</td></tr>
<tr><td colspan="6"><b>Mirror Synchronizing:</b> (SYMsm Description: Data on mirrored pair synchronizing)
Logged when a mirrored pair begins the synchronization process.</td></tr>
<tr><td>System
(0x0)</td><td>(0x0)</td><td>Notification
(0x4)</td><td>Volume
(0xD)</td><td>0x6403</td><td>None</td></tr>
<tr><td colspan="6"><b>Mirror Optimal:</b> (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.</td></tr>
<tr><td>System
(0x0)</td><td>(0x0)</td><td>Notification
(0x4)</td><td>Volume
(0xD)</td><td>0x6404</td><td>None</td></tr>
<tr><td colspan="6"><b>Mirror Orphan Created:</b> (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.</td></tr>
<tr><td>System
(0x0)</td><td>(0x0)</td><td>Command
(0x3)</td><td>Volume
(0xD)</td><td>0x6405</td><td>None</td></tr>
</table>

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

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)	(0x4)	Volume (0xD)	0x6601	
VOLCOPY Deleted: (SYMsm Description: Volume copy pair removed) Logged when a volume copy is deleted.					
System (0x0)	Informational (0x0)	(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)	(0x4)	Volume (0xD)	0x6603	
VOLCOPY Queued: (SYMsm Description: Volume copy operation pending) Logged when a volume copy operation is queued.					
System (0x0)	Informational (0x0)	(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)	(0x4)	Volume (0xD)	0x6605	
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)	(0x4)	Volume (0xD)	0x6606	

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 value 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
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

Name	Data Field Type	Data Description
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	
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	

Name	Data Field Type	Data Description
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 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	

Name	Data Field Type	Data Description
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 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)

Name	Data Field Type	Data Description
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)
SYMbol Tray Number	0x0800	Tray location
Volume Label Update	0x0801	Volume Label Update Descriptor
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	0x0811	Volume Media Scan Parameters Update

Name	Data Field Type	Data Description
Descriptor		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 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)
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
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	

Name	Data Field Type	Data Description
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	clearAllPersistentRegistrations(void)
		Clear all persistent registrations.

SYMbol return codes

Return Code		Definition/ SYMsm Description
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 or (2) 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.
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.

Return Code		Definition/ SYMsm Description
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 Active/Active. Please use the Controller>>Change Mode option in the Array Management Window to change the controller to active.
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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 Volume Group>>Place 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 because either (1) the segment size requested is not valid, or (2) the segment size you specified is not allowed because this volume has an odd number of segments. Therefore, you can 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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		**Definition/ SYMsm Description**
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 an Active/Passive mode. Please use the Controller>>Change Mode option in the Array Management Window to change the passive controller to active 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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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 Active/Optimal 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 Controllers must be in active/active mode to run diagnostics.
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.
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).

Return Code		Definition/ SYMsm Description
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 you cannot create a snapshot volume from a snapshot repository volume, another snapshot volume, a mirror repository volume, a secondary volume in a Remote Volume Mirror, or a target volume in a Volume Copy.
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.
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.

Return Code		Definition/ SYMsm Description
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.
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 (8MB) 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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.
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.

Return Code		Definition/ SYMsm Description
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.

Return Code		Definition/ SYMsm Description
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 the volume entered, 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 (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 reconfiguration operation.
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>>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.

Return Code		Definition/ SYMsm Description
224	0xE0	Not Used
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.
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.

Return Code		Definition/ SYMsm Description
232 (5.33 only)	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 Customer Support Representative to resolve this problem.
265 (5.42 only)	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 Customer 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 Storage Manager 8.2 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                      Storage Manager 8.2 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\tdata..."
        v2Header =
"Hdr\tver#\tSeq#\tEvent#\tTimestamp\tDevice\tId\tOrigin\tlunNum\tctlr\tcat\tcmpTyp\tcmpLoc\tl
ocVal\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

Notices

This publication was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this publication to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product, and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

IBM
AIX
e (logo) server
IntelliStation
Netfinity
pSeries
Predictive Failure Analysis

TotalStorage
xSeries

Intel and Pentium III are trademarks of Intel Corporation in the United States, other countries, or both.

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

Other company, product, or service names may be the trademarks or service marks of others.

Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1000000 bytes, and GB stands for approximately 1000000000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory may require replacement of the standard memory with an optional memory module.

IBM makes no representation or warranties regarding non-IBM products and services that are ServerProven®, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. These products are offered and warranted solely by third parties.

Unless otherwise stated, IBM makes no representations or warranties with respect to non-IBM products. Support (if any) for the non-IBM products is provided by the third party, not IBM.

Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.

Electronic emission notices

Federal Communications Commission (FCC) statement

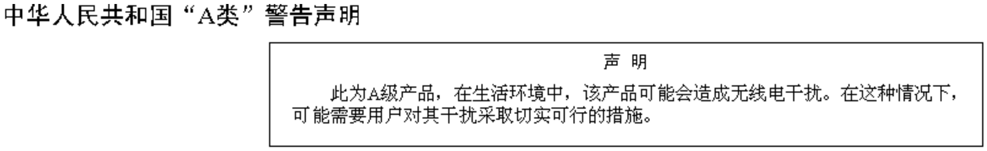
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits.IBM is not responsible for any radio or television interference causedby using other than recommended cables and connectors or by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Chinese class A compliance statement

Attention: This is a class A statement. In a domestic environment, this product might cause radio interference in which case the user might be required to take adequate measures.



中华人民共和国“A类”警告声明

声 明

此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取切实可行的措施。

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The Limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Taiwan electrical emission statement

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

Japanese Voluntary Control Council for Interference (VCCI) statement

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

Glossary

This glossary provides definitions for the terminology used for the IBM TotalStorage FAStT. This glossary also provides definitions for the terminology used for the IBM TotalStorage FAStT Storage Manager.

This glossary defines technical terms and abbreviations used in this document. If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at: www.ibm.com/networking/nsg/nsgmain.htm

This glossary also includes terms and definitions from:

- *Information Technology Vocabulary* by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- *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.

AT. See *advanced technology (AT) bus architecture*.

ATA. See *AT-attached*.

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.

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*.

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 services monitor (ESM) canister. A component in a drive 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 services monitor canister*.

EXP. See *expansion unit*.

expansion port (E_port). A port that connects the switches for two fabrics.

expansion unit (EXP). A feature that can be connected to a system unit to provide additional storage and processing capacity.

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 FAStT 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*.

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 FAStT 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*.

isolated group. A collection of isolated devices not connected to the storage area network (SAN) but discovered by the SANavigator tool. The isolated group displays with a gray background near the bottom of the Physical and Data Path maps.

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 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 groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path maps.

loop port. A node port (N_port) or fabric port (F_port) that supports arbitrated loop functions associated with an arbitrated loop topology.

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*.

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.

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.

model. The model identification that is assigned to a device by its manufacturer.

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.

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*.

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 that appears as a single volume to the server and are fault tolerant through mirroring or parity checking.

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.

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*.

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 FAStT 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 FAStT Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and expansion units in a FAStT 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 FAStT 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 time-out. The maximum amount of time the SANavigator tool will wait for a device to respond to a request. The specified time applies to one retry only.

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 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 FAStT 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.

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 groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path maps.

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.

vendor. Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered, but will always remain editable.

worldwide name (WWN). A unique identifier for a switch on local and global networks.

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. A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.

Index

Readers' Comments — We'd Like to Hear from You

IBM TotalStorage FAStT
Problem Determination Guide

Publication No. GC26-7642-00

Overall, how satisfied are you with the information in this book?

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	□	□	□	□	□

How satisfied are you that the information in this book is:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Accurate	□	□	□	□	□
Complete	□	□	□	□	□
Easy to find	□	□	□	□	□
Easy to understand	□	□	□	□	□
Well organized	□	□	□	□	□
Applicable to your tasks	□	□	□	□	□

Please tell us how we can improve this book:

Thank you for your responses. May we contact you? □ Yes □ No

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate without incurring any obligation to you.

Name

Address

Company or Organization

Phone No.

Readers' Comments — We'd Like to Hear from You
GC26-7642-00

Cut or Fold
Along Line

Fold and Tape **Please do not staple** Fold and Tape

NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 40 ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

International Business Machines Corporation
Information Development
Department GZW
9000 South Rita Road
Tucson, Arizona
U.S.A 85744-0001

Fold and Tape **Please do not staple** Fold and Tape

Cut or Fold
Along Line

Printed in USA

GC26-7642-00