SSA Adapters

User's Guide and Maintenance Information

IBM

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Contents

Safety Notices

For a translation of the *danger* and *caution* notices contained in this book, see the *Safety Information* manual, SA23-2652.

Definitions of Safety Notices

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

This book contains no *danger* notices.

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

This book contains one *caution* notice. That caution notice is in this safety section.

An *attention* notice indicates an action that could cause damage to a program, device, system, or data.

Safety Notice for Installing, Relocating, or Servicing

Before connecting or removing any cables to or from connectors at the using system, be sure to follow the steps in the installation or relocation checklist specified in the *Installation and Service Guide* for your using system. For safety checks when servicing, refer to that manual and to the *Installation and Service Guide* for your subsystem.

CAUTION:
A lithium battery can cause fire, explosion, or a severe burn. Do not recharge, disassemble, heat above 100°C (212°F), solder directly to the cell, incinerate, or expose cell contents to water. Keep away from children. Replace only with the part number specified with your system. Use of another battery might present a risk of fire or explosion.

The battery connector is polarized; do not try to reverse the polarity.

Dispose of the battery according to local regulations.

A module on each of the following adapters contains a lithium battery:
- SSA 4-Port RAID Adapter (type 4–I)
- PCI SSA 4-port RAID Adapter (type 4–J)
- The Fast-Write Cache Option Card (if present) of a Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)
- The Fast-Write Cache Option Card (if present) of a PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

About This Book

Who Should Use This Book

This book is for people who operate or service a RISC system that contains one or more SSA adapters. To follow the instructions in this book, you should be familiar with the basic operational procedures for a RISC system.

What This Book Contains

Part 1 of this book is mainly for the user. It describes:

- The SSA adapters
- SSA loops
- The RAID facilities that are provided by the various RAID adapters
- How to use the RAID configuration utility to configure arrays of SSA disk drives, and how to deal with problems such as the failure of a disk drive in a RAID array
- How to configure the Fast-Write feature
- SSA error logs
- How to use the SSA Command Line Interface
- How to use the programming interface

Part 2 of this book is mainly for service representatives. It describes:

- General technical topics about the SSA adapters
- Removal and replacement procedures
- How to use the SSA Command Line Utilities
- The SSA service aids
- Problem determination procedures, including Service Request Numbers (SRNs) and Maintenance analysis procedures (MAPs)

The appendix contains the communications statements for the adapters.

A glossary and an index are provided.

If You Need More Information

The *Problem Solving Guide and Reference*, SC23-2204, is the first book you should use if you have a problem with your system.

Other books that you might need are:
- The operator guide for your system
- *Diagnostic Information for Micro Channel Bus Systems*, SA23-2765
- *Diagnostic Information for Multiple Bus Systems*, SA38-0509
- *Technical Reference* for your adapter

Numbering Convention

In this book:

KB means 1 000 bytes.

MB means 1 000 000 bytes.

GB means 1 000 000 000 bytes.

Part 1. User Information

Chapter 1. Introducing SSA and the SSA Adapters

This chapter describes:

- Serial storage architecture (SSA)
- The SSA adapters

Serial Storage Architecture (SSA)

Serial Storage Architecture (SSA) is an industry-standard interface that provides high-performance fault-tolerant attachment of I/O storage devices. In SSA subsystems, transmissions to several destinations are multiplexed; the effective bandwidth is further increased by spatial reuse of the individual links. Commands are forwarded automatically from device to device along a loop until the target device is reached. Multiple commands can be travelling around the loop simultaneously. SSA retains the SCSI-2 commands, queuing model, and status and sense bytes.

The SSA 4-Port Adapter (type 4–D)

The SSA 4-Port Adapter (see Figure 1 on page 4) is a Micro Channel bus-master adapter that serves as the interface between systems that use Micro Channel architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain a maximum of two pairs of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "SSA Adapter".

1	Connector B2	**5**	Green light
2	Green light	**6**	Connector A1
3	Connector B1	**7**	Type-number label
4	Connector A2		
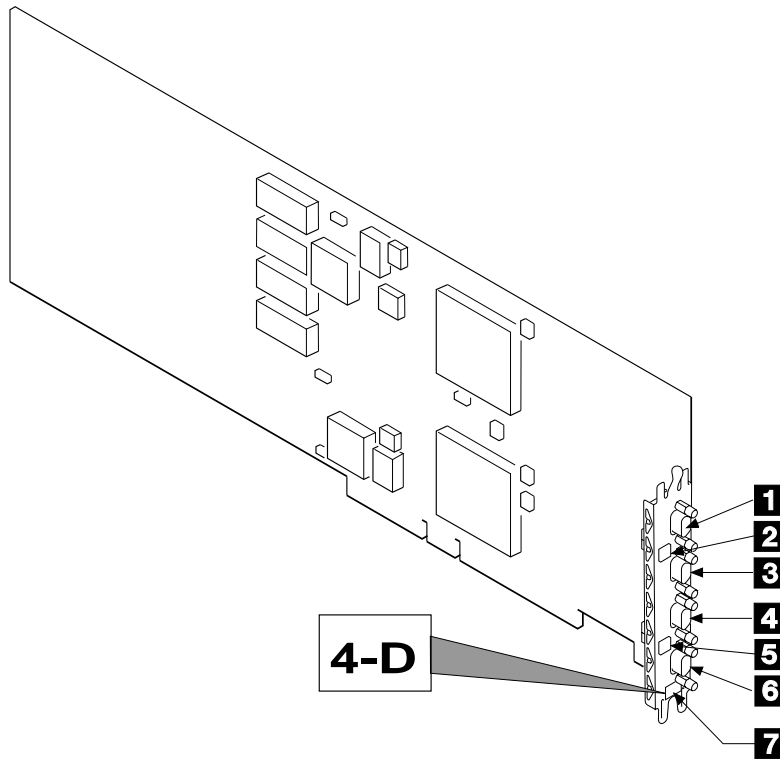
Figure 1. The SSA 4-Port Adapter Card (Type 4–D)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

Lights of the 4-Port Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
　　　　Both SSA links are active (normal operating condition).

Slow Flash
　　　　Only one SSA link is active.

Port Addresses of the 4-Port Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The Enhanced SSA 4-Port Adapter (type 4–G)

The Enhanced SSA 4-Port Adapter (see Figure 2 on page 6) is a Micro Channel bus-master adapter that serves as the interface between systems that use Micro Channel architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain a maximum of eight pairs of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "SSA Enhanced Adapter".

1	Connector B2	**5**	Green light
2	Green light	**6**	Connector A1
3	Connector B1	**7**	Type-number label
4	Connector A2		
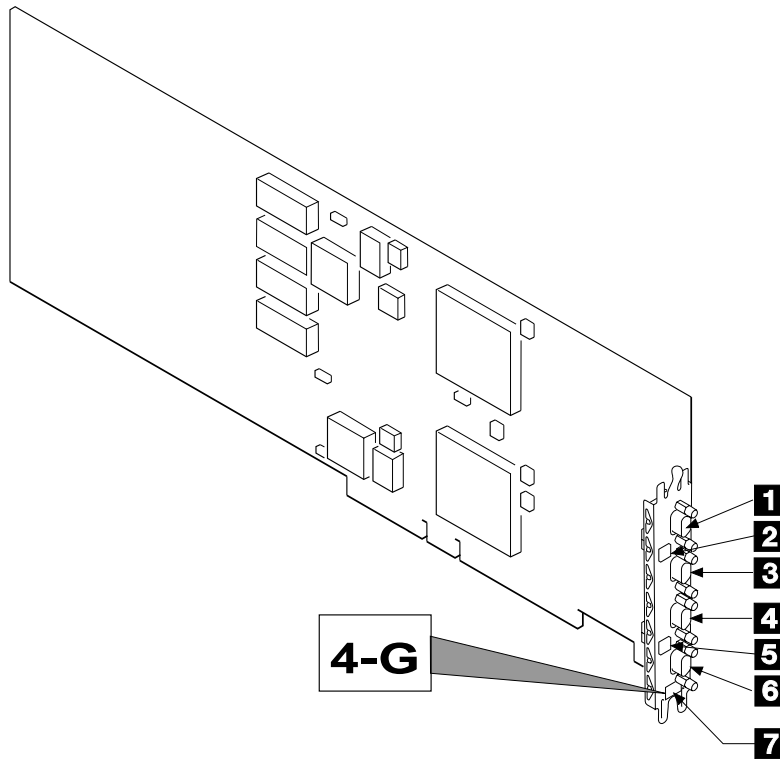
Figure 2. The Enhanced SSA 4-Port Adapter Card (Type 4–G)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

Lights of the Enhanced SSA 4-Port Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
    Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
> Both SSA links are active (normal operating condition).

Slow Flash
> Only one SSA link is active.

Port Addresses of the Enhanced SSA 4-Port Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The SSA 4-Port RAID Adapter (type 4–I)

The SSA 4-Port RAID Adapter (see Figure 3 on page 8) is a Micro Channel bus-master adapter that serves as the interface between systems that use Micro Channel architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain only one pair of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "SSA RAID Adapter".

1 Connector B2
2 Green light
3 Connector B1
4 Connector A2

5 Green light
6 Connector A1
7 Type-number label
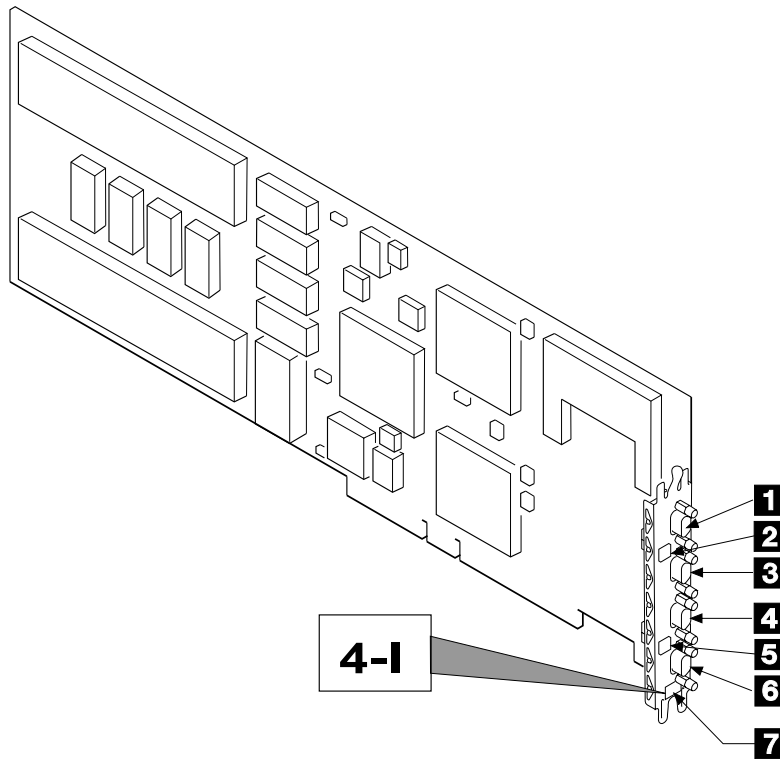
Figure 3. The SSA 4-Port RAID Adapter Card (Type 4–I)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

This adapter also contains *array management software* that provides RAID-5 functions to control the *arrays* of the RAID subsystem (see also "Chapter 3. RAID Functions and Array States" on page 37). An array can have from 3 to 16 *member disk drives*. Each array is handled as *one large disk* by the operating system. The array management software translates requests to this large disk into requests to the member disk drives. Although this adapter is a RAID adapter, it can be configured so that all, some, or none of the disk drives that are attached to it are member disks of arrays.

Lights of the 4-Port RAID Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
     Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
     Both SSA links are active (normal operating condition).

Slow Flash
     Only one SSA link is active.

Port Addresses of the 4-Port RAID Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The PCI SSA 4-Port RAID Adapter (type 4–J)

The PCI SSA 4-Port RAID Adapter (see Figure 4 on page 10) is a Peripheral Component Interconnect (PCI) adapter that serves as the interface between systems that use PCI architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain only one pair of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "IBM SSA RAID Adapter (14104500)".

1	Connector B2	**5**	Green light
2	Green light	**6**	Connector A1
3	Connector B1	**7**	Type-number label
4	Connector A2		
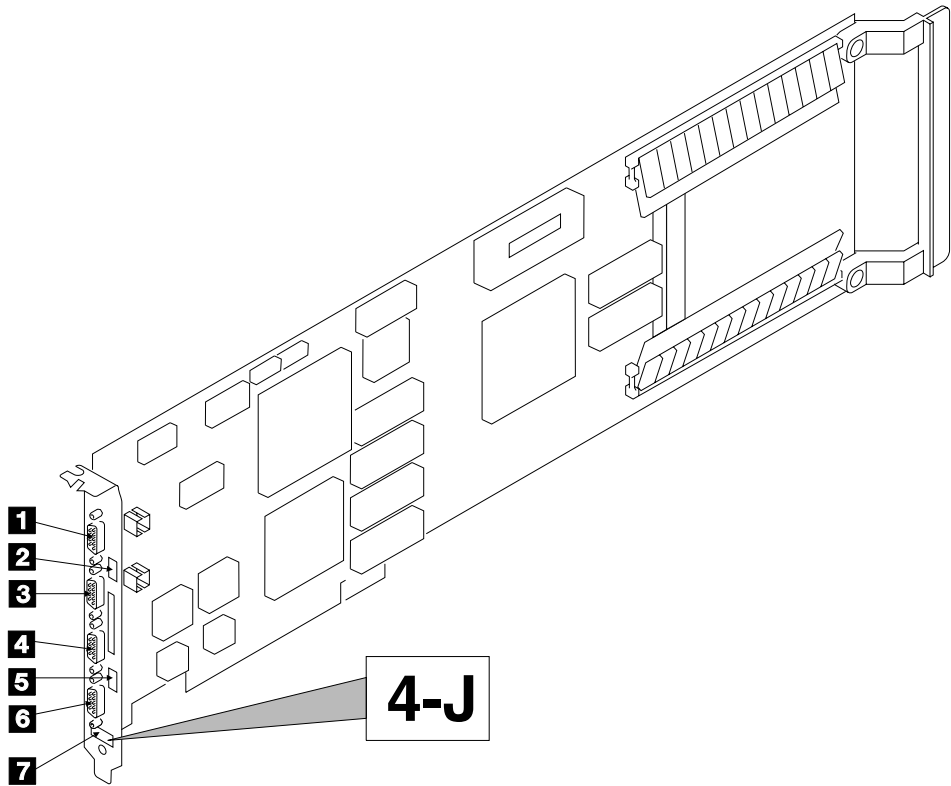
Figure 4. The PCI SSA 4-Port RAID Adapter Card (Type 4–J)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

This adapter also contains *array management software* that provides RAID-5 functions to control the *arrays* of the RAID subsystem (see also "Chapter 3. RAID Functions and Array States" on page 37). An array can have from 3 to 16 *member disk drives.* Each array is handled as *one large disk* by the operating system. The array management software translates requests to this large disk into requests to the member disk drives. Although this adapter is a RAID adapter, it can be configured so that all, some, or none of the disk drives that are attached to it are member disks of arrays.

Lights of the PCI 4-Port RAID Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
Both SSA links are active (normal operating condition).

Slow Flash
Only one SSA link is active.

Port Addresses of the PCI 4-Port RAID Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)

The Micro Channel SSA Multi-Initiator/RAID EL Adapter (see Figure 5 on page 12) is a Micro Channel bus-master adapter that serves as the interface between systems that use Micro Channel architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain a maximum of two pairs of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "IBM SSA Enhanced RAID Adapter".

1 Connector B2	**5** Green light
2 Green light	**6** Connector A1
3 Connector B1	**7** Type-number label
4 Connector A2	

Figure 5. The Micro Channel SSA Multi-Initiator/RAID EL Adapter Card (Type 4–M)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

This adapter also contains *array management software* that provides RAID-5 functions to control the *arrays* of the RAID subsystem (see also "Chapter 3. RAID Functions and Array States" on page 37). An array can have from 3 to 16 *member disk drives*. Each array is handled as *one large disk* by the operating system. The array management software translates requests to this large disk into requests to the member disk drives.

Although this adapter is a RAID adapter, it can be configured so that all, some, or none of the disk drives that are attached to it are member disks of arrays.

The Micro Channel SSA Multi-Initiator/RAID EL Adapter can be connected, by way of one or two SSA loops, to another Micro Channel SSA Multi-Initiator/RAID EL Adapter or to a PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N). The adapters can be either in the same using system, or in separate using systems. (See "Two Loops with Two Adapters" on page 25 for further details.) In such a configuration, all the disk drives can be non-array disk drives. If the microcode of both adapters is at level 50 or higher, those disk drives can alternatively be configured as members of RAID-5 arrays.

Up to eight Micro Channel SSA Multi-Initiator/RAID EL Adapters, PCI SSA Multi-Initiator/RAID EL Adapters, or adapters of both types, can be connected in one SSA loop if all the following conditions are true:

- No disk drive is a member of a RAID-5 array.
- No disk drive is configured for fast-write operations (see "Fast-Write Cache Feature").
- All the adapters have microcode that is at level 50 or higher.

Fast-Write Cache Feature

An optional 4 MB Fast-Write Cache feature is available for the Micro Channel SSA Multi-Initiator/RAID EL Adapter. This feature improves performance for jobs that include many write operations.

This feature can be used only in SSA loops that contain one SSA adapter.

Lights of the Micro Channel SSA Multi-Initiator/RAID EL Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
Both SSA links are active (normal operating condition).

Slow Flash
Only one SSA link is active.

The Micro Channel SSA Multi-Initiator/RAID EL Adapter also has an activity light. This light is located on the actual adapter card, rather than on the SSA connector and light assembly. The light flickers when the adapter is running I/O operations. When the light is not flickering, either the using system has not requested any I/O operations, or the adapter has failed. The activity light might not be visible on all using systems.

Port Addresses of the Micro Channel SSA Multi-Initiator/RAID EL Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

The PCI SSA Multi-Initiator/RAID EL Adapter (see Figure 6 on page 15) is a Peripheral Component Interconnect (PCI) adapter that serves as the interface between systems that use PCI architecture and devices that use Serial Storage Architecture (SSA). This adapter provides support for two SSA loops. Each loop can contain a maximum of two pairs of adapter connectors and a maximum of 48 disk drives. See also "Rules for SSA Loops" on page 29.

Note: In the SSA service aids, this adapter is called "IBM SSA Enhanced RAID Adapter (14104500)".

| 1 | Connector B2 | | 5 | Green light |
2	Green light		6	Connector A1
3	Connector B1		7	Type-number label
4	Connector A2			

Figure 6. The PCI SSA Multi-Initiator/RAID EL Adapter Card (Type 4–N)

The adapter card has four SSA connectors that are arranged in two pairs. Connectors A1 and A2 are one pair; connectors B1 and B2 are the other pair.

The SSA links must be configured as loops. Each loop is connected to a pair of connectors at the SSA adapter card. These connectors *must* be a valid pair (that is, A1 and A2 or B1 and B2); otherwise, the disk drives on the loop are not fully configured, and the diagnostics fail. Operations to all the disk drives on a particular loop can continue if that loop breaks at any one point.

This adapter also contains *array management software* that provides RAID-5 functions to control the *arrays* of the RAID subsystem (see also "Chapter 3. RAID Functions and Array States" on page 37). An array can have from 3 to 16 *member disk drives*. Each array is handled as *one large disk* by the operating system. The array management software translates requests to this large disk into requests to the member disk drives. Although this adapter is a RAID adapter, it can be configured so that all, some, or none of the disk drives that are attached to it are member disks of arrays.

Chapter 1. Introducing SSA and the SSA Adapters **15**

The PCI SSA Multi-Initiator/RAID EL Adapter can be connected, by way of one or two SSA loops, to another PCI SSA Multi-Initiator/RAID EL Adapter or to a Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M). The adapters can be either in the same using system, or in separate using systems. (See "Two Loops with Two Adapters" on page 25 for further details.) In such a configuration, all the disk drives can be non-array disk drives. If the microcode of both adapters is at level 50 or higher, those disk drives can alternatively be configured as members of RAID-5 arrays.

Up to eight PCI SSA Multi-Initiator/RAID EL Adapters, Micro Channel SSA Multi-Initiator/RAID EL Adapters, or adapters of both types, can be connected in one SSA loop if all the following conditions are true:

- No disk drive is a member of a RAID-5 array.
- No disk drive is configured for fast-write operations (see "Fast-Write Cache Feature").
- All the adapters have microcode that is at level 50 or higher.

Fast-Write Cache Feature

An optional 4 MB Fast-Write Cache feature is available for the PCI SSA Multi-Initiator/RAID EL Adapter. This feature improves performance for jobs that include many write operations.

This feature can be used only in SSA loops that contain one SSA adapter.

Lights of the PCI SSA Multi-Initiator/RAID EL Adapter

Each pair of connectors has a green light that indicates the operational status of its related loop:

Status of Light
    Meaning

Off   Both SSA connectors are inactive. If disk drives or other SSA adapters are connected to these connectors, either those disk drives or adapters are failing, or their SSA links are not active.

Permanently on
    Both SSA links are active (normal operating condition).

Slow Flash
    Only one SSA link is active.

The PCI SSA Multi-Initiator/RAID EL Adapter also has an activity light. This light is located on the actual adapter card, rather than on the SSA connector and light assembly. The light flickers when the adapter is running I/O operations. When the light is not flickering, either the using system has not requested any I/O operations, or the adapter has failed. The activity light might not be visible on all using systems.

Port Addresses of the PCI SSA Multi-Initiator/RAID EL Adapter

The port addresses used in some SRNs that relate to these adapters can be numbers 0 through 3. They correspond to the port connectors on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

SSA Adapter ID during Bring-Up

All adapters that can be used on RISC using systems generate a three-digit configuration program indicator number. During system bring-up, this indicator number appears on the three-digit display of the using system. The numbers are:

80C	SSA 4-Port Adapter (type 4-D) is being identified or configured.
80C	Enhanced SSA 4-Port Adapter (type 4-G) is being identified or configured.
80C	SSA 4-Port RAID Adapter (type 4-I) is being identified or configured.
80C	PCI SSA 4-Port RAID Adapter (type 4-J) is being identified or configured.
80C	SSA Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4-M) is being identified or configured.
80C	PCI SSA Multi-Initiator/RAID EL Adapter (type 4-N) is being identified or configured.

Booting the Using System

Micro Channel systems can be booted only from AIX system disk drives. They *cannot* be booted from:

- RAID arrays
- Disk drives that have the fast-write function enabled

PCI systems can be booted only from non-SSA disk drives. They *cannot* be booted from:

- SSA disk drives
- RAID arrays
- Disk drives that have the fast-write function enabled

Chapter 2. Introducing SSA Loops

This chapter describes the principles of SSA loops, how SSA devices are known to the system programs, and the rules that you must observe when you configure your SSA loops.

Loops, Links, and Data Paths

In the simplest SSA configuration, SSA devices are connected through two or more SSA links to an SSA adapter that is located in a using system. The devices, SSA links, and SSA adapter are configured in loops. Each loop provides a data path that starts at one connector of the SSA adapter and passes through a link (SSA cable) to the devices. The loop continues through the devices, then returns through another link to a second connector on the SSA adapter.

The maximum permitted length for an external copper cable that connects two SSA nodes (for example, disk drives) is 25 meters (82 feet).

The maximum permitted length for an external fiber optic cable that connects two SSA nodes (for example, disk drives) is 2.4 kilometers (7874 feet).

Details of the rules for configuring SSA loops are given for each SSA adapter in "Rules for SSA Loops" on page 29.

Simple Loop

Figure 7 on page 20 shows a simple SSA loop. The devices that are attached to the SSA adapter card **1** are connected through SSA links **2** . These SSA links are configured as a loop. Data and commands to a particular device pass through all other devices on the link between the adapter and the target device.

Data can travel in either direction round the loop. The adapter can, therefore, get access to the devices **3** (disk drives in this example) through two data paths. The using system cannot detect which data path is being used.
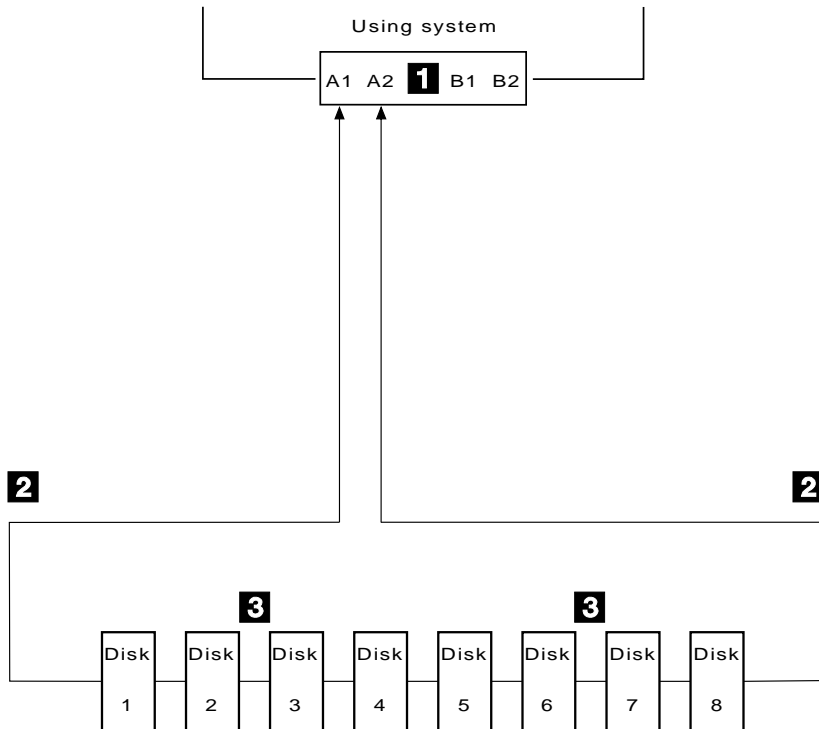
Figure 7. Simple Loop

Simple Loop — One Disk Drive Missing

If a disk drive fails, or is switched off, the loop is broken, and one of the data paths to a particular disk drive is no longer available. The disk drives on the remainder of the loop continue to work, but an error is reported to the system.

In Figure 8 on page 21, disk drive number 3 has failed. Disk drives 1 and 2 can communicate with the using system only through connector A1 of the SSA adapter. Disk drives 4 through 8 can communicate only through connector A2 of the SSA adapter.
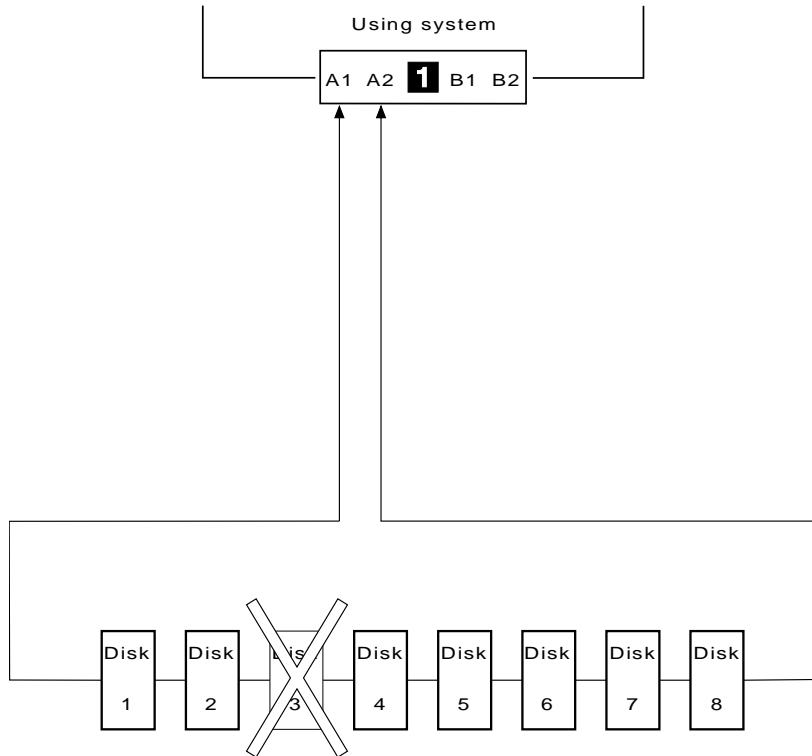
Figure 8. Simple Loop with One Disk Drive Missing

Simple Loop — Two Disk Drives Missing

If two or more disk drives are switched off, fail, or are removed from the loop, some disk drives might become isolated from the SSA adapter.

In Figure 9 on page 22, disk drives 3 and 7 have been removed. Disk drives 1 and 2 can communicate with the using system only through connector A1 of the SSA adapter. Disk drive number 8 can communicate with the using system only through connector A2 of the SSA adapter. Disk drives 4, 5, and 6 are isolated from the SSA adapter.
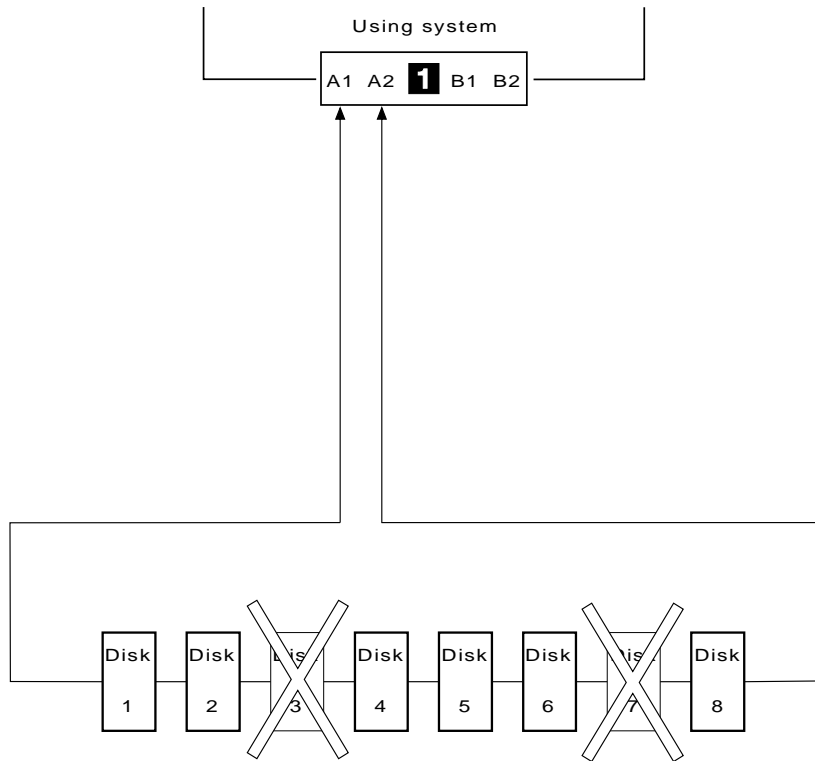
Figure 9. Simple Loop with Two Disk Drives Missing

One Loop with Two Adapters in One Using System

In Figure 10 on page 23, the loop contains two SSA adapters **1** and **2** that are both in the same using system. In this configuration, all the disk drives can still communicate with the using system if one SSA adapter fails.

Using System

A1 A2 **1** B1 B2   A1 A2 **2** B1 B2

| Disk 16 | Disk 15 | Disk 14 | Disk 13 | Disk 12 | Disk 11 | Disk 10 | Disk 9 |

| Disk 1 | Disk 2 | Disk 3 | Disk 4 | Disk 5 | Disk 6 | Disk 7 | Disk 8 |
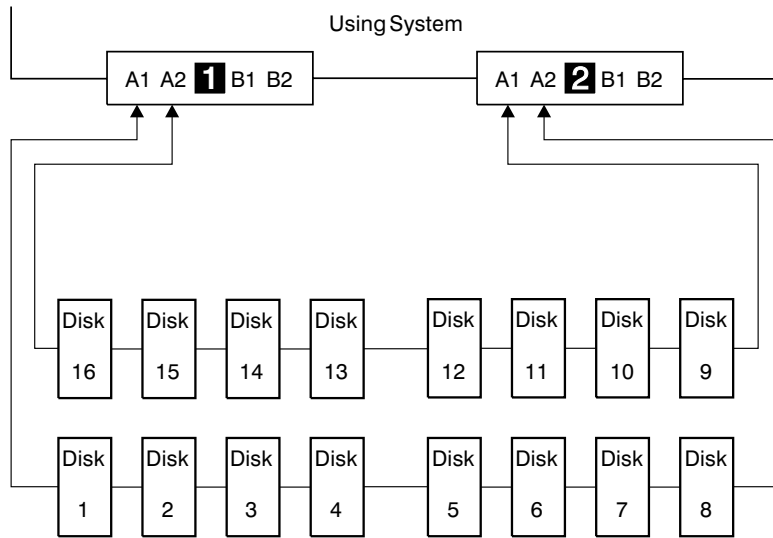
Figure 10. One Loop with Two Adapters in One Using System

One Loop with Two Adapters in Each of Two Using Systems

If the loop contains four SSA adapters, with two adapters in each of two using systems, disk drives become isolated if they are connected between the two adapters of one using system, and both those adapters fail, or are held reset, *but remain powered on.*

Bypass Note: Your SSA Disk Subsystem, or SSA Disk Enclosure, might contain bypass cards. Each bypass card can switch the internal strings of the subsystem, or enclosure, if it detects that neither of its connectors is connected to a powered-on SSA adapter or device. Therefore, if the two SSA adapters fail, or are held reset, but remain powered on, the bypass card does not operate, and the disk drives become isolated. (For more information about bypass cards, see the publications for your disk subsystem or enclosure.)

In Figure 11 on page 24, SSA adapters **1** and **2** are in using system 1; SSA adapters **3** and **4** are in using system 2. In each using system, the two adapters are connected to each other.

If the two SSA adapters of either using system fail, or are held reset, but remain powered on, all the disk drives can still communicate with the other using system.
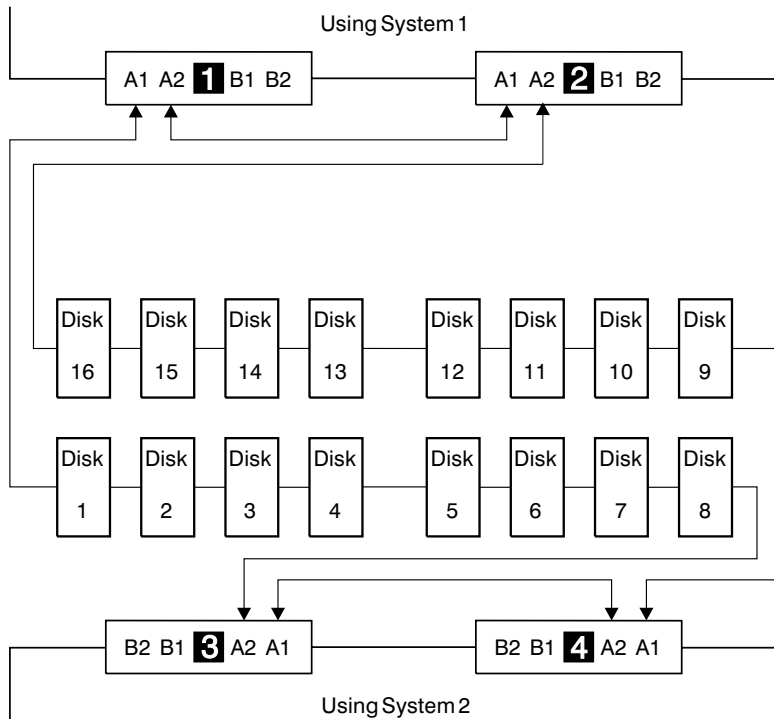
Figure 11. One Loop, Two Adapters in Each of Two Using Systems

If, however, disk drives are connected into the link between two SSA adapters that are in the same using system, those disk drives become isolated if both SSA adapters fail, or are held reset, but remain powered on (see also "Bypass Note" on page 23). In Figure 12 on page 25, disk drives 13 through 16 have been connected between the SSA adapters in using system 1. If both adapters fail, or are held reset, but remain powered on, disk drives 1 through 12 can still communicate with using system 2. Disk drives 13 through 16, however, cannot communicate with using system 2, because their data paths are through the adapters in using system 1. When using system 1 is rebooted, disk drives 13 through 16 remain unavailable for a long time.
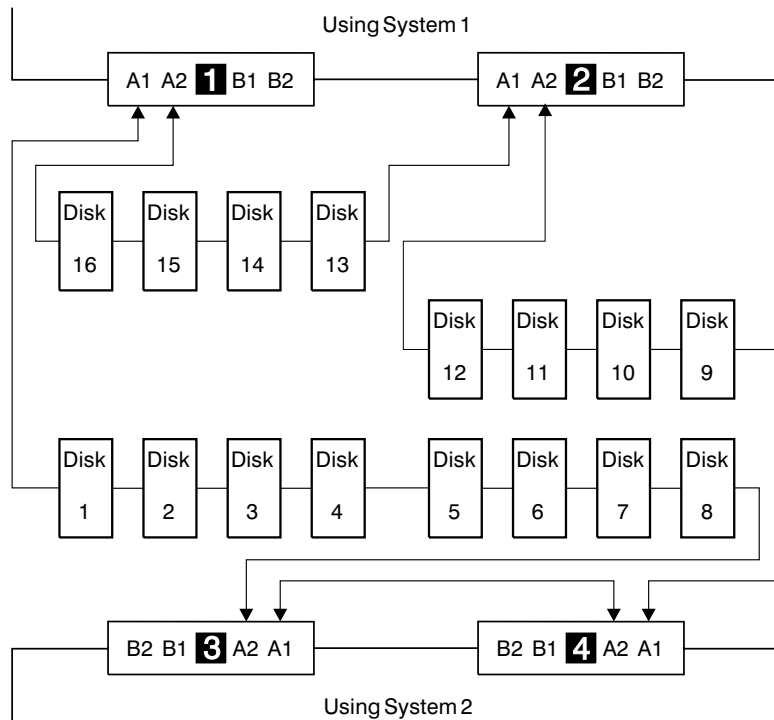
Figure 12. Disk Drives Isolated by Failing Using System

Two Loops with Two Adapters

The following types of SSA adapter can be connected in one or two SSA loops that contain SSA disk drives and two SSA adapters. (See "Rules for SSA Loops" on page 29 for information about the disk drive configurations that are allowed with each adapter.)

- Two SSA 4-Port Adapters (type 4–D)
- Two Enhanced SSA 4-Port Adapters (type 4–G)
- One SSA 4-Port Adapter (type 4–D) and One Enhanced SSA 4-Port Adapter (type 4–G)
- Two Micro Channel SSA Multi-Initiator/RAID EL Adapters (type 4–M)
- Two PCI SSA Multi-Initiator/RAID EL Adapters (type 4–N)
- One Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M) and one PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

Note: The fast-write functions and RAID functions that are mentioned in this section are available only on the Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M) and the PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N).

The two adapters can provide support for up to 96 SSA disk drives (a maximum of 48 per loop). The disk drives must be configured as non-RAID disk drives. In this type of configuration, the disk drives cannot be configured for fast-write operations.

Figure 13 shows an example configuration that has two loops and two adapters:
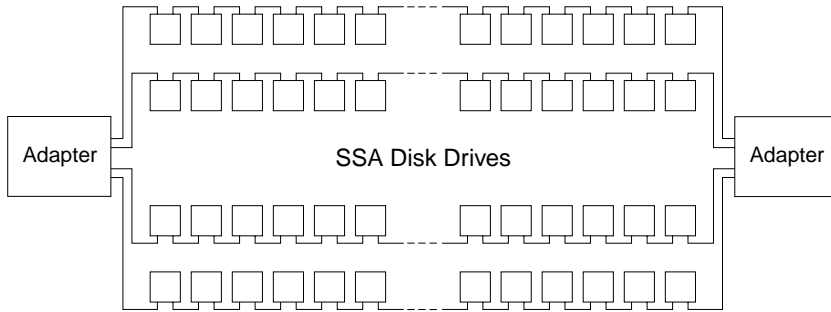
Figure 13. Two Loops with Two Adapters

Two Loops with One Adapter

Note: The fast-write functions and RAID functions that are mentioned in this section are available only on the Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M) and the PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N).

If only one SSA adapter is contained in the SSA loops, the adapter can provide support for up to 96 disk drives (a maximum of 48 per loop). The disk drives can be configured as:

- Disk drives that are members of RAID-5 arrays
- Disk drives that are not in arrays
- Hot spare disk drives for the arrays

Non-RAID disk drives and RAID-5 arrays can be configured for fast-write cache operations.

Figure 14 on page 27 shows an example configuration that has two loops and one adapter:
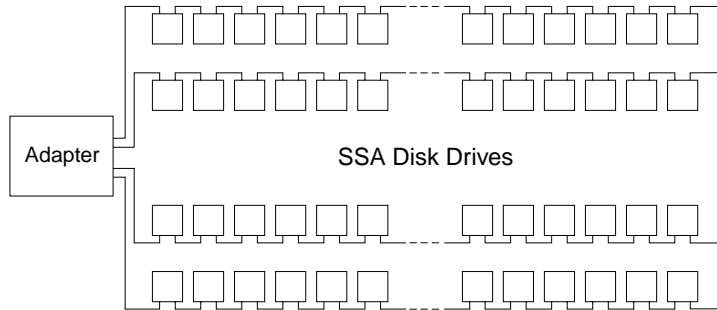
Figure 14. Two Loops with One Adapter

Configuring Devices on an SSA Loop

If an SSA loop contains two or more SSA adapters that are installed in two or more using systems, you must ensure that all those using systems are switched on, and that all the disk drives in all those using systems are configured, as follows:

- If the using systems are Micro Channel systems, and they are all switched off:
    1. Set Secure mode on each using system.
    2. Switch on all the using systems.
    3. When the operator panel on each using system displays 200, set Normal mode to continue the boot process.
- If the using systems are PCI systems, and they are all switched off:
    1. Switch on one using system only.
    2. When the first display (logo) appears on the screen, press F4 *immediately*. The using system goes into System Management Services mode.
    3. Repeat the procedure for each using system in the SSA loop.
    4. When all the using systems are in System Management Services mode, press F9 to continue the boot process.
- If one or more using systems are switched on (Micro Channel or PCI):
    1. Switch on the remaining using systems.
    2. On each using system:
        a. Run the **cfgmgr** command to configure all the disk drives.
        b. Manually **vary on** the volume groups and mount the file systems as required.

Identifying and Addressing SSA Devices

This section describes how SSA adapters and devices are known to the using system programs.

Location Code Format

Location codes identify the locations of adapters and devices in the using system and its attached subsystems and devices. These codes are displayed when the diagnostic programs isolate a problem. For information about the location codes that are used by the using system, see the *Operator Guide* for the using system.

```
A B  -  C D  -  E F  -  G H
```

	Unused
	Unused
	Unused
	P = Physical disk drive
	L = Logical disk drive
	Adapter position (number of the slot, 1 through 8, containing the SSA adapter)
	System I/O bus identifier
	Expansion adapter position
	Expansion drawer
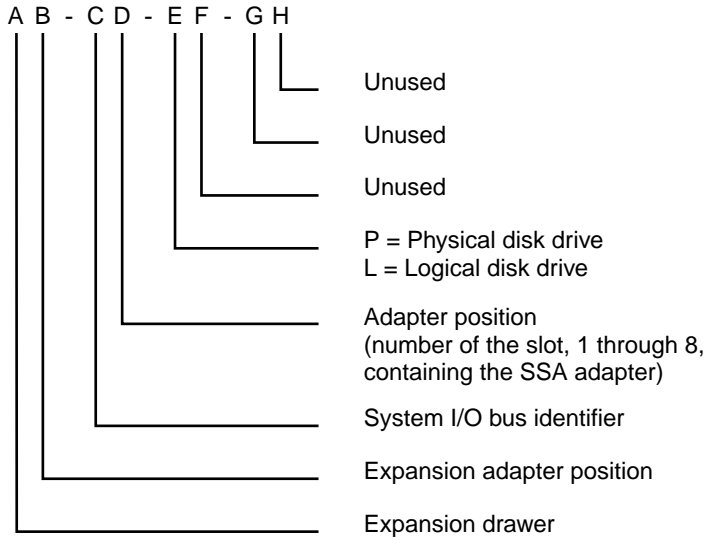
The location code shows only the position of the SSA adapter in the using system and the type of device that is attached. The location of the device within the SSA loop must be found by use of a service aid. The service aids use the IEEE-standard 16-digit unique ID of the device.

Pdisks, Hdisks, and Disk Drive Identification

The *physical* disk drives (**pdisks**) in an SSA subsystem can be configured as logical units (LUNs). A LUN is also known as an **hdisk**, and can consist of one or more physical disk drives. An hdisk in an SSA subsystem might, therefore, consist of one pdisk or several pdisks.

The configuration software allocates an identification (hdisk and pdisk number) to each disk drive during the configuration of the SSA link. The disk drives do not have fixed physical addresses.

The numeric identifiers of pdisks, hdisks, and the disk drive slots are not related to each other. For example, pdisk1 is not necessarily in slot 1 of the physical unit in which it is installed.

The configuration software first recognizes the disk drive by its machine-readable serial number. The serial number of the disk drive is also displayed by the service aids. The service aids show the number as the last eight digits of the IEEE SSA Unique ID.

Service actions are always related to physical disk drives. For this reason, errors that occur on SSA disk drives are always logged against the physical disk drive (pdisk).

If a disk drive that has been formatted on a machine of a particular type (for example, a Personal System/2) is later installed into a using system that is of a different type (for example, an RS/6000), that disk drive is configured only as a pdisk during the configuration of the using system.

SSA Unique IDs

Each SSA device has a specific identifier that is not used by any other SSA device in the whole world. This identifier is called the IEEE SSA Unique ID (UID) of the device. It is written into the device during manufacture.

The full UID consists of 16 characters. The label on the side of a disk drive shows the full UID. The label on the front of a disk drive shows the serial number of the disk drive. The serial number is actually part of the UID. Also part of the UID, the Connection Address consists of the LUN name and the device-type identifier. The software uses this information to access the device.

```
Full UID                        0000XXXXXXNNNNNN
Disk drive serial number              XXNNNNNN
Connection Address                 XXXXXXNNNNNNLLD
```

where:

XXXXXX	=	IEEE Organization Identifier (manufacturer)
NNNNNN	=	Product / ID (assigned unique number)
LL	=	LUN (always 00 for a LUN device)
D	=	**Device type:**
		(D for an SSA Physical disk drive)
		(E for a fast-write logical disk)
		(K for RAID-5 array)

You might need to know the UID of a disk drive if you want to use the **mkdev** command to give that disk drive a specific hdisk number.

Rules for SSA Loops

- For SSA loops that include an SSA 4-Port Adapter (type 4–D) or an Enhanced SSA 4-Port Adapter (type 4–G), the following rules apply:
  - Each SSA loop must be connected to a valid pair of connectors on the SSA adapter (that is, either connectors A1 and A2, or connectors B1 and B2).
  - Only one of the two pairs of connectors on an adapter card can be connected in a particular SSA loop.
  - A maximum of 48 devices can be connected in a particular SSA loop.

- A maximum of two pairs of adapter connectors can be connected in a particular loop if one adapter is an SSA 4-Port Adapter (type 4–D).
- A maximum of eight pairs of adapter connectors can be connected in a particular SSA loop if all the adapters are Enhanced SSA 4-Port Adapters (type 4–G).
- A maximum of two SSA adapters, that are connected in a particular SSA loop, can be installed in a particular using system.

- For SSA loops that include an SSA 4-Port RAID Adapter (type 4–I) or a PCI SSA 4-Port RAID Adapter (type 4–J), the following rules apply:
  - Each SSA loop must be connected to a valid pair of connectors on the SSA adapter (that is, either connectors A1 and A2, or connectors B1 and B2).
  - Only one pair of adapter connectors can be connected in a particular SSA loop.
  - A maximum of 48 devices can be connected in a particular SSA loop.
  - Member disk drives of an array can be on either SSA loop.

- For SSA loops that include a Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M) or a PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N), the following rules apply:
  - Each SSA loop must be connected to a valid pair of connectors on the SSA adapter (that is, either connectors A1 and A2, or connectors B1 and B2).
  - Only one pair of adapter connectors can be connected in a particular SSA loop.
  - Only one Micro Channel SSA Multi-Initiator/RAID EL Adapter or PCI SSA Multi-Initiator/RAID EL Adapter can be connected in a particular loop if either, or both, of the following conditions are true:
    - At least one disk drive or RAID-5 array in the loop is configured for fast-write operations.
    - The adapter microcode is below level 50 (see "Checking the Level of the Adapter Microcode" on page 31), and one or more disk drives are members of a RAID-5 array.
  - A maximum of two adapters can be connected in a particular loop in either of the following configurations:
    - Either, or both, adapters have microcode below level 50 (see "Checking the Level of the Adapter Microcode" on page 31), and no disk drive is a member of a RAID-5 array or configured for fast-write operations.
    - Both adapters have microcode at level 50 or higher, any disk drive is a member of a RAID-5 array, and no disk drive or array is configured for fast-write operations.

    The adapters can be two Micro Channel SSA Multi-Initiator/RAID EL Adapters, two PCI SSA Multi-Initiator/RAID EL Adapters, or one adapter of each type.
  - A maximum of eight adapters can be connected in a particular loop if all the adapters have microcode at level 50 or higher (see "Checking the Level of the Adapter Microcode" on page 31), and no disk drive is a member of a RAID-5 array or configured for fast-write operations.

    The adapters can be Micro Channel SSA Multi-Initiator/RAID EL Adapters, PCI SSA Multi-Initiator/RAID EL Adapters, or adapters of both types.
  - All member disk drives of an array must be on the same SSA loop.

- A maximum of 48 devices can be connected in a particular SSA loop.
- When an SSA adapter is connected to two SSA loops, and each loop is connected to other adapters, all adapters must be connected to both loops (see Figure 13 on page 26).

Checking the Level of the Adapter Microcode

If you need to check the level of the adapter microcode:

1. Type, on the command line:

   ```
   lscfg -vl ssan
   ```

   where ssan is the name of the adapter whose microcode you are checking; for example, ssa0.

   A list of vital product data (VPD) is displayed.

2. Find **ROS Level and ID**. The first two characters of this field show the level of the adapter microcode. For example, 50nn (where n is a digit 0 through 9) shows a microcode level of 50.

Rules for the Physical Relationship between Disk Drives and Adapters

The physical relationship between the disk drives and the adapters in an SSA loop can affect the performance of the subsystem. The following rules help you to get best performance from your subsystem.

One Pair of Adapter Connectors in the Loop

The following sequence enables you to determine the best relationship between the disk drives and the adapter on an SSA loop that contains only one pair of adapter connectors.

1. Determine which data is accessed most frequently.
2. Assign that data to those disks drives that are farthest (round the loop) from the adapter connectors. By doing this, you prevent the activity of the busiest disk drive from obstructing the data path to the other disk drives.

For example, the loop that is shown in Figure 15 on page 32 contains 16 disk drives, and the adapter connectors are between disk drives 1 and 16. The most-frequently-accessed data, therefore, should be on disk drives 8 and 9.
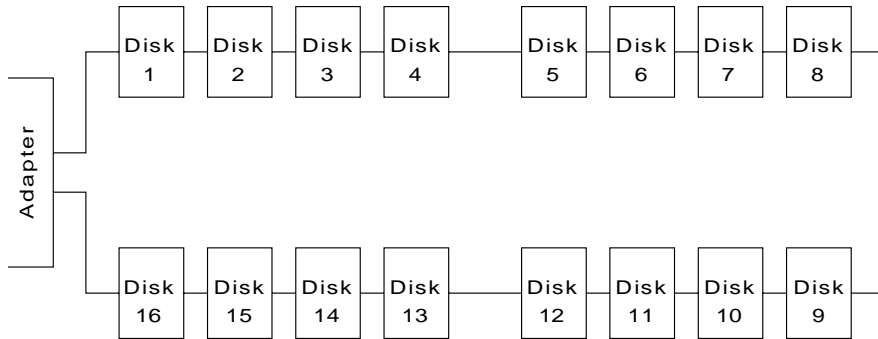
Figure 15. One Pair of Connectors in the Loop

Pairs of Adapter Connectors in the Loop – Some Shared Data

The following sequence enables you to determine the best relationship between the disk drives and the adapter on an SSA loop that contains two or more pairs of adapter connectors. Some of the disk drives share data access with other disk drives.

1. For each pair of connectors, identify all the data that the loop is to access.

2. For each pair of connectors, identify the data that the loop is to access most frequently.

3. Assign the data for each pair of adapter connectors to the disk drives that are connected immediately next to the pair of connectors in the loop. Assign the most-frequently-accessed data to those disk drives that are farthest from the adapter connectors. By doing this, you prevent the activity of the busiest disk drive from obstructing the data path to the other disk drives.

For example, the loop that is shown in Figure 16 on page 33 contains 16 disk drives. The connectors of adapter A are between disk drives 1 and 16, and the connectors of adapter B are between disks 8 and 9. Therefore:

• Adapter A should access disk drives 1 through 4 and disk drives 13 through 16. The most-frequently-accessed data should be on disk drives 4 and 13.

• Adapter B should access disk drives 5 through 8 and disk drives 9 through 12. The most-frequently-accessed data should be on disk drives 5 and 12.
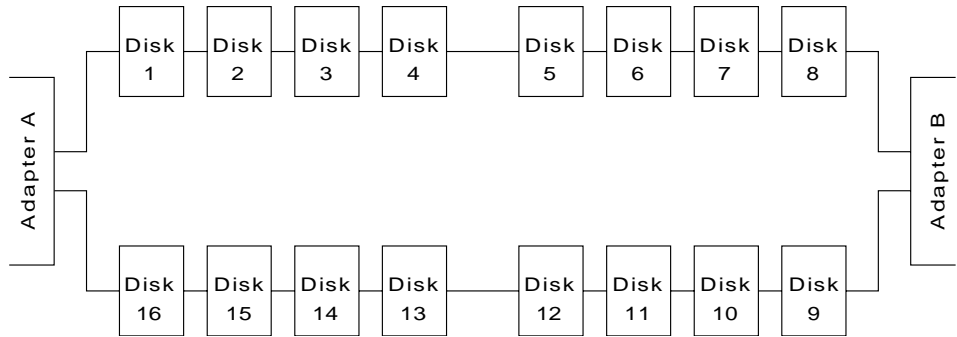
Figure 16. Pairs of Connectors in the Loop – Some Shared Data

Pairs Of Adapter Connectors in the Loop – Mainly Shared Data

The following sequence enables you to determine the best relationship between the disk drives and the adapter, or adapters, on an SSA loop that contains two or more pairs of adapter connectors. Most of the disk drives share data access with each other.

1. Determine which data is shared between the pairs of adapter connectors.
2. Assign this data to the disk drives that are equally spaced between the sharing pairs of adapter connectors.

For example, the loop that is shown in Figure 17 on page 34 contains 16 disks and four adapters. In this loop:

- The pairs of adapter connectors should be spaced between the disk drives.
- Data that is shared by adapters A and B should be put onto disk drives 1 through 4.
- Data that is shared by adapters B and C should be put onto disk drives 5 through 8.
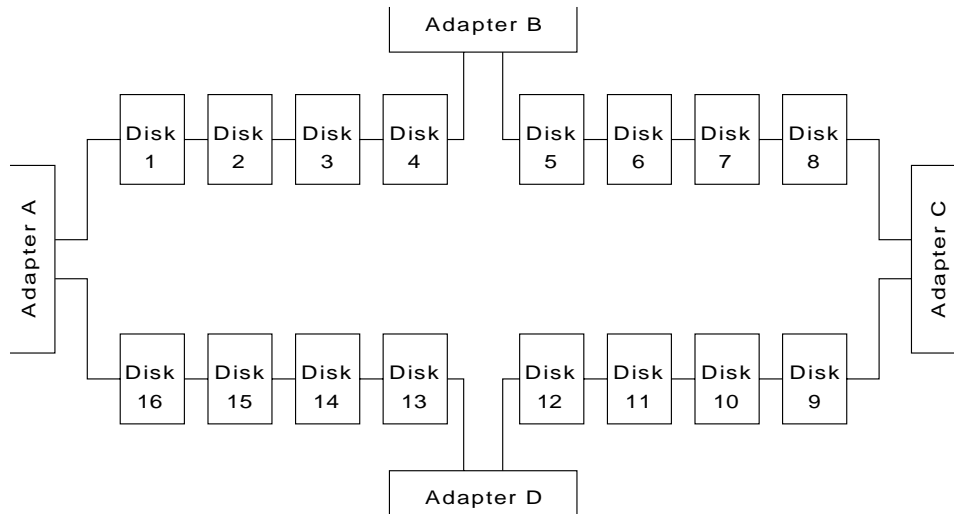
Figure 17. Pairs of Connectors in the Loop – Mainly Shared Data

Note: For configurations such as that shown here, we recommend that the adapters be installed in separate using systems. Otherwise, disk drives can become isolated should both adapters fail, or be held reset, in one of the using systems. See "One Loop with Two Adapters in One Using System" on page 22 and "One Loop with Two Adapters in Each of Two Using Systems" on page 23 for more information.

If two using systems are switched off, disk drives can become isolated if the SSA subsystem does not have bypass cards (see "Bypass Note" on page 23). If more than one using system is rebooted at the same time, disk drives can become isolated while the boot is running.

Reserving Disk Drives

The SSA 4-Port Adapter, the Enhanced SSA 4-Port Adapter, the SSA 4-Port RAID Adapter, and the PCI SSA 4-Port RAID Adapter implement reservation by sending an SSA-SCSI reserve command to the SSA device. The drive is reserved to the adapter that issued the reservation command and remains so until either a release is issued, a device reset is issued, or power is lost to the disk. This means that a disk drive can be reserved to an adapter to which it is no longer connected.

The PCI SSA Multi-Initiator/RAID EL Adapter and the Micro Channel SSA Multi-Initiator/RAID EL Adapter implement reservation by using commands that are sent directly from adapter to adapter. They do not use the SCSI reservation command. The advantages of this method are:

- The AIX Physical Volume ID (PVID) can be read from a reserved drive by system software.

- It is possible to determine which adapter is holding a reservation to a disk using the **ssa_rescheck** command.
- The diagnostics can detect particular failure conditions on reserved drives that they cannot detect with the other reservation method.
- Fencing can be used on a reserved disk.
- Node_number locking is supported. With node_number locking, the drive is not locked to an adapter, but rather to a using system. To do this, each using system in an SSA network must have a unique node number. The node number is stored as the node_number attribute of ssar. It can be queried with the **lsattr** command and set by using the **chdev** command. The **ssavfynn** command (described in "ssavfynn Command" on page 201) can be used to verify that no duplicate node numbers exist.
- If a reservation is challenged (that is, a node that does not hold the reservation attempts to access a reserved SSA logical disk), the adapter verifies that a valid path still exists to the node that is holding the reservation. If no path exists, the reservation is removed, and the new node is allowed access to the disk. This means that, if an adapter is used to reserve a disk and is then disconnected or powered off, that disk becomes effectively unreserved.

Chapter 3. RAID Functions and Array States

This chapter describes the RAID functions and the states of RAID arrays.

RAID Functions

Redundant Array of Independent Disks (RAID) technology provides:
* Larger disk capacity
* Immediate availability and recovery of data
* Redundancy of data at a level that you can choose.

RAID technology stores data across groups of disk drives that are known as *arrays*. These arrays are contained in array subsystems, which can be configured with one or more arrays.

The arrays can provide data redundancy that ensures that no data is lost if one disk drive in the array fails.

The SSA 4-Port RAID Adapter (type 4–I), the PCI SSA 4-Port RAID Adapter (type 4–J), the Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M), and the PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N) provide RAID-5 functions to control the arrays of the RAID subsystem. RAID-5 provides good data *availability* with good performance for workloads that include many read and write operations.

Availability

Availability is an important consideration that can affect the way you configure your arrays. It is the ability of a system to *continue operating*, although one or more of its components have failed. RAID-5 enables the system to continue to access and move data in an array, although a member disk drive of that array has failed.

Disk Drives That Are Not in Arrays

Disk drives that are connected to an SSA RAID adapter do not need to be members of an array. The SSA RAID adapter handles such disk drives in the same way as a non-RAID SSA adapter does. It transfers data directly between the disk drives and the system, and uses no RAID functions.

When first installed, all disk drives are, by default, defined as AIX disks; that is, they are not members of an array. Before they can be added to arrays, you must redefine them so that the system no longer has direct access to them.

Array States

An array can be in one of several states. A knowledge of those states is useful when you are configuring your arrays. The states are described here. A flowchart for the array states is shown in Figure 18 on page 40.

Good State

An array is in the Good state when all the member disk drives of that array are present.

Exposed State

An array enters the Exposed state when a member disk drive becomes missing (logically or physically) from that array. When an array is in the Exposed state, you can reintroduce the missing disk drive, or exchange it for a new one. If the missing disk drive is reintroduced, the array returns to the Good state. The array management software does not need to rebuild the data. If a new disk drive is exchanged for the missing disk drive, the array management software rebuilds the data that was on the original disk drive before it became missing, then writes that rebuilt data to the replacement, disk drive. When the data is correct, the array management software returns the array to the Good state.

Read Operations while in the Exposed State

When a read operation is performed on an array that is in the Exposed state, the array management software recreates the data that was contained on the missing disk drive. On the Micro Channel SSA Multi-Initiator/RAID EL Adapter and the PCI SSA Multi-Initiator/RAID EL Adapter, the array management software immediately exchanges a hot spare disk drive for the missing disk drive, if a hot spare disk drive is enabled and available when the read command is sent.

Write Operations while in the Exposed State

When a write command is sent to an array that is in the Exposed state, the array management software does the following:

- If a hot spare disk drive is enabled and available when the write command is sent, the array management software immediately exchanges the hot spare disk drive for the missing disk drive, and returns the array to the Rebuilding state.
- If no hot spare disk drive is enabled and available, the first write operation causes the array to enter the Degraded state. The written data is not protected. If the power fails during a write operation, data might be lost (64 KB) unless the array is configured to allow read-only operations while in the Exposed state. Most application programs, however, cannot be run when write operations are not allowed.

Degraded State

An array enters the Degraded state if, while in the Exposed state, it receives a write command. If a hot spare disk drive is available, the array management software immediately exchanges the hot spare disk drive for the missing disk drive, and returns the array to the Rebuilding state. If no hot spare disk drive is available, and a write operation is performed on the array, the array remains in the Degraded state until you take action to return that array to the Good state.

While in Degraded state, an array is not protected. If another disk drive in the array fails, or the power fails during a write operation, data might be lost.

You can return the disk drive to the array, or install another disk drive by using the procedure in step 35 on page 272 of MAP 2324: SSA RAID to logically add the device to the array. The array management software starts a rebuilding operation to synchronize the new disk drive with the data that is contained in the other disk drives of the array. This action returns the array to the Good state.

Rebuilding State

Rebuilding state occurs when a disk drive or an adapter is replaced.

Disk Drive Replacement

An array enters Rebuilding state after a missing disk drive has been returned to the array or exchanged for a replacement disk drive. When the array is in this state, all the member disk drives are present, but the data and parity are being rebuilt on the returned or replacement disk drive. The array management software allows read and write operations on a disk drive that is in Rebuilding state. If the power fails before the rebuilding is complete, the array management software restarts the complete rebuilding operation when the power returns.

Adapter Replacement

If, for any reason, an adapter is exchanged for a replacement adapter, the parity is rebuilt on *all* the associated arrays when the replacement adapter powers on.

Offline State

An array enters Offline state when two or more member disk drives become missing. Read and write operations are not allowed.

Array State Flowchart
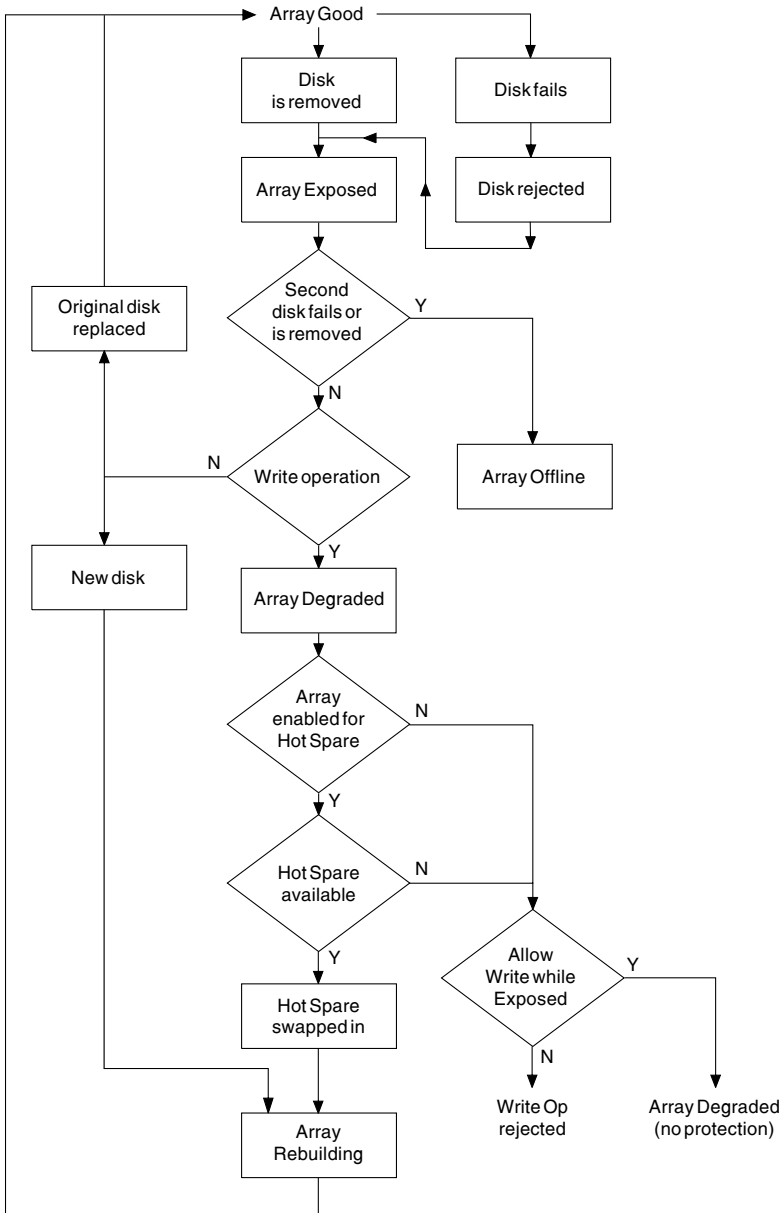
Figure 18. Array State Flowchart

Chapter 4. Using the RAID Array Configurator

This chapter describes how to use the system management interface tool (SMIT). The SMIT provides a set of menus from which you can select the various functions of the **ssaraid** command. The **ssaraid** command allows you to create, delete, and manage your RAID arrays.

If you prefer to use the **ssaraid** command through the command line interface instead of through the menus, see Chapter 7. Using the SSA Command Line Interface for RAID Configurations. If you want to use the SMIT menus, remain in this chapter . Help information is available from each SMIT menu.

This chapter has three main parts:
- "Installing and Configuring SSA RAID Arrays"
- "Dealing with RAID Array Problems" on page 48
- "Using Other Configuration Functions" on page 54

Installing and Configuring SSA RAID Arrays

You can get to the required SMIT menu by using fast path commands, or by working through other menus. In this chapter , the fast path command for a particular option is given at the start of the description of that option.

Note: Although this book always refers to the **smitty** commands, you can use either the **smitty** command, or the **smit** command. The procedures that you follow and the contents of the displays remain the same, whichever of the two commands you use.

Getting Access to the SSA RAID Array SMIT Menu

1. For fast-path access to the SSA RAID Array SMIT menus, type `smitty ssaraid` and press Enter.

   Otherwise:

   a. Type `smitty` and press Enter. The System Management menu is displayed.

   b. Select **Devices**. The Devices menu is displayed.

   c. Select **SSA RAID Arrays**.

2. The SSA RAID Arrays menu is displayed:

```
                              SSA RAID Arrays

   Move cursor to desired item and press Enter.

     List All Defined SSA RAID Arrays
     List All Supported SSA RAID Arrays
     List All SSA RAID Arrays Connected to a RAID Manager
     List Status Of All Defined SSA RAID Arrays
     List/Identify SSA Physical Disks
     List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
     Add an SSA RAID Array
     Delete an SSA RAID Array
     Change/Show Attributes of an SSA RAID Array
     Change Member Disks in an SSA RAID Array
     Change/Show Use of an SSA Physical Disk
     Change Use of Multiple SSA Physical Disks






     F1=Help              F2=Refresh          F3=Cancel          F8=Image
     F9=Shell             F10=Exit            Enter=Do
```

From the following list, find the option that you want, and go to the place that is indicated.

- "Adding an SSA RAID Array"
- "Deleting an SSA RAID Array" on page 45
- "Creating a Hot Spare Disk Drive" on page 46

Adding an SSA RAID Array

This option lets you add an array to the configuration.

1. For fast path, type smitty mkssaraid and press Enter.

   Otherwise, select **Add an SSA RAID Array** from the SSA RAID Array menu.

   A list of adapters is displayed in a window:

```
                        SSA RAID Arrays

Move cursor to desired item and press Enter.

   List All Defined SSA RAID Arrays
   List All Supported SSA RAID Arrays
   List All SSA RAID Arrays Connected to a RAID Manager
   List Status Of All Defined SSA RAID Arrays
   List/Identify SSA Physical Disks
   List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
   Add an SSA RAID Array
   Delete an SSA RAID Array
   Change/Show Attributes of an SSA RAID Array
   Change Member Disks in an SSA RAID Array
   --------------------------------------------------------------------
  |                      SSA RAID Manager                              |
  |                                                                    |
  | Move cursor to desired item and press Enter.                       |
  |                                                                    |
  |    ssa0 Available 00-04 SSA RAID Adapter                           |
  |                                                                    |
  | F1=Help              F2=Refresh              F3=Cancel             |
  | F8=Image             F10=Exit                Enter=Do              |
  | /=Find               n=Find Next                                   |
   --------------------------------------------------------------------
```

2. Select the adapter to which you want to add the array.

   A list of array types is displayed in a window:

```
                        SSA RAID Arrays

Move cursor to desired item and press Enter.

   List All Defined SSA RAID Arrays
   List All Supported SSA RAID Arrays
   List All SSA RAID Arrays Connected to a RAID Manager
   List Status Of All Defined SSA RAID Arrays
   List/Identify SSA Physical Disks
   List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
   Add an SSA RAID Array
   Delete an SSA RAID Array
   Change/Show Attributes of an SSA RAID Array
   Change Member Disks in an SSA RAID Array
   --------------------------------------------------------------------
  |                      RAID Array Type                               |
  |                                                                    |
  | Move cursor to desired item and press Enter.                       |
  |                                                                    |
  |    raid_5                 RAID-5 array                             |
  |                                                                    |
  | F1=Help              F2=Refresh              F3=Cancel             |
  | F8=Image             F10=Exit                Enter=Do              |
  | /=Find               n=Find Next                                   |
   --------------------------------------------------------------------
```

3. Select the type of array that you want to create.

   A list of attributes is displayed:

```
                        Add an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                              [Entry Fields]
  SSA RAID Manager                            ssa0
  RAID Array Type                             raid_5
* Member Disks                                                    +
  Enable Use of Hot Spares                    yes                 +
  Allow Page Splits                           yes                 +
  Enable Fast Write                           no                  +







 F1=Help            F2=Refresh         F3=Cancel         F4=List
 F5=Reset           F6=Command         F7=Edit           F8=Image
 F9=Shell           F10=Exit           Enter=Do
```

Note: The Enable Fast Write option is displayed only if the Fast-Write Cache
feature has been installed on the adapter.

4. Select **yes** or **no**, as required, for the **Enable Use of Hot Spares** and **Allow Page Splits** fields.

5. Press the List key to list the candidate disk drives that are available for your new array.

6. If candidate disk drives are available, a list of those disk drives is displayed in a window:

```
                       Add an SSA RAID Array

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                [Entry Fields]
   SSA RAID Manager                            ssa0
   RAID Array Type                             raid_5
 * Member Disks                                                      +
   Enable Use of Hot Spares                    yes                   +
    -----------------------------------------------------------------------
   |                        Member Disks                                   |
   |                                                                       |
   |  Move cursor to desired item and press F7.                            |
   |        ONE OR MORE items can be selected                              |
   |   Press Enter AFTER making all selections                             |
   |                                                                       |
   |      # Disks in Loop B are:                                           |
   |    pdisk0 0004AC506C2900D free n/a 4.5GB Physical Disk                 |
   |    pdisk1 0004AC5119E000D free n/a 4.5GB Physical Disk                 |
   |    pdisk2 0004AC7C00E800D free n/a 4.5GB Physical Disk                 |
   |    pdisk3 0004AC9C00E700D free n/a 1.1GB Physical Disk                 |
   | F1=Help              F2=Refresh             F3=Cancel                  |
   | F7=Select            F8=Image               F10=Exit                   |
   | Enter=Do             /=Find                 n=Find Next                |
    -----------------------------------------------------------------------
 The disks selected must all be on the same loop.
```

If a list of disk drives is displayed, and the list contains enough disk drives for the array you are creating, go to step 7.

If no list is displayed, or the list does not contain enough disk drives, go to "Changing or Showing the Use of an SSA Disk Drive" on page 87 for a description of how to assign disk drives as array candidates. When you have enough candidate disk drives, return to step 7 in this section.

7. Select the disk drives that you want in the array. **You must have a minimum of three disk drives in an array**.

   Try to select disk drives of equal capacities. Although you can mix disk drives of various capacities, all the disk drives in a particular array are truncated to the capacity of the smallest disk drive in that array. For example, if you create an array from the four disk drives pdisk0, pdisk1, pdisk2, and pdisk3 that are shown on the screen in step 6 on page 44, all four disk drives are assigned as 1.1 GB disk drives, because pdisk3 is a 1.1 GB disk drive. If you use disk drives of various sizes, therefore, you waste some storage capacity.

   Note: When the array has been created, you can use it. Before you do, however, you might prefer to wait until the array state changes from Rebuilding to Good.

Deleting an SSA RAID Array

This option allows you to delete arrays that you have created through the **Add an SSA RAID Array** option. The deleted array is broken into its component disk drives. You cannot delete arrays that do not have a corresponding hdisk.

1. For fast path, type smitty rmssaraid and press Enter.

Otherwise, select **Delete an SSA RAID Array** from the SSA RAID Array menu.

A list of arrays is displayed in a window:

```
                          SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
  List All Supported SSA RAID Arrays
  List All SSA RAID Arrays Connected to a RAID Manager
  List Status Of All Defined SSA RAID Arrays
  List/Identify SSA Physical Disks
  List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
  Add an SSA RAID Array
  Delete an SSA RAID Array
  Change/Show Attributes of an SSA RAID Array
 ---------------------------------------------------------------------------
|                          SSA RAID Array                                   |
|                                                                           |
| Move cursor to desired item and press Enter.                              |
|                                                                           |
|   hdisk3           095231779F0737K good      3.4G    RAID-5 array         |
|   hdisk4           09523173A02137K good      3.4G    RAID-5 array         |
|                                                                           |
| F1=Help                F2=Refresh                F3=Cancel                |
| F8=Image               F10=Exit                  Enter=Do                 |
| /=Find                 n=Find Next                                        |
 ---------------------------------------------------------------------------
```

2. Select the array that you want to delete.
3. A prompt is displayed in a window:

```
                          SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
  List All Supported SSA RAID Arrays
  List All SSA RAID Arrays Connected to a RAID Manager
  List Status Of All Defined SSA RAID Arrays
  List/Identify SSA Physical Disks
  List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
  Add an SSA RAID Array
  Delete an SSA RAID Array
  Change/Show Attributes of an SSA RAID Array
 ---------------------------------------------------------------------------
|                          ARE YOU SURE?                                    |
|                                                                           |
| Continuing may delete information you may want                            |
| to keep.  This is your last chance to stop                                |
| before continuing.                                                        |
|     Press Enter to continue.                                              |
|     Press Cancel to return to the application.                            |
|                                                                           |
| F1=Help                F2=Refresh                F3=Cancel                |
| F8=Image               F10=Exit                  Enter=Do                 |
| /=Find                 n=Find Next                                        |
 ---------------------------------------------------------------------------
```

4. At the prompt, press Enter if you want to delete the array. Press Cancel if you do not want to delete the array.

Creating a Hot Spare Disk Drive

1. For fast path, type `smitty chgssadisk` and press Enter.

Otherwise, select **Change/Show Use of an SSA Physical Disk** from the SSA RAID Array menu.

A list of disk drives and their usage is displayed in a window:

```
                      SSA RAID Arrays

 Move cursor to desired item and press Enter.

   List All Defined SSA RAID Arrays
     -------------------------------------------------------------------------
    |                         SSA Physical Disk                               |
    |                                                                         |
    |  Move cursor to desired item and press Enter. Use arrow keys to scroll. |
    |                                                                         |
    |    # SSA physical disks which are members of arrays.                    |
    |    pdisk0          00022123DFHC00D member    n/a        4.5G  Physical d |
    |    pdisk1          0004AC5119E000D member    n/a        1.1G  Physical d |
    |    pdisk2          0004AC5119E000D member    n/a        1.1G  Physical d |
    |    pdisk3          08005AEA003500D member    n/a        4.5G  Physical d |
    |    pdisk4          08005AEA030D00D member    n/a        2.3G  Physical d |
    |    pdisk5          08005AEA080100D member    n/a        4.5G  Physical d |
    |    pdisk7          08005AEA087A00D member    n/a        4.5G  Physical d |
    |    # SSA physical disks which are hot spares.                           |
    |    pdisk6          08005AEA080800D spare     n/a        4.5G  Physical d |
    |                                                                         |
    |  F1=Help              F2=Refresh             F3=Cancel                   |
    |  F8=Image             F10=Exit               Enter=Do                   |
    | /=Find               n=Find Next                                        |
     -------------------------------------------------------------------------
```

2. Using the arrow keys, scroll the information until you find the list of SSA physical disks that are not used.
3. Select the disk drive that you want to designate as a hot spare.

   The following screen is displayed for the disk drive that you have chosen:

```
                  Change/Show Attributes of an SSA Physical Disk

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                 [Entry Fields]
    SSA RAID Manager                             ssa0
    SSA physical disk                            pdisk6
    CONNECTION address                           08005AEA080800D
    Current use                                  Hot Spare Disk          +













 F1=Help           F2=Refresh        F3=Cancel         F4=List
 F5=Reset          F6=Command        F7=Edit           F8=Image
 F9=Shell          F10=Exit          Enter=Do
```

Move the cursor to **Current Use**, and press the List key.

> **Note:** If the **Current Use** field shows that the disk drive is owned by an array, you cannot change that use.

4. Select **Hot Spare Disk** in the **Current Use** field.
5. Press Enter.

Dealing with RAID Array Problems

This part of the chapter describes how to solve problems that might occur on your SSA RAID arrays. You can get to the required SMIT menu by using fast path commands or by working through other menus. During problem determination, you can use any of the maintenance procedures described in Using Other Configuration Functions.

A hot spare disk drive automatically replaces a failed or missing disk drive in a RAID array if:

- The **Enable Use of Hot Spares** attribute is set to **yes**.
- A hot spare disk drive is available.

When a hot spare disk drive starts operating, its **Current Use** attribute is changed from **Hot Spare Disk** to **Member of an SSA RAID Array**. If a member disk drive of an array fails, but access to that disk drive is still possible, its **Current Use** attribute is changed from **Member of an SSA RAID Array** to **Rejected**. For all other changes to the use of a disk drive, you must use either the **ssaraid** commands or the SMIT menus.

> **Note:** Although this book always refers to **smitty** commands, you can use either the **smitty** command, or the **smit** command. The procedures that you follow and the contents of the displays remain the same, whichever of the two commands you use.

Getting Access to the SSA RAID Array SMIT Menu

1. For fast-path access to the SSA RAID Array SMIT menus, type smitty ssaraid and press Enter.

   Otherwise:

   a. Type smitty and press Enter. The System Management menu is displayed.
   b. Select **Devices**. The Devices menu is displayed.
   c. Select **SSA RAID Arrays**.
2. The SSA RAID Arrays menu is displayed:

```
                          SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
  List All Supported SSA RAID Arrays
  List All SSA RAID Arrays Connected to a RAID Manager
  List Status Of All Defined SSA RAID Arrays
  List/Identify SSA Physical Disks
  List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
  Add an SSA RAID Array
  Delete an SSA RAID Array
  Change/Show Attributes of an SSA RAID Array
  Change Member Disks in an SSA RAID Array
  Change/Show Use of an SSA Physical Disk
  Change Use of Multiple SSA Physical Disks




F1=Help          F2=Refresh        F3=Cancel         F8=Image
F9=Shell         F10=Exit          Enter=Do
```

From the following list, find the option that you want, and go to the place that is indicated.

- "Identifying and Correcting or Removing Failed Disk Drives"
- "Installing a Replacement Disk Drive" on page 53

Identifying and Correcting or Removing Failed Disk Drives

1. For fast path, type smitty lfssaraid and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **List Rejected Array Disks**.

2. A list of adapters is displayed in a window:

```
                         List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
  ------------------------------------------------------------------------
 |                           SSA RAID Manager                             |
 |                                                                        |
 |  Move cursor to desired item and press Enter.                          |
 |                                                                        |
 |    ssa0 Available 00-04 SSA RAID Adapter                               |
 |                                                                        |
 |  F1=Help              F2=Refresh              F3=Cancel                 |
 |  F8=Image             F10=Exit                Enter=Do                 |
 | /=Find                n=Find Next                                       |
  ------------------------------------------------------------------------
```

Select the adapter whose rejected disk drives you want to list.

3. A list of rejected disk drives is displayed:

```
                               COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

pdisk4         08005AEA030D00D member   rejected   2.3G  Physical disk




F1=Help            F2=Refresh          F3=Cancel          F6=Command
F8=Image           F9=Shell            F10=Exit           /=Find
n=Find Next
```

4. Check the list of rejected disk drives against other error reports to find out why the disk drive was rejected from the array.

5. If you know the physical location of the rejected disk drive, go to step 12 on page 51. Otherwise, go to step 6 to identify the rejected disk drive.

6. For fast path, type smitty ifssaraid and press Enter.

   Otherwise:

   a. Return to the List/Identify SSA Physical Disks menu.

b. Select **Identify Rejected Array Disks**.

7. The list of adapters that was displayed in step 2 on page 49 is displayed again.

8. Select the adapter that contains the rejected disk drive.

    The following menu is displayed:

```
                        Identify Rejected Array Disks


Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                [Entry Fields]
  SSA RAID Manager                              ssa0
* Rejected Array Disks                                            +
  Flash Disk Identification Lights              yes               +










F1=Help           F2=Refresh        F3=Cancel         F4=List
F5=Reset          F6=Command        F7=Edit           F8=Image
F9=Shell          F10=Exit          Enter=Do
```

9. Select **yes** in the **Flash Disk Identification Lights** field.

10. Press the List key to list the disk drives.

11. From the displayed list, select the disk drives that you want to identify.

    The Check light flashes on each disk drive that you have selected.

12. If the disk drive was rejected from the array because the disk drive itself has failed, go to step 13.

    If the disk drive was rejected from the array because some other part has failed (for example, a power supply unit, or an SSA cable):

    a. Correct the problem, or call your service representative.

    b. Add the disk drive to the array (see "Adding a Disk Drive to an SSA RAID Array" on page 84).

    c. Run system diagnostics to verify that the repair is successful.

    Alternatively:

    a. Change the use of the original disk drive so that it becomes a hot spare disk drive (see "Changing or Showing the Use of an SSA Disk Drive" on page 87).

    b. Install a replacement disk drive (see "Installing a Replacement Disk Drive" on page 53).

    c. Run system diagnostics to verify that the repair is successful.

13. For fast path, type `smitty redssaraid` and press Enter.

    Otherwise:

a. Return to the SSA RAID Array menu.

b. Select **Change Member Disks in an SSA RAID Array**.

c. Select **Remove a Disk from an SSA RAID Array**.

14. A list of arrays is displayed in a window:

```
                    Change Member Disks in an SSA RAID Array

Move cursor to desired item and press Enter.

   Remove a Disk from an SSA RAID Array
   Add a Disk to a Reduced SSA RAID Array
   Swap Members of an SSA RAID Array




     ---------------------------------------------------------------------------
    |                          SSA RAID Array                                   |
    |                                                                           |
    |  Move cursor to desired item and press Enter.                             |
    |                                                                           |
    |    hdisk3         095231779F0737K good      3.4G   RAID-5 array           |
    |    hdisk4         09523173A02137K good      3.4G   RAID-5 array           |
    |                                                                           |
    |  F1=Help              F2=Refresh            F3=Cancel                      |
    |  F8=Image             F10=Exit              Enter=Do                       |
    |  /=Find               n=Find Next                                         |
     ---------------------------------------------------------------------------
```

Select the array that contains the disk drive that you want to remove.

15. The following information is displayed:

```
                    Remove a Disk From an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                 [Entry Fields]
   SSA RAID Manager                              ssa0
   SSA RAID Array                                hdisk3
   Connection Address / Array Name               095231779F0737K
 * Disk to Remove                                                       +









F1=Help            F2=Refresh          F3=Cancel         F4=List
F5=Reset           F6=Command          F7=Edit           F8=Image
F9=Shell           F10=Exit            Enter=Do
```
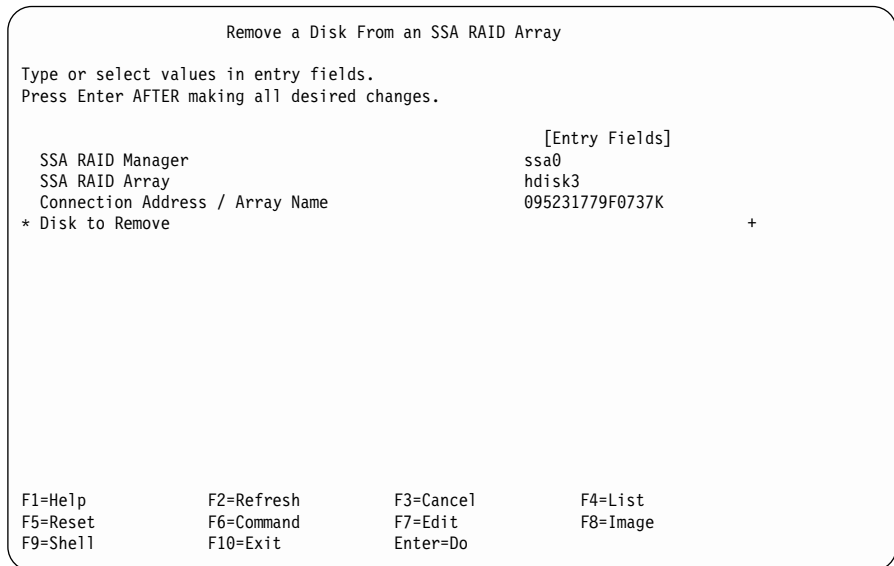
Press the List key to list the disk drives.

16. From the displayed list, select the disk drives that you want to remove.
17. Physically remove the failing disk drive for a new one (see the *Operator Guide* or *Service Guide* for the unit).
18. If you are going to install a replacement disk drive, go to "Installing a Replacement Disk Drive".

Installing a Replacement Disk Drive

1. Physically install the replacement disk drive (see the *Operator Guide* or *Service Guide* for the unit).
2. Add the new disk drive to the array:

   For fast path, type `smitty addssaraid` and press Enter.

   Otherwise:

   a. Select **Change Member Disks of an SSA RAID Array** from the SSA RAID Array menu.

   b. Select **Add a Disk to an SSA RAID Array**.
3. A list of degraded arrays is displayed:

```
                        Change Member Disks of an SSA RAID Array

Move cursor to desired item and press Enter.

  Remove a Disk from an SSA RAID Array
  Add a Disk to an SSA RAID Array
  Swap Members of an SSA RAID Array




    -------------------------------------------------------------------------
    |                          SSA RAID Array                               |
    |                                                                       |
    |  Move cursor to desired item and press Enter.                         |
    |                                                                       |
    |    hdisk3          095231779F0737K degraded   3.4G   RAID-5 array     |
    |                                                                       |
    |  F1=Help                F2=Refresh              F3=Cancel             |
    |  F8=Image               F10=Exit                Enter=Do              |
    |  /=Find                 n=Find Next                                   |
    -------------------------------------------------------------------------
```

   Select the array into which you are installing the replacement disk drive.
4. The following information is displayed:

```
                      Add a Disk to an SSA RAID Array

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                  [Entry Fields]
   SSA RAID Manager                             ssa0
   SSA RAID Array                               hdisk3
   Connection Address / Array Name              095231779F0737K
 * Disk To Add                                                          +









 F1=Help            F2=Refresh         F3=Cancel          F4=List
 F5=Reset           F6=Command         F7=Edit            F8=Image
 F9=Shell           F10=Exit           Enter=Do
```
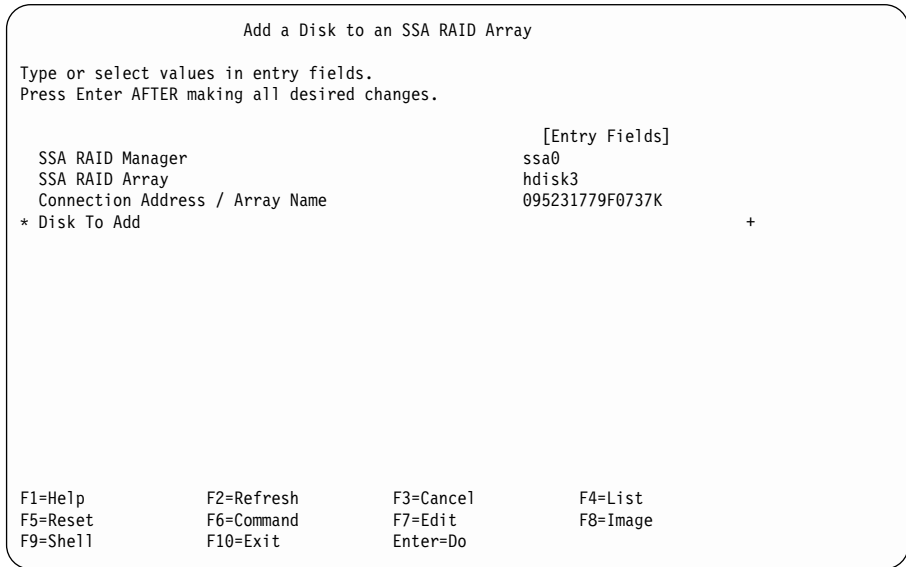
Press the List key to list the disk drives.

5. From the displayed list, select the disk drive that you want to add.

   The array management software writes all the information from the original disk drive onto the new disk drive.

6. Run system diagnostics to verify that the disk drive is working correctly.

Using Other Configuration Functions

This part of the chapter describes the maintenance procedures that are available for your SSA RAID adapter. You can use these procedures at any time. You can get to the required SMIT menu by using fast path commands or by working through other menus.

Note: Although this book always refers to the **smitty** commands, you can use either the **smitty** command, or the **smit** command. The procedures that you follow and the contents of the displays remain the same, whichever of the two commands you use.

Getting Access to the SSA RAID Array SMIT Menu

1. For fast-path access to the SSA RAID Array SMIT menus, type smitty ssaraid and press Enter.

   Otherwise:

   a. Type smitty and press Enter. The System Management menu is displayed.

   b. Select **Devices**. The Devices menu is displayed.

   c. Select **SSA RAID Arrays**.

2. The SSA RAID Arrays menu is displayed:

```
                        SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
  List All Supported SSA RAID Arrays
  List All SSA RAID Arrays Connected to a RAID Manager
  List Status Of All Defined SSA RAID Arrays
  List/Identify SSA Physical Disks
  List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
  Add an SSA RAID Array
  Delete an SSA RAID Array
  Change/Show Attributes of an SSA RAID Array
  Change Member Disks in an SSA RAID Array
  Change/Show Use of an SSA Physical Disk
  Change Use of Multiple SSA Physical Disks




F1=Help            F2=Refresh        F3=Cancel          F8=Image
F9=Shell           F10=Exit          Enter=Do
```

From the following list, find the option that you want, and go to the place that is
indicated.

Listing All Defined SSA RAID Arrays

This option lists all the arrays that are connected to the SSA adapter.

1. For fast path, type `smitty lsdssaraid` and press Enter.

   Otherwise, select **List All Defined SSA RAID Arrays** from the SSA RAID Array menu.

2. A list of defined arrays is displayed:

```
                            COMMAND STATUS

Command: OK            stdout: yes            stderr: no

Before command completion, additional instructions may appear below.

hdisk3           095231779F0737K good       3.4G   RAID-5 array
hdisk4           09523173A02137K good       3.4G   RAID-5 array

















F1=Help            F2=Refresh         F3=Cancel          F6=Command
F8=Image           F9=Shell           F10=Exit           /=Find
n=Find Next
```

Listing All Supported SSA RAID Arrays

This option lists all the types of array that are supported by the installed SSA RAID managers.

1. For fast path, type `smitty lsssaraid` and press Enter.

   Otherwise, select **List All Supported SSA RAID Arrays** from the SSA RAID Array menu.

2. A list of supported arrays is displayed:

```
                        COMMAND STATUS

Command: OK           stdout: yes          stderr: no

Before command completion, additional instructions may appear below.

raid_5                 RAID-5 array







F1=Help           F2=Refresh          F3=Cancel           F6=Command
F8=Image          F9=Shell            F10=Exit            /=Find
n=Find Next
```

Listing All SSA RAID Arrays That Are Connected to a RAID Manager

This option lists all the SSA RAID disk drives that are connected to a particular RAID manager.

1. For fast path, type `smitty lsmssaraid` and press Enter.

   Otherwise, select **List All SSA RAID Arrays Connected to a RAID Manager** from the SSA RAID Array menu.

2. A list of arrays is displayed in a window:

```
                           SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
  List All Supported SSA RAID Arrays
  List All SSA RAID Arrays Connected to a RAID Manager
  List Status Of All Defined SSA RAID Arrays
  List/Identify SSA Physical Disks
  List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
  Add an SSA RAID Array
  Delete an SSA RAID Array
  Change/Show Attributes of an SSA RAID Array
  Change Member Disks in an SSA RAID Array
   --------------------------------------------------------------------
  |                         SSA RAID Manager                            |
  |                                                                     |
  | Move cursor to desired item and press Enter.                        |
  |                                                                     |
  |    ssa0 Available 00-04 SSA RAID Adapter                            |
  |                                                                     |
  | F1=Help              F2=Refresh            F3=Cancel                 |
  | F8=Image             F10=Exit              Enter=Do                 |
  | /=Find               n=Find Next                                    |
   --------------------------------------------------------------------
```

Select the RAID manager for which you want a list of connected arrays.

3. A list of arrays is displayed:

```
                           COMMAND STATUS

Command: OK             stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

hdisk4          09523173A02137K good      3.4G   RAID-5 array
hdisk3          095231779F0737K good      3.4G   RAID-5 array




















F1=Help           F2=Refresh        F3=Cancel         F6=Command
F8=Image          F9=Shell          F10=Exit          /=Find
n=Find Next
```

Listing the Status of All Defined SSA RAID Arrays

This option lists the status of each defined array.

1. For fast path, type `smitty lstssaraid` and press Enter.

   Otherwise, select **List Status of All Defined SSA RAID Arrays** from the SSA RAID Array menu.

2. The following information is displayed:

```
                         COMMAND STATUS

Command: OK            stdout: yes            stderr: no

Before command completion, additional instructions may appear below.

                 Unsynced Parity Strips  Unbuilt Data Strips
hdisk3                    0                      0
hdisk4                    0                      0




















F1=Help            F2=Refresh         F3=Cancel          F6=Command
F8=Image           F9=Shell           F10=Exit           /=Find
n=Find Next
```

Listing or Identifying SSA Physical Disk Drives

This option allows you to list the disk drives that are being used by a particular array, and to identify particular disk drives.

1. For fast path, type smitty lsidssaraid and press Enter.

   Otherwise, select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

2. The following information is displayed:

```
                          List/Identify SSA Physical Disks

   Move cursor to desired item and press Enter.

     List Disks in an SSA RAID Array
     List Hot Spares
     List Rejected Array Disks
     List Array Candidate Disks
     List AIX System Disks
     Identify Disks in an SSA RAID Array
     Identify Hot Spares
     Identify Rejected Array Disks
     Identify Array Candidate Disks
     Identify AIX System Disks
     Cancel all SSA Disk Identifications






   F1=Help              F2=Refresh          F3=Cancel           F8=Image
   F9=Shell             F10=Exit            Enter=Do
```

Select the option that you want, and go to the instructions for that option:

- "Listing the Disk Drives in an SSA RAID Array"
- "Listing Hot Spare Disk Drives" on page 61
- "Listing Rejected Array Disk Drives" on page 63
- "Listing Array Candidate Disk Drives" on page 65
- "Listing AIX System Disk Drives" on page 66
- "Identifying the Disk Drives in an SSA RAID Array" on page 68
- "Identifying Hot Spare Disk Drives" on page 70
- "Identifying Rejected Array Disk Drives" on page 71
- "Identifying Array Candidate Disk Drives" on page 73
- "Identifying AIX System Disk Drives" on page 74
- "Canceling all SSA Disk Drive Identifications" on page 76

Listing the Disk Drives in an SSA RAID Array

This option allows you to list the disk drives that are contained in a particular array.

1. For fast path, type `smitty lssaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **List Disks in an SSA RAID Array**.

2. A list of arrays is displayed in a window:

```
                      List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  ---------------------------------------------------------------------------
 |                            SSA RAID Array                                 |
 |                                                                           |
 | Move cursor to desired item and press Enter.                              |
 |                                                                           |
 |   hdisk3           095231779F0737K good       3.4G   RAID-5 array         |
 |   hdisk4           09253173A02137K good       3.4G   RAID-5 array         |
 |                                                                           |
 | F1=Help               F2=Refresh              F3=Cancel                   |
 | F8=Image              F10=Exit                Enter=Do                    |
 | /=Find                n=Find Next                                         |
  ---------------------------------------------------------------------------
```

Select the array whose disk drives you want to list.

3. A list of disk drives is displayed:

```
                            COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

pdisk1          0004AC5119E000D member    present    1.1G   Physical disk
pdisk4          08005AEA030D00D member    present    2.3G   Physical disk
pdisk7          08005AEA087A00D member    present    4.5G   Physical disk
pdisk8          08005AEA098100D member    not_present n/a   Physical disk




F1=Help           F2=Refresh        F3=Cancel        F6=Command
F8=Image          F9=Shell          F10=Exit         /=Find
n=Find Next
```

Listing Hot Spare Disk Drives

This option allows you to list the hot spare disk drives that are available to a particular
array.

1. For fast path, type `smitty lhssaraid` and press Enter.

   Otherwise:

a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

b. Select **List Hot Spares**.

2. A list of adapters is displayed in a window:

```
                    List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
   ------------------------------------------------------------------------
  |                          SSA RAID Manager                              |
  |                                                                        |
  |  Move cursor to desired item and press Enter.                          |
  |                                                                        |
  |    ssa0 Available 00-04 SSA RAID Adapter                               |
  |                                                                        |
  |  F1=Help               F2=Refresh               F3=Cancel              |
  |  F8=Image              F10=Exit                  Enter=Do              |
  |  /=Find                n=Find Next                                      |
   ------------------------------------------------------------------------
```

Select the adapter whose hot spare disk drives you want to list.

3. A list of arrays is displayed in a window:

```
                    List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
   ------------------------------------------------------------------------
  |                          SSA RAID Array                                |
  |                                                                        |
  |  Move cursor to desired item and press Enter.                          |
  |                                                                        |
  |    hdisk3        095231779F0737K good      3.4G   RAID-5 array         |
  |    hdisk4        09253173A02137K good      3.4G   RAID-5 array         |
  |                                                                        |
  |  F1=Help               F2=Refresh               F3=Cancel              |
  |  F8=Image              F10=Exit                  Enter=Do              |
  |  /=Find                n=Find Next                                      |
   ------------------------------------------------------------------------
```

Select the array for which you want a list of hot spare disk drives.

4. A list of hot spare disk drives is displayed:

```
                          COMMAND STATUS

 Command: OK            stdout: yes            stderr: no

 Before command completion, additional instructions may appear below.

 pdisk3          0004AC5119E000D spare      n/a        1.1G   Physical disk
 pdisk5          08005AEA030D00D spare      n/a        2.3G   Physical disk










 F1=Help          F2=Refresh          F3=Cancel          F6=Command
 F8=Image         F9=Shell            F10=Exit           /=Find
 n=Find Next
```

Listing Rejected Array Disk Drives

This option allows you to list disk drives that have been rejected (probably because of failure) from arrays.

1. For fast path, type `smitty lfssaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **List Rejected Array Disks**.

2. A list of adapters is displayed in a window:

```
                           List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
   Identify AIX System Disks
   ----------------------------------------------------------------------------
   |                              SSA RAID Manager                            |
   |                                                                          |
   |  Move cursor to desired item and press Enter.                            |
   |                                                                          |
   |    ssa0 Available 00-04 SSA RAID Adapter                                 |
   |                                                                          |
   |  F1=Help                F2=Refresh                F3=Cancel              |
   |  F8=Image               F10=Exit                  Enter=Do               |
   |  /=Find                 n=Find Next                                      |
   ----------------------------------------------------------------------------
```

Select the adapter whose rejected disk drives you want to list.

3. A list of arrays is displayed in a window:

```
                           List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
   ----------------------------------------------------------------------------
   |                              SSA RAID Array                              |
   |                                                                          |
   |  Move cursor to desired item and press Enter.                            |
   |                                                                          |
   |    hdisk3          095231779F0737K good       3.4G    RAID-5 array       |
   |    hdisk4          09253173A02137K good       3.4G    RAID-5 array       |
   |                                                                          |
   |  F1=Help                F2=Refresh                F3=Cancel              |
   |  F8=Image               F10=Exit                  Enter=Do               |
   |  /=Find                 n=Find Next                                      |
   ----------------------------------------------------------------------------
```

Select the array whose rejected disk drives you want to list.

4. A list of rejected disk drives is displayed:

```
                         COMMAND STATUS

Command: OK            stdout: yes            stderr: no

Before command completion, additional instructions may appear below.

pdisk3          0004AC5119E000D rejected n/a        1.1G  Physical disk
pdisk5          08005AEA030D00D rejected n/a        2.3G  Physical disk









F1=Help          F2=Refresh          F3=Cancel          F6=Command
F8=Image         F9=Shell            F10=Exit           /=Find
n=Find Next
```

Listing Array Candidate Disk Drives

This option allows you to list disk drives that are available for adding to an array.

1. For fast path, type `smitty lcssaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **List Array Candidate Disks**.

2. A list of adapters is displayed in a window:

```
                      List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
  ---------------------------------------------------------------------
  |                         SSA RAID Manager                          |
  |                                                                   |
  | Move cursor to desired item and press Enter.                      |
  |                                                                   |
  |   ssa0 Available 00-04 SSA RAID Adapter                           |
  |                                                                   |
  | F1=Help              F2=Refresh            F3=Cancel              |
  | F8=Image             F10=Exit              Enter=Do               |
  | /=Find               n=Find Next                                  |
  ---------------------------------------------------------------------
```

Select the adapter whose candidate disk drives you want to list.

3. A list of candidate disk drives is displayed:

```
                            COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

pdisk3          0004AC5119E000D free             1.1G   Physical disk
pdisk5          08005AEA030D00D free             2.3G   Physical disk












F1=Help            F2=Refresh         F3=Cancel          F6=Command
F8=Image           F9=Shell           F10=Exit           /=Find
n=Find Next
```

Listing AIX System Disk Drives

This option allows you to list disk drives that are used by the using system. These disk
drives are not member disk drives of any array.

1. For fast path, type smitty lassaraid and press Enter.

   Otherwise:

a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

b. Select **List AIX System Disks**.

2. A list of adapters is displayed in a window:

```
                    List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
  ---------------------------------------------------------------------
 |                          SSA RAID Manager                           |
 |                                                                     |
 |  Move cursor to desired item and press Enter.                       |
 |                                                                     |
 |    ssa0 Available 00-04 SSA RAID Adapter                            |
 |                                                                     |
 |  F1=Help               F2=Refresh               F3=Cancel           |
 |  F8=Image              F10=Exit                 Enter=Do            |
 | /=Find                 n=Find Next                                   |
  ---------------------------------------------------------------------
```

Select the adapter whose AIX system disk drives you want to list.

A list of AIX system disk drives is displayed:

```
                          COMMAND STATUS

 Command: OK              stdout: yes              stderr: no

 Before command completion, additional instructions may appear below.

 pdisk3         0004AC5119E000D system              1.1G   Physical disk
 pdisk5         08005AEA030D00D system              2.3G   Physical disk











 F1=Help            F2=Refresh         F3=Cancel          F6=Command
 F8=Image           F9=Shell           F10=Exit           /=Find
 n=Find Next
```

Identifying the Disk Drives in an SSA RAID Array

This option allows you to identify the disk drives that are contained in a particular array.

1. For fast path, type `smitty issaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **Identify Disks in an SSA RAID Array**.

2. A list of arrays is displayed in a window:

```
                        List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
   ----------------------------------------------------------------------------
  |                              SSA RAID Array                                |
  |                                                                            |
  |  Move cursor to desired item and press Enter.                              |
  |                                                                            |
  |    hdisk3          095231779F0737K good       3.4G   RAID-5 array          |
  |    hdisk4          09253173A02137K good       3.4G   RAID-5 array          |
  |                                                                            |
  |  F1=Help               F2=Refresh             F3=Cancel                    |
  |  F8=Image              F10=Exit               Enter=Do                     |
  | /=Find                 n=Find Next                                         |
   ----------------------------------------------------------------------------
```

Select the array whose disk drives you want to identify.

3. The following information is displayed:

```
                        Identify Disks in an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     Entry Fields
  SSA RAID Manager                                ssa0
  SSA RAID Array                                  hdisk2
* Member Disks                                                              +
  Flash Disk Identification Lights                yes                       +




















F1=Help            F2=Refresh         F3=Cancel          F4=List
F5=Reset           F6=Command         F7=Edit            F8=Image
F9=Shell           F10=Exit           Enter=Do
```

4. Select **yes** in the **Flash Disk Identification Lights** field.

5. Press the List key to list the disk drives.

6. From the displayed list, select the disk drives that you want to identify.

   The Check light flashes on each disk drive that you have selected.

Identifying Hot Spare Disk Drives

This option allows you to identify the hot spare disk drives that are available to a particular SSA RAID manager.

1. For fast path, type `smitty ilhssaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **Identify Hot Spares**.

2. A list of arrays is displayed in a window:

```
                      List/Identify SSA Physical Disks

 Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
    --------------------------------------------------------------------------
   |                           SSA RAID Array                                 |
   |                                                                          |
   |  Move cursor to desired item and press Enter.                            |
   |                                                                          |
   |    hdisk3          095231779F0737K good      3.4G   RAID-5 array         |
   |    hdisk4          09253173A02137K good      3.4G   RAID-5 array         |
   |                                                                          |
   |  F1=Help              F2=Refresh            F3=Cancel                     |
   |  F8=Image             F10=Exit              Enter=Do                      |
   |  /=Find               n=Find Next                                        |
    --------------------------------------------------------------------------
```

Select the RAID manager whose hot spare disk drives you want to identify.

3. The following information is displayed:

```
                        Identify Hot Spares

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                 [Entry Fields]
  SSA RAID Manager                             ssa0
* Hot Spare Disks                                                        +
  Flash Disk Identification Lights             yes                       +









F1=Help            F2=Refresh        F3=Cancel          F4=List
F5=Reset           F6=Command        F7=Edit            F8=Image
F9=Shell           F10=Exit          Enter=Do
```

4. Select **yes** in the **Flash Disk Identification Lights** field.

5. Press the List key to list the disk drives.

6. From the displayed list, select the disk drives that you want to identify.

   The Check light flashes on each disk drive that you have selected.

Identifying Rejected Array Disk Drives

This option allows you to identify disk drives that have been rejected (probably because of failure) from arrays.

1. For fast path, type smitty ifssaraid and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **Identify Rejected Array Disks**.

2. A list of arrays is displayed in a window:

```
                          List/Identify SSA Physical Disks

 Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
    ---------------------------------------------------------------------------
   |                           SSA RAID Array                                  |
   |                                                                           |
   | Move cursor to desired item and press Enter.                              |
   |                                                                           |
   |   hdisk3         095231779F0737K good      3.4G   RAID-5 array            |
   |   hdisk4         09253173A02137K good      3.4G   RAID-5 array            |
   |                                                                           |
   | F1=Help             F2=Refresh            F3=Cancel                       |
   | F8=Image            F10=Exit              Enter=Do                        |
   | /=Find              n=Find Next                                           |
    ---------------------------------------------------------------------------
```
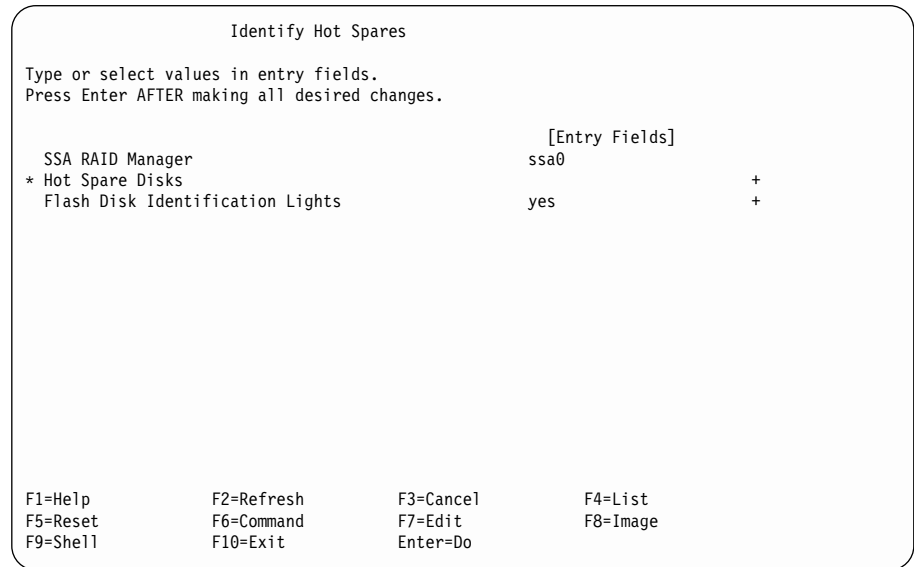
Select the array whose rejected disk drives you want to identify.

3. The following information is displayed:

```
                       Identify Rejected Array Disks


 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                             [Entry Fields]
   SSA RAID Manager                          ssa0
 * Rejected Array Disks                                               +
   Flash Disk Identification Lights          yes                      +












 F1=Help            F2=Refresh         F3=Cancel          F4=List
 F5=Reset           F6=Command         F7=Edit            F8=Image
 F9=Shell           F10=Exit           Enter=Do
```

4. Select **yes** in the **Flash Disk Identification Lights** field.
5. Press the List key to list the disk drives.
6. From the displayed list, select the disk drives that you want to identify.

   The Check light flashes on each disk drive that you have selected.

Identifying Array Candidate Disk Drives

This option allows you to identify disk drives that are available for adding to an array.

1. For fast path, type `smitty icssaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **Identify Array Candidate Disks**.

2. A list of adapters is displayed in a window:

```
                      List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

   List Disks in an SSA RAID Array
   List Hot Spares
   List Rejected Array Disks
   List Array Candidate Disks
   List AIX System Disks
   Identify Disks in an SSA RAID Array
   Identify Hot Spares
   Identify Rejected Array Disks
   Identify Array Candidate Disks
   Identify AIX System Disks
   ------------------------------------------------------------------------
  |                          SSA RAID Manager                              |
  |                                                                        |
  |  Move cursor to desired item and press Enter.                          |
  |                                                                        |
  |    ssa0 Available 00-04 SSA RAID Adapter                               |
  |                                                                        |
  |  F1=Help               F2=Refresh              F3=Cancel               |
  |  F8=Image              F10=Exit               Enter=Do                 |
  |  /=Find               n=Find Next                                      |
   ------------------------------------------------------------------------
```
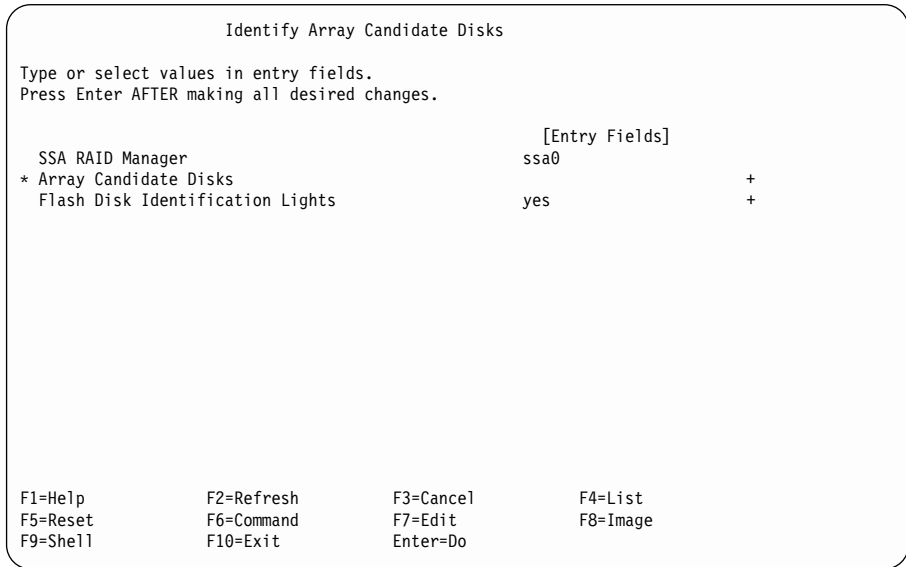
   Select the adapter whose candidate disk drives you want to identify.

3. The following information is displayed:

```
                    Identify Array Candidate Disks

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                [Entry Fields]
  SSA RAID Manager                              ssa0
* Array Candidate Disks                                               +
  Flash Disk Identification Lights             yes                    +




F1=Help             F2=Refresh          F3=Cancel         F4=List
F5=Reset            F6=Command          F7=Edit           F8=Image
F9=Shell            F10=Exit            Enter=Do
```

4. Select **yes** in the **Flash Disk Identification Lights** field.
5. Press the List key to list the disk drives.
6. From the displayed list, select the disk drives that you want to identify.

   The Check light flashes on each disk drive that you have selected.

Identifying AIX System Disk Drives

This option allows you to identify disk drives that are used by the using system. These disk drives are not member disk drives of any array.

1. For fast path, type `smitty iassaraid` and press Enter.

   Otherwise:

   a. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.

   b. Select **Identify AIX System Disks**.

2. A list of adapters is displayed in a window:

```
                        List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
  --------------------------------------------------------------------------
 |                            SSA RAID Manager                              |
 |                                                                          |
 |  Move cursor to desired item and press Enter.                            |
 |                                                                          |
 |    ssa0 Available 00-04 SSA RAID Adapter                                 |
 |                                                                          |
 |  F1=Help              F2=Refresh              F3=Cancel                   |
 |  F8=Image             F10=Exit                Enter=Do                    |
 |  /=Find               n=Find Next                                         |
  --------------------------------------------------------------------------
```

Select the adapter whose AIX system disk drives you want to identify.

3. The following information is displayed:

```
                     Identify AIX System Disks

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                               [Entry Fields]
   SSA RAID Manager                            ssa0
 * AIX System Disks                                                    +
   Flash Disk Identification Lights            yes                     +











 F1=Help            F2=Refresh        F3=Cancel        F4=List
 F5=Reset           F6=Command        F7=Edit          F8=Image
 F9=Shell           F10=Exit          Enter=Do
```

4. Select **yes** in the **Flash Disk Identification Lights** field.

5. Press the List key to list the disk drives.

6. From the displayed list, select the disk drives that you want to identify.

   The Check light flashes on each disk drive that you have selected.

Canceling all SSA Disk Drive Identifications

This option allows you to cancel all disk drive identifications.

For fast path, type ssa_identify_cancel and press Enter.

Otherwise:
1. Select **List/Identify SSA Physical Disks** from the SSA RAID Array menu.
2. Select **Cancel all SSA Disk Identifications**.

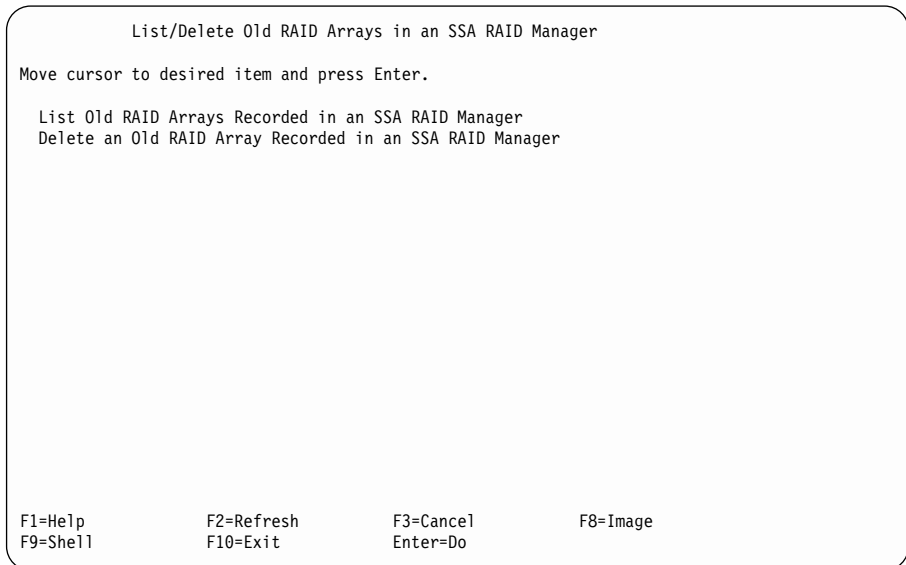The Check lights of all identified disk drives stop flashing.

Listing or Deleting Old RAID Arrays Recorded in an SSA RAID Manager

If an array becomes disconnected from a RAID manager by some method other than the method described in "Deleting an SSA RAID Array" on page 45, a record of that array remains in the RAID manager. The record must be deleted manually. This option allows you to list the serial numbers of such arrays, and to delete the records of those arrays from the SSA RAID manager.

1. For fast path, type smitty nvrssaraid and press Enter.

   Otherwise, select **List/Delete Old RAID Arrays in an SSA RAID Manager** from the SSA RAID Array menu.

2. The following menu is displayed:

```
                 List/Delete Old RAID Arrays in an SSA RAID Manager

Move cursor to desired item and press Enter.

  List Old RAID Arrays Recorded in an SSA RAID Manager
  Delete an Old RAID Array Recorded in an SSA RAID Manager










  F1=Help             F2=Refresh          F3=Cancel           F8=Image
  F9=Shell            F10=Exit            Enter=Do
```

If you want to list the arrays, select **List Old RAID Arrays Recorded in an SSA RAID Manager**, and go to step 2 on page 77 of Listing Old RAID Arrays Recorded in an SSA RAID Manager.

If you want to delete the arrays, select **Delete an Old RAID Array Recorded in an SSA RAID Manager**, and go to step 2 on page 78 of Deleting an Old RAID Array Recorded in an SSA RAID Manager.

Listing Old RAID Arrays Recorded in an SSA RAID Manager

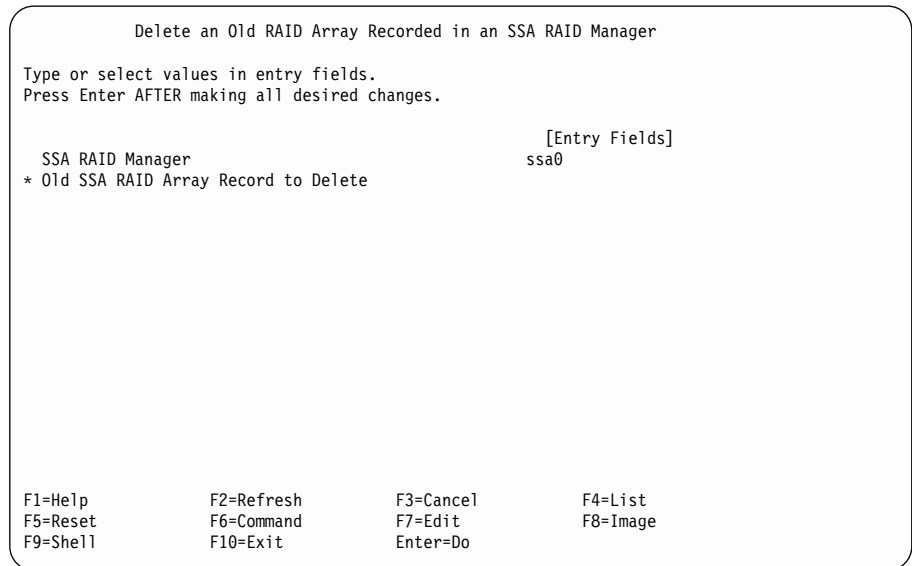This option allows you to list the serial numbers of disconnected arrays whose records remain in the RAID manager.

1. For fast path, type `smitty lsssanvram` and press Enter.

   Otherwise:

   a. Select **List/Delete Old RAID Arrays in an SSA RAID Manager** from the SSA RAID Array menu.

   b. Select **List Old RAID Arrays Recorded in an SSA RAID Manager**.

2. A list of RAID managers is displayed in a window:

```
              List/Delete Old RAID Arrays in an SSA RAID Manager

 Move cursor to desired item and press Enter.

   List Old RAID Arrays Recorded in an SSA RAID Manager
   Delete an Old RAID Array Recorded in an SSA RAID Manager




     --------------------------------------------------------------------------
    |                           SSA RAID Manager                               |
    |                                                                          |
    | Move cursor to desired item and press Enter.                             |
    |                                                                          |
    |   ssa0 Available 00-02 SSA RAID Adapter                                  |
    |                                                                          |
    | F1=Help               F2=Refresh               F3=Cancel                 |
    | F8=Image              F10=Exit                  Enter=Do                 |
    | /=Find                n=Find Next                                        |
     --------------------------------------------------------------------------
```

3. Select the RAID manager for which you want a list of old arrays.

4. If any old arrays are in the RAID manager, a list of those arrays appears:

```
                          COMMAND STATUS

Command: OK            stdout: yes            stderr: no

Before command completion, additional instructions may appear below.

[TOP]
0952314698B637K
09523146994837K
0952314699A437K
0952314699CE37K
095231469A9337K
095231469B6D37K
095231469C4537K
095231469CEE37K
095231469D7A37K
095231469E2C37K
095231469F7C37K
09523146A42637K
09523146A4B737K
[MORE...15]

F1=Help              F2=Refresh           F3=Cancel            F6=Command
F8=Image             F9=Shell             F10=Exit             /=Find
n=Find Next
```

5. If you want to delete any records, note the names of those records, and go to "Deleting an Old RAID Array Recorded in an SSA RAID Manager".

Deleting an Old RAID Array Recorded in an SSA RAID Manager

This option allows you to delete the records of RAID managers that have been disconnected, but whose records remain in the RAID manager.

1. For fast path, type `smitty rmssanvram` and press Enter.

   Otherwise:

   a. Select **List/Delete Old RAID Arrays in an SSA RAID Manager** from the SSA RAID Array menu.

   b. Select **Delete an Old RAID Array Recorded in an SSA RAID Manager**.

2. A list of RAID managers is displayed in a window:

```
                List/Delete Old RAID Arrays in an SSA RAID Manager

Move cursor to desired item and press Enter.

  List Old RAID Arrays Recorded in an SSA RAID Manager
  Delete an Old RAID Array Recorded in an SSA RAID Manager




      --------------------------------------------------------------------------
      |                         SSA RAID Manager                                |
      |                                                                         |
      | Move cursor to desired item and press Enter.                            |
      |                                                                         |
      |   ssa0 Available 00-02 SSA RAID Adapter                                 |
      |                                                                         |
      | F1=Help              F2=Refresh              F3=Cancel                  |
      | F8=Image             F10=Exit                Enter=Do                   |
      | /=Find               n=Find Next                                        |
      --------------------------------------------------------------------------
```
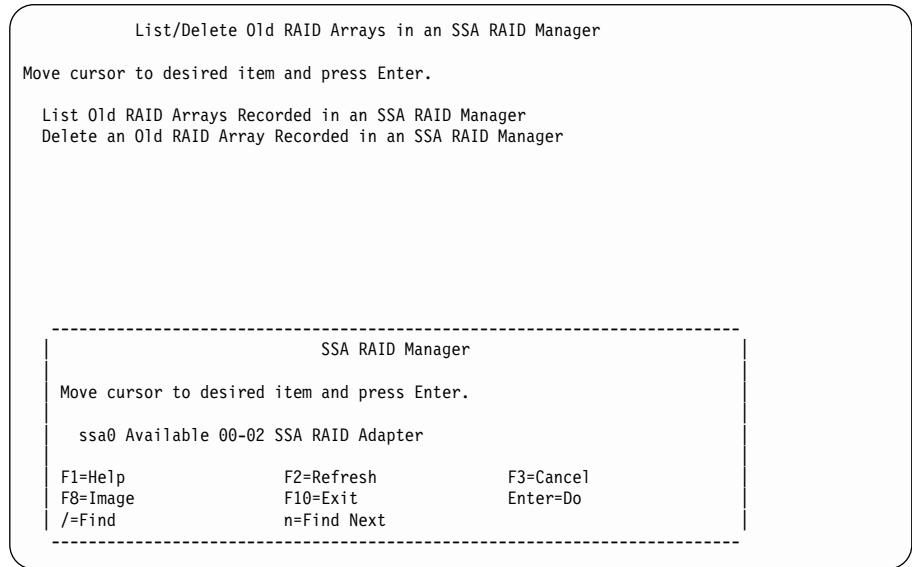
Select the RAID manager from which you want to delete an old array.

3. The following information is displayed:

```
            Delete an Old RAID Array Recorded in an SSA RAID Manager

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  SSA RAID Manager                                 ssa0
* Old SSA RAID Array Record to Delete








F1=Help           F2=Refresh         F3=Cancel          F4=List
F5=Reset          F6=Command         F7=Edit           F8=Image
F9=Shell          F10=Exit           Enter=Do
```

Press the List key to list the records.

4. From the displayed list, select the record that you want to delete.

Changing or Showing the Attributes of an SSA RAID Array

Each array type has several attributes associated with it. This option allows you to see, and possibly change, those attributes.

1. For fast path, type `smitty chssaraid` and press Enter.

   Otherwise, select **Change/Show Attributes of an SSA RAID Array** from the SSA RAID Array menu.

2. A list of arrays is displayed in a window:

```
                              SSA RAID Arrays

 Move cursor to desired item and press Enter.

   List All Defined SSA RAID Arrays
   List All Supported SSA RAID Arrays
   List All SSA RAID Arrays Connected to a RAID Manager
   List Status Of All Defined SSA RAID Arrays
   List/Identify SSA Physical Disks
   List/Delete Old RAID Arrays Recorded in an SSA RAID Manager
   Add an SSA RAID Array
   Delete an SSA RAID Array
   Change/Show Attributes of an SSA RAID Array
    --------------------------------------------------------------------------
   |                          SSA RAID Array                                  |
   |                                                                          |
   |  Move cursor to desired item and press Enter.                            |
   |                                                                          |
   |    hdisk2          095231779F0737K good        3.4G   RAID-5 array       |
   |    hdisk3          09523173A02137K good        3.4G   RAID-5 array       |
   |                                                                          |
   |  F1=Help              F2=Refresh           F3=Cancel                     |
   |  F8=Image             F10=Exit             Enter=Do                      |
   | /=Find                n=Find Next                                        |
    --------------------------------------------------------------------------
```
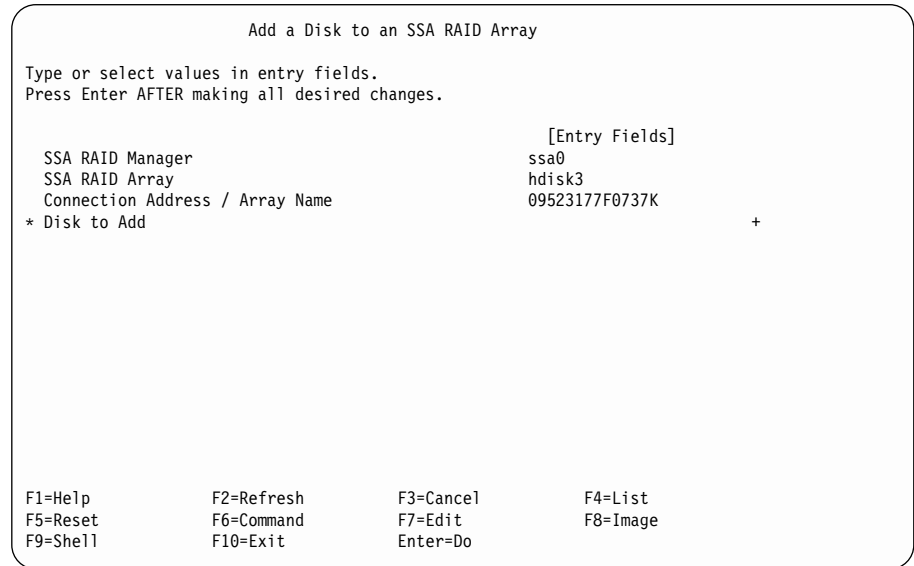
Select the array whose attributes you want to see or change.

3. A list of attributes is displayed:

```
                   Change/Show Attributes of an SSA RAID Array

  Type or select values in entry fields.
  Press Enter AFTER making all desired changes.

                                                [Entry Fields]
    SSA RAID Manager                            ssa0
    SSA RAID Array                              hdisk3
    Connection Address / Array Name             00243199986267K
    RAID Array Type                             raid_5
    State                                       good
    Member Disks                                pdisk1 pdisk3 pdisk4 p>
    Size of Array                               3.4G
    Percentage Rebuilt                          Not Rebuilding
    Enable Use of Hot Spares                    yes                    +
    Allow Page Splits                           yes                    +
    Current Use                                 AIX System Disk        +




  F1=Help              F2=Refresh          F3=Cancel            F4=List
  F5=Reset             F6=Command          F7=Edit              F8=Image
  F9=Shell             F10=Exit            Enter=Do
```

Move the cursor to the attribute that you want to change, and press the List key.

4. A list of options for that attribute is displayed. Select the option that you want.

5. If you want to change another attribute, move the cursor to that attribute and press the List key.

6. Again, choose from the list of displayed options.

7. Repeat steps 5 and 6 for each attribute that you want to change.

Changing Member Disks in an SSA RAID Array

This option allows you to remove a disk drive from an array and install a replacement disk drive. All the data that is on the original disk drive is automatically written to the replacement disk drive.

1. For fast path, type smitty swpssaraid and press Enter.

   Otherwise, select **Change Member Disks in an SSA RAID Array** from the SSA RAID Array menu.

2. The following menu is displayed:

```
 ╭─────────────────────────────────────────────────────────────────────────╮
 │                   Change Member Disks in an SSA RAID Array                │
 │                                                                           │
 │ Move cursor to desired item and press Enter.                              │
 │                                                                           │
 │   Remove a Disk From an SSA RAID Array                                    │
 │   Add a Disk to an SSA RAID Array                                         │
 │   Swap Members of an SSA RAID Array                                       │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │                                                                           │
 │ F1=Help            F2=Refresh         F3=Cancel         F8=Image          │
 │ F9=Shell           F10=Exit           Enter=Do                            │
 ╰─────────────────────────────────────────────────────────────────────────╯
```
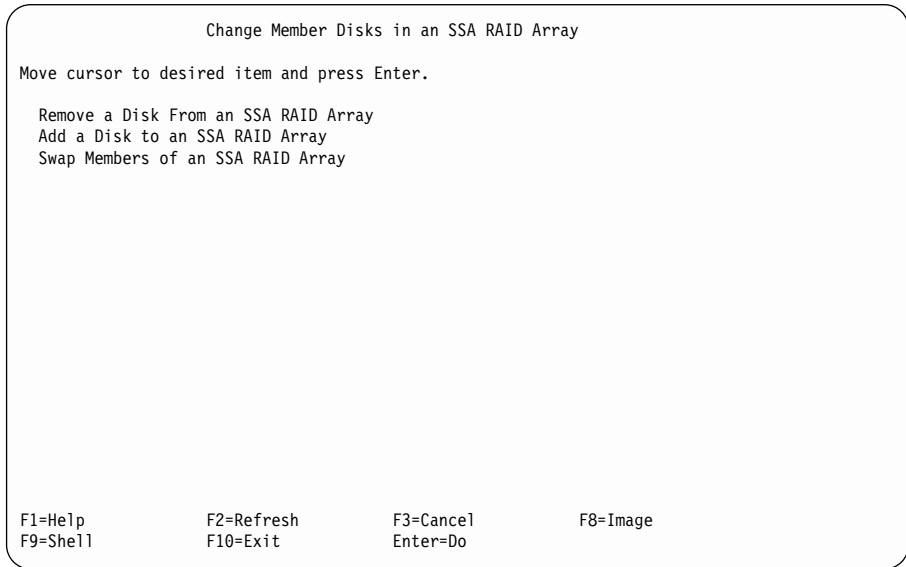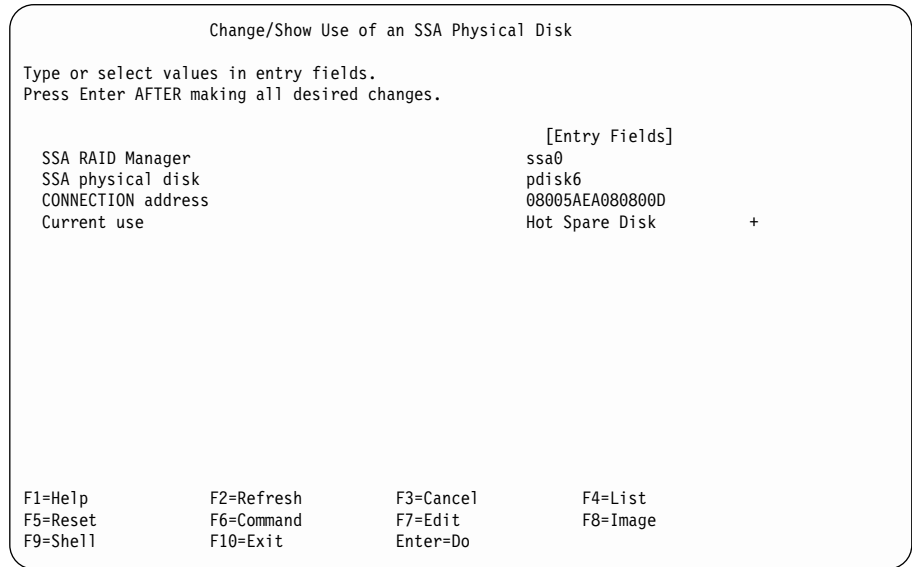
If you have an available disk drive, select **Swap Members of an SSA RAID Array**, and go to step 2 on page 85 of Swapping Members of an SSA RAID Array.

If you do not have an available disk drive, select **Remove a Disk from an SSA RAID Array**, and go to step 2 of Removing a Disk Drive from an SSA RAID Array.

Removing a Disk Drive from an SSA RAID Array

This option allows you to remove a disk drive from an array so that you can install a replacement disk drive. Use this option when you do not have either an available online disk drive, or a spare slot for a replacement disk drive.

1. For fast path, type smitty redssaraid and press Enter.

   Otherwise:

   a. Select **Change Member Disks in an SSA RAID Array** from the SSA RAID Array menu.

   b. Select **Remove a Disk from an SSA RAID Array**.

2. A list of arrays is displayed in a window:

```
                    Change Member Disks in an SSA RAID Array

Move cursor to desired item and press Enter.

  Remove a Disk from an SSA RAID Array
  Add a Disk to an SSA RAID Array
  Swap Members of an SSA RAID Array




     --------------------------------------------------------------------
    |                        SSA RAID Array                              |
    |                                                                    |
    | Move cursor to desired item and press Enter.                       |
    |                                                                    |
    |   hdisk3          095231779F0737K good       3.4G   RAID-5 array   |
    |   hdisk4          09523173A02137K good       3.4G   RAID-5 array   |
    |                                                                    |
    | F1=Help                 F2=Refresh              F3=Cancel          |
    | F8=Image                F10=Exit                 Enter=Do          |
    | /=Find                  n=Find Next                                 |
     --------------------------------------------------------------------
```
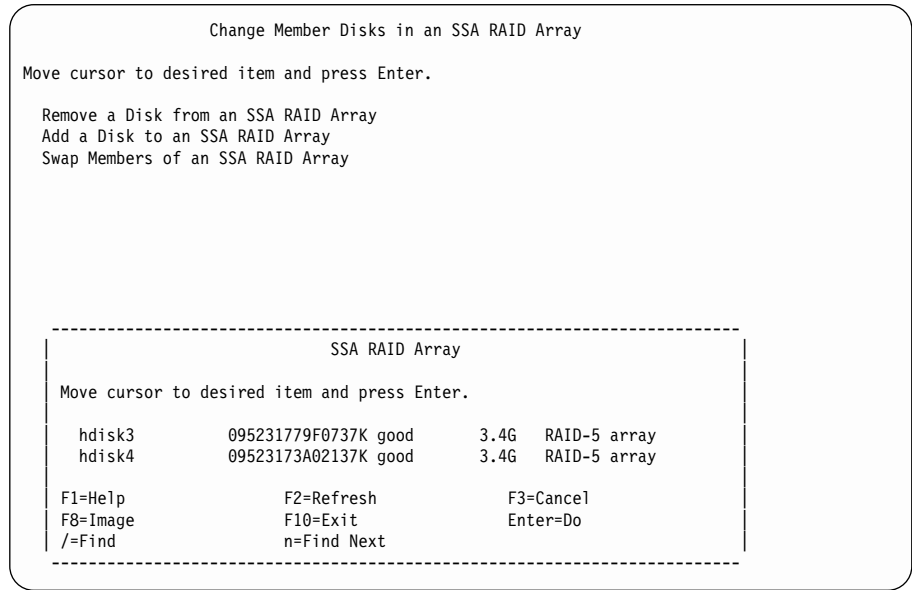
Select the array from which you want to remove a disk drive.

3. The following information is displayed:
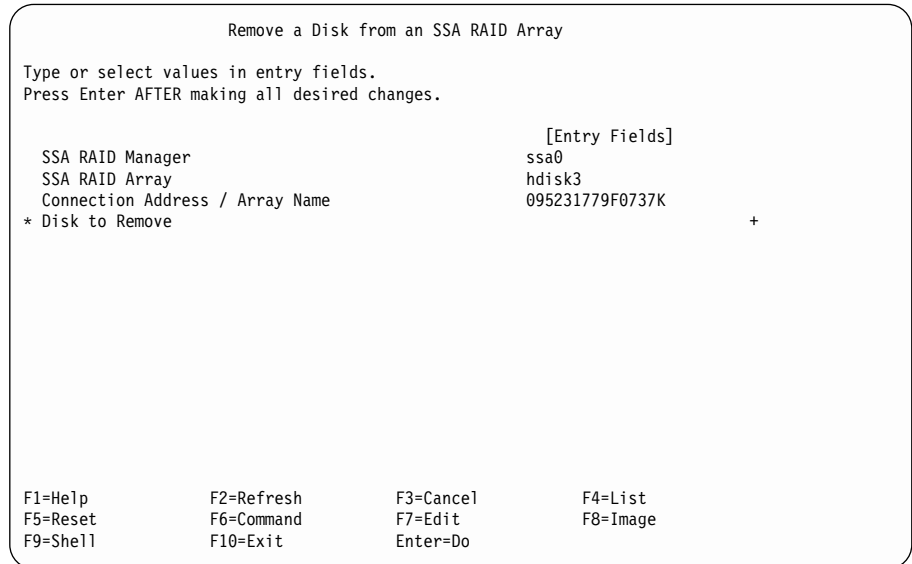
```
                    Remove a Disk from an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                              [Entry Fields]
  SSA RAID Manager                            ssa0
  SSA RAID Array                              hdisk3
  Connection Address / Array Name             095231779F0737K
* Disk to Remove                                                          +









 F1=Help            F2=Refresh        F3=Cancel         F4=List
 F5=Reset           F6=Command        F7=Edit           F8=Image
 F9=Shell           F10=Exit          Enter=Do
```

Press the List key to list the disk drives.

4. From the displayed list, select the disk drive that you want to remove.
5. Physically remove the disk drive from the subsystem (see the *Operator Guide* or *Service Guide* for the unit).
6. Go to "Adding a Disk Drive to an SSA RAID Array" on page 84.

Adding a Disk Drive to an SSA RAID Array

This option allows you to install a replacement disk drive into an array that is running in the Exposed or Degraded state because you have removed a disk drive. When you install the replacement disk drive, all the data that was contained on the original disk drive is automatically written to the replacement disk drive.

1. For fast path, type `smitty addssaraid` and press Enter.

    Otherwise:

    a. Select **Change Member Disks of an SSA RAID Array** from the SSA RAID Array menu.

    b. Select **Add a Disk to an SSA RAID Array**.

2. A list of arrays is displayed in a window:

```
                      Change Member Disks in an SSA RAID Array

Move cursor to desired item and press Enter.

  Remove a Disk from an SSA RAID Array
  Add a Disk to an SSA RAID Array
  Swap Members of an SSA RAID Array




      ----------------------------------------------------------------------
     |                          SSA RAID Array                              |
     |                                                                      |
     | Move cursor to desired item and press Enter.                         |
     |                                                                      |
     |   hdisk2          095231779F0737K degraded   3.4G   RAID-5 array     |
     |                                                                      |
     | F1=Help              F2=Refresh              F3=Cancel               |
     | F8=Image             F10=Exit                Enter=Do                |
     | /=Find               n=Find Next                                     |
      ----------------------------------------------------------------------
```

Select the array to which you are adding the disk drive.

3. The following information is displayed:

```
                     Add a Disk to an SSA RAID Array

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                             [Entry Fields]
   SSA RAID Manager                          ssa0
   SSA RAID Array                            hdisk3
   Connection Address / Array Name           09523177F0737K
 * Disk to Add                                                         +




 F1=Help              F2=Refresh         F3=Cancel          F4=List
 F5=Reset             F6=Command         F7=Edit            F8=Image
 F9=Shell             F10=Exit           Enter=Do
```

Press the List key to list the disk drives.

4. From the displayed list, select the name of the disk drive that you are adding.

5. Install the replacement disk drive (see the *Operator Guide*, or equivalent, for the subsystem).

6. Run system diagnostics to verify that the disk drive is working correctly.

Swapping Members of an SSA RAID Array

This option allows you to swap a disk drive for a replacement disk drive.

1. For fast path, type `smitty exssaraid` and press Enter.

   Otherwise:

   a. Select **Change Member Disks in an SSA RAID Array** from the SSA RAID Array menu.

   b. Select **Swap Members of an SSA RAID Array**.

2. A list of arrays is displayed in a window:

```
                    Change Member Disks of an SSA RAID Array

Move cursor to desired item and press Enter.

  Remove a Disk from an SSA RAID Array
  Add a Disk to an SSA RAID Array
  Swap Members of an SSA RAID Array




     ---------------------------------------------------------------------
     |                          SSA RAID Array                           |
     |                                                                   |
     | Move cursor to desired item and press Enter. Use arrow keys to scroll. |
     |                                                                   |
     |   hdisk3           095231779F0737K rebuilding 3.4G   RAID-5 array |
     |   hdisk3           09523173A02137K good        3.4G   RAID-5 array |
     |                                                                   |
     | F1=Help              F2=Refresh             F3=Cancel             |
     | F8=Image             F10=Exit               Enter=Do              |
     | /=Find               n=Find Next                                  |
     ---------------------------------------------------------------------
```

Select the array whose disk drives you want to swap.

3. The following information is displayed:

```
                    Swap Members of an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                              [Entry Fields]
  SSA RAID Manager                          ssa0
  SSA RAID Array                            hdisk3
  Connection Address / Array Name           09523173A02137K
* Disk To Remove                                                    +
* Disk To Add                                                       +









 F1=Help           F2=Refresh         F3=Cancel          F4=List
 F5=Reset          F6=Command         F7=Edit            F8=Image
 F9=Shell          F10=Exit           Enter=Do
```

Press the List key to list the disk drives that can be removed.

4. From the displayed list, select the disk drive that you want to remove.

5. The following information is displayed:

```
                     Swap Members of an SSA RAID Array

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                  [Entry Fields]
   SSA RAID Manager                             ssa0
   SSA RAID Array                               hdisk3
   Connection Address / Array Name              09523173A02137K
 * Disk To Remove                                                      +
 * Disk To Add                                                         +




  F1=Help            F2=Refresh         F3=Cancel          F4=List
  F5=Reset           F6=Command         F7=Edit            F8=Image
  F9=Shell           F10=Exit           Enter=Do
```
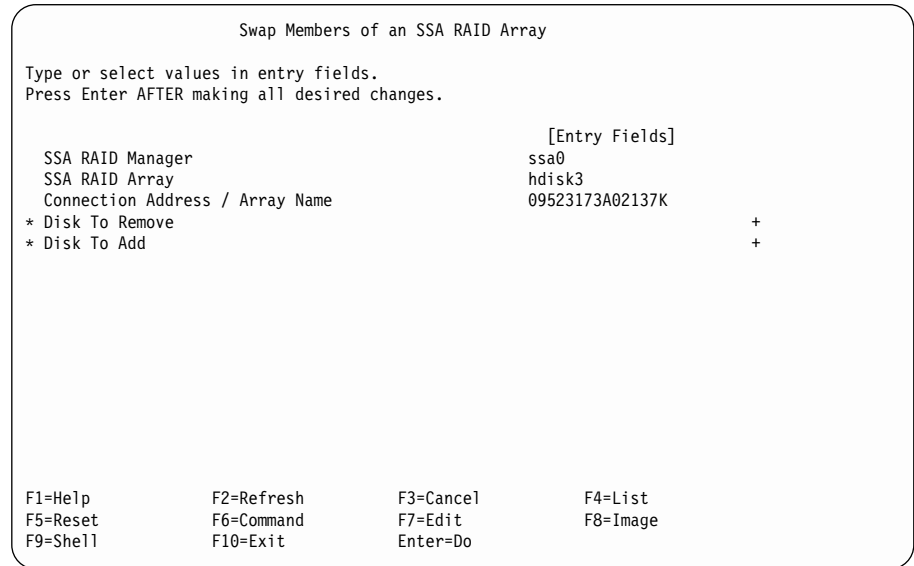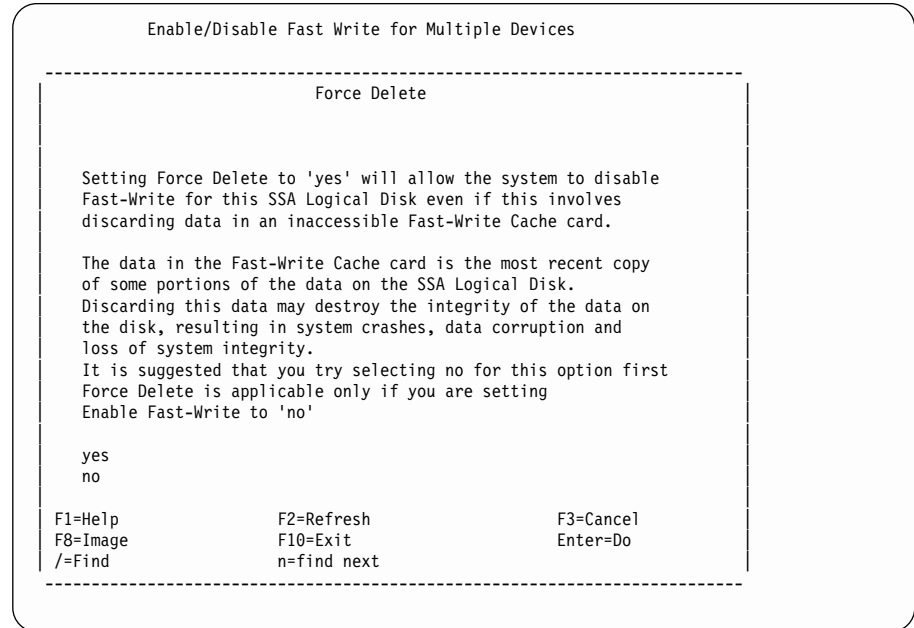
Press the List key to list the candidate disk drives that can be added.

6. From the displayed list, select the name of the disk drive that you want to add.

7. Remove the selected disk drive (see the *Operator Guide* or *Service Guide* for the unit.)

8. Install the replacement disk drive (see the *Operator Guide* or *Service Guide* for the unit.)

9. Run system diagnostics to verify that the replacement disk drive is working correctly.

Changing or Showing the Use of an SSA Disk Drive

This option allows you to change, or see, how particular disk drives are used.

1. For fast path, type smitty chgssadisk and press Enter.

   Otherwise, select **Change/Show Use of an SSA Physical Disk** from the SSA RAID Array menu.

2. A list of adapters is displayed in a window:

```
                      List/Identify SSA Physical Disks

Move cursor to desired item and press Enter.

  List Disks in an SSA RAID Array
  List Hot Spares
  List Rejected Array Disks
  List Array Candidate Disks
  List AIX System Disks
  Identify Disks in an SSA RAID Array
  Identify Hot Spares
  Identify Rejected Array Disks
  Identify Array Candidate Disks
  Identify AIX System Disks
   ------------------------------------------------------------------------
  |                          SSA RAID Manager                              |
  |                                                                        |
  | Move cursor to desired item and press Enter.                           |
  |                                                                        |
  |   ssa0 Available 00-04 SSA RAID Adapter                                |
  |                                                                        |
  | F1=Help               F2=Refresh              F3=Cancel                |
  | F8=Image              F10=Exit                Enter=Do                 |
  | /=Find                n=Find Next                                      |
   ------------------------------------------------------------------------
```

Select the adapter whose disk drives you want to list.

3. A list of disk drives and their usage is displayed in a window:

```
                   SSA RAID Arrays

Move cursor to desired item and press Enter.

  List All Defined SSA RAID Arrays
   ------------------------------------------------------------------------
  |                          SSA Physical Disk                             |
  |                                                                        |
  | Move cursor to desired item and press Enter. Use arrow keys to scroll. |
  |                                                                        |
  |   # SSA physical disks which are members of arrays.                    |
  |   pdisk0       00022123DFHC00D member   n/a        4.5G  Physical d    |
  |   pdisk1       0004AC5119E000D member   n/a        1.1G  Physical d    |
  |   pdisk2       0004AC5119E000D member   n/a        1.1G  Physical d    |
  |   pdisk3       08005AEA003500D member   n/a        4.5G  Physical d    |
  |   pdisk4       08005AEA030D00D member   n/a        2.3G  Physical d    |
  |   pdisk5       08005AEA080100D member   n/a        4.5G  Physical d    |
  |   pdisk7       08005AEA087A00D member   n/a        4.5G  Physical d    |
  |   # SSA physical disks which are hot spares.                           |
  |   pdisk6       08005AEA080800D spare    n/a        4.5G  Physical d    |
  |                                                                        |
  | F1=Help               F2=Refresh              F3=Cancel                |
  | F8=Image              F10=Exit                Enter=Do                 |
  | /=Find                n=Find Next                                      |
   ------------------------------------------------------------------------
```

Using the arrow keys, scroll the information until you find the list of SSA physical
disks that contains the disk drive that you want to change.

4. Select the disk drive that you want to change or show.

   The following screen is displayed for the disk drive that you have chosen:

```
                    Change/Show Use of an SSA Physical Disk

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                  [Entry Fields]
   SSA RAID Manager                               ssa0
   SSA physical disk                              pdisk6
   CONNECTION address                             08005AEA080800D
   Current use                                    Hot Spare Disk           +







 F1=Help              F2=Refresh          F3=Cancel           F4=List
 F5=Reset             F6=Command          F7=Edit             F8=Image
 F9=Shell             F10=Exit            Enter=Do
```

If you are only checking the use of the disk drive, and do not want to change it, go no further with these instructions. Otherwise, go to step 5.

5. **Note:** If the **Current Use** field shows that the disk drive is owned by an array, you cannot change that use.

   Move the cursor to **Current Use**, and press the List key.

6. A list of uses is displayed. Make your selection, and press Enter.

Changing the Use of Multiple SSA Physical Disks

1. For fast path, type smitty chgssadisks and press Enter.

   Otherwise, select **Change Use of Multiple SSA Physical Disks** from the SSA RAID Array menu.

2. A list of adapters is displayed in a window:

```
                          SSA RAID Arrays

  Move cursor to desired item and press Enter.

    List All Defined SSA RAID Arrays
    List All Supported SSA RAID Arrays
    List All SSA RAID Arrays Connected to a RAID Manager
    List Status of All Defined SSA RAID Arrays
    Add an SSA RAID Array
    Change/Show Attributes of an SSA RAID Array
    Delete an SSA RAID Array
    Change Member Disks in an SSA RAID Array
    List/Identify SSA Physical Disks
    Change/Show Use of an SSA Physical Disk
     ---------------------------------------------------------------------
    |                         SSA RAID Manager                            |
    |                                                                     |
    |  Move cursor to desired item and press Enter.                       |
    |                                                                     |
    |    ssa0 Available 00-04 SSA RAID Adapter                            |
    |                                                                     |
    |  F1=Help              F2=Refresh              F3=Cancel             |
    |  F8=Image             F10=Exit                Enter=Do              |
    |  /=Find               n=Find Next                                   |
     ---------------------------------------------------------------------
```

3. Select the adapter.

   A list is displayed of the disk drives that are attached to the adapter:

```
                          SSA RAID Arrays

     ---------------------------------------------------------------------
    |                        SSA Physical Disks                           |
    |                                                                     |
    |  Move cursor to desired item and press F7. Use arrow keys to scroll.|
    |      ONE OR MORE items can be selected.                             |
    |  Press Enter AFTER making all selections.                           |
    |                                                                     |
    |    # SSA physical disks that are free.                              |
    |    pdisk7        0004AC51848900D free     n/a      2.3G   Physical d|
    |    pdisk8        0004AC51965300D free     n/a      2.3G   Physical d|
    |    pdisk10       0004AC51BD8F00D free     n/a      4.5G   Physical d|
    |    # SSA physical disks that are hot spares.                        |
    |    pdisk9        0004AC51BD8000D spare    n/a      4.5G   Physical d|
    |    # SSA physical disks that are AIX system disks.                  |
    |    pdisk0        0004AC50A30300D system   n/a      4.5G   Physical d|
    |                                                                     |
    |                                                                     |
    |                                                                     |
    |  F1=Help              F2=Refresh              F3=Cancel             |
    |  F7=Select            F8=Image                F10=Exit              |
    |  Enter=Do             /=Find                  n=Find Next           |
     ---------------------------------------------------------------------
```

4. Use the Select key to select the disk drives whose use you want to change. Select
   only those disk drives that are to have the same use. (For example, select only disk
   drives that are to become hot spare disk drives, or select only disk drives that are to
   become AIX system disks.)

   The following screen is displayed for the disk drives that you have chosen:

```
                  Change Use of Multiple SSA Physical Disks

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                             [Entry Fields]
  SSA RAID Manager                         ssa0
  SSA physical disk                        pdisk6, pdisk7, pdisk8
  New use                                  AIX System Disks        +










F1=Help          F2=Refresh        F3=Cancel          F4=List
F5=Reset         F6=Command        F7=Edit            F8=Image
F9=Shell         F10=Exit          Enter=Do
```

5. If you want to select other uses for other disk drives, repeat this procedure for each
   different use.

Chapter 5. Using The Fast-Write Cache Feature

This chapter describes how to configure the Fast-Write Cache feature, and how to deal with any fast-write problems that might occur during fast-write operations. The Fast-Write Cache feature is available only on the Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M) and the PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N).

Configuring the Fast-Write Cache Feature

This section describes how to use the system management tool (SMIT) to configure and install arrays and disks with the fast-write attribute. If you prefer to use the **ssaraid** command through the command line interface instead of through the menus, see "Chapter 7. Using the SSA Command Line Interface for RAID Configurations" on page 113.

You can get access to the SMIT panels by using fast path commands, or by working through the menus. In this chapter , the fast path command for a particular option is given at the start of the description of that option.

Note: Although this book refers to the **smitty** commands, you can use either the **smitty** command or the **smit** command. The procedures that you follow and the contents of the displays remain the same, whichever of the two commands you use.

Getting Access to the Fast-Write Menus

1. For fast-path access to the Fast-Write SMIT menus, type smitty ssadlog and press Enter.

   Otherwise:

   a. Type smitty and press Enter. The System Management menu is displayed.

   b. Select **Devices**. The Devices menu is displayed.

   c. Select **SSA Disks**. The SSA Disks menu is displayed.

   d. Select **SSA Logical Disks**.

2. The SSA Logical Disks menu is displayed:

```
                              SSA Logical Disks

  Move cursor to desired item and press Enter.

    List All Defined SSA Logical Disks
    List All Supported SSA Logical Disks
    Add an SSA Logical Disk
    Change/Show Characteristics of an SSA Logical Disk
    Remove an SSA Logical Disk
    Configure a Defined SSA Logical Disk
    Generate an Error Report
    Trace an SSA Logical Disk
    Show Logical to Physical SSA Disk Relationship
    List Adapters Connected to an SSA Logical Disk
    List SSA Logical Disks Connected to an SSA Adapter
    Identify an SSA Logical Disk
    Cancel all SSA Disk Identifications
    Enable/Disable Fast-Write for Multiple Devices




  F1=Help              F2=Refresh           F3=Cancel           F8=Image
  F9=Shell             F10=Exit             Enter=Do
```

If you want to enable or disable a fast-write attribute for one logical disk drive, see
"Enabling or Disabling Fast-Write for One Disk Drive".

If you want to enable or disable a fast-write attribute for multiple devices, see "Enabling
or Disabling Fast-Write for Multiple Devices" on page 95.

Enabling or Disabling Fast-Write for One Disk Drive

This option lets you enable or disable the fast-write function for one disk drive.

1. For fast path access to the Change/Show Characteristics of an SSA Logical Disk
   menu, type smitty chgssardsk and press Enter.

   Otherwise, select **Change/Show Characteristics of an SSA Logical Disk** from the
   SSA Logical Disks menu.

   A list of options for the logical disk drives is displayed:

```
                Change/Show Characteristics of an SSA Logical Disk

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[MORE...5]                                            [Entry Fields]
  Location                                       00-02-L
  Location Label                                 [ ]
  Parent                                         ssar
  Size in Megabytes                              4512
  adapter_a                                      ssa0
  adapter_b                                      none
  primary_adapter                                adapter_a
  Connection address                             080005AEA036800D
  Physical volume IDENTIFIER                     none
  ASSIGN physical volume identifier              no
  RESERVE disk on open                           yes
  Queue depth                                    [3]
  Maximum Coalesce                               [0x20000]
  Enable Fast-Write                              no
 [BOTTOM]
F1=Help           F2=Refresh        F3=Cancel          F4=List
F5=Reset          F6=Command        F7=Edit            F8=Image
F9=Shell          F10=Exit          Enter=Do
```

2. If you want to enable the fast-write function for a particular disk drive, set the
   Enable Fast Write option to **yes** for that disk drive.

   If you want to disable the fast-write function for a particular disk drive, set the
   Enable Fast Write option to **no** for that disk drive.

   Note: You can disable the fast-write function from this menu only if no data for your
   selected device is present in the fast-write cache. If data for your selected
   device is present in the fast-write cache, and you want to disable the
   fast-write function, go to "Enabling or Disabling Fast-Write for Multiple
   Devices".

Enabling or Disabling Fast-Write for Multiple Devices

This option allows you to enable or disable the fast-write function on multiple devices.
You can select multiple devices from the list that this option displays. The displayed list
contains also offline and broken cache items, so that you can delete them.

1. For fast path access to the Enable/Disable Fast Write for Multiple Devices menu,
   type smitty ssafastw and press Enter.

   Otherwise, select **Enable/Disable Fast Write for Multiple Devices** from the SSA
   Logical Disks menu.

   A list of options for the logical disk drives is displayed in a window:

```
                         SSA Logical Disks

Move cursor to desired item and press Enter.

  List All Defined SSA Logical Disks
  List All Supported SSA Logical Disks
  Add an SSA Logical Disk
  Change/Show Characteristics of an SSA Logical Disk
  Remove an SSA Logical Disk
  Configure a Defined SSA Logical Disk
  ---------------------------------------------------------------------------
  |                           List of Devices                               |
  |                                                                         |
  |  Move cursor to desired item and press F7. Use arrow keys to scroll     |
  |      ONE OR MORE items can be selected.                                 |
  | Press Enter AFTER making all selections.                                |
  |                                                                         |
  |    # Fast Write is Disabled for these devices                           |
  |  hdisk1          0004AC506C2900D available            SSA Logical Disk D|
  |  pdisk3          08005AEA022600D free     n/a              2.3GB   Physical|
  |                                                                         |
  | F1=Help              F2=Refresh              F3=Cancel                   |
  | F7=Select            F8=Image                F10=Exit                    |
  | Enter=Do             /=Find                  n=find next                 |
  ---------------------------------------------------------------------------
```

Select the disk drives for which you are enabling or disabling the fast-write function.

2. The Enable/Disable Fast Write for Multiple Devices menu appears:

```
                    Enable/Disable Fast Write for Multiple Devices

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                   [Entry Fields]
   List of Devices                                 hdisk1
   Enable Fast Write                               no
   Force Delete                                    no









  [BOTTOM]
 F1=Help           F2=Refresh          F3=Cancel          F4=List
 F5=Reset          F6=Command          F7=Edit            F8=Image
 F9=Shell          F10=Exit            Enter=Do
```

If you want to enable the fast-write function for the selected disk drives, set the
Enable Fast Write option to **yes** for those disk drives. The state of the **Force
Delete** option is ignored.

If you want to disable the fast-write function for the selected disk drives, set the
Enable Fast Write option to **no** and the **Force Delete** option to **no** for those disk
drives.

Note: The fast-write function is disabled only if no data for your selected devices is present in the fast-write cache. If data for your selected devices is present in the fast-write cache, and you want to disable the fast-write function, go to step 3.

3. If data for your selected devices is present in the fast-write cache, and you want to disable the fast-write function, set the **Enable Fast Write** option to **no**, and the **Force Delete** option to **yes**. The Force Delete screen is displayed:

```
              Enable/Disable Fast Write for Multiple Devices

  ------------------------------------------------------------------------
  |                         Force Delete                                 |
  |                                                                      |
  |                                                                      |
  |   Setting Force Delete to 'yes' will allow the system to disable     |
  |   Fast-Write for this SSA Logical Disk even if this involves         |
  |   discarding data in an inaccessible Fast-Write Cache card.          |
  |                                                                      |
  |   The data in the Fast-Write Cache card is the most recent copy      |
  |   of some portions of the data on the SSA Logical Disk.              |
  |   Discarding this data may destroy the integrity of the data on      |
  |   the disk, resulting in system crashes, data corruption and         |
  |   loss of system integrity.                                          |
  |   It is suggested that you try selecting no for this option first    |
  |   Force Delete is applicable only if you are setting                 |
  |   Enable Fast-Write to 'no'                                          |
  |                                                                      |
  |     yes                                                              |
  |     no                                                               |
  |                                                                      |
  | F1=Help              F2=Refresh              F3=Cancel               |
  | F8=Image             F10=Exit                Enter=Do                |
  | /=Find               n=find next                                     |
  ------------------------------------------------------------------------
```

Dealing with Fast-Write Problems

This section describes how to recover from problems that might occur during fast-write operations. These problems are indicated by any of the following Service Request Numbers (SRNs):

- 42520
- 42521
- 42522
- 42524
- 42525

If any of these SRNs occurs, find that SRN in this section, and do the actions given.

SRNs 42520, 42521, and 42522

You can use the **ssaraid** command to list the devices that are affected by this failure. The **ssaraid** command is in /usr/sbin.

- To list all devices that are affected by this cache failure, type:

```
ssaraid -l ssaX -Iz -a state=cache_data_error
```

where X is the number of the adapter that has reported the failure in the error log; for example, ssa3. The output from the command produces one line of information for each device, as follows:

```
2327340C228635K 2327340C228635K cache_data_error       2.3GB   RAID-5  array
hdisk3          2327340C423235K cache_data_error      36.4GB   RAID-5  array
pdisk5          08005AEA045E00D cache_data_error       9.1GB   Physical disk
```

This output shows the name of the device, if available, the 15-digit SSA serial number, the device state, and the device size and type.

The location of the corrupted data is not known, and no simple data recovery procedure is possible. To attempt data recovery, you must disable the fast-write cache, then make the devices available again.

- To disable the fast-write cache, type:

```
ssaraid -l ssaX -H -n Y -a fastwrite=off -a force=yes -u
```

where X is the number of the adapter that has reported the failure, and Y is the name of the device. (The name of the device can be either the logical disk name, or the SSA serial number.) A typical command line might be, therefore:

```
ssaraid -l ssa3 -H -n pdisk5 -a fastwrite=off -a force=yes -u
```

or:

```
ssaraid -l ssa3 -H -n 2327340C423235K -a fastwrite=off -a force=yes -u
```

The force attribute ensures that all data is lost from the fast-write cache. You cannot recover that data. The force attribute also prevents the reattachment of the disk to AIX; no logical disk can, therefore, be created. The actions of the force attribute are important, because the lost data might include file system metadata. If that data is damaged as a result of the fast-write cache failure, further data loss and system crashes might occur when you attempt to restart the file system.

When the fast-write cache has been disabled, you can attempt to recover the data on the device.**Attention:** Ensure that the disk is not returned with its current use defined as **System Disk**, until you are sure that the file system is safe.

- To reattach the disk and create a logical disk, type:

```
ssaraid -l ssaX -H -n Y -a use=system -k Z -d
```

where X is the adapter number, Y is the 15-digit device serial number from the list function that you ran earlier, and Z is the name of a logical disk. For the logical disk, choose a name that is different from the names of existing logical disks. This action ensures that the logical disk that you have created is not automatically attached if the using system crashes and reboots.

When this operation has completed, a message is displayed. This message tells you that the logical disk (Z) has been attached, and that the device (/dev/Z) can be accessed. For example:

```
ssaraid -l ssa3 -H -n 2327340C228635K -a use=system -k ZZDataRecovery -d

2327340C228635K attached
ZZDataRecovery Available
```

where /dev/ZZDataRecovery is the device.

You can now use standard AIX commands (for example, **fsck** and **fsdb**) to attempt to repair any possible damage to the file system, before you attempt data recovery.

SRN 42524

If a Fast-Write Cache Option Card fails, or is removed from the adapter, the affected devices are all those that contain unsynchronized data when the cache card fails, or is removed. To list these devices, type:

```
ssaraid -l ssaX -Iz -a state=no_cache
```

where X is the adapter number. Use the recovery procedure that is described for SRN 42520. You must recover all the devices that are listed.

SRN 42525

If a Fast-Write Cache Option Card fails, or is removed from the adapter, the affected devices are all those that contain unsynchronized data when the cache card fails, or is removed. To list these devices, type:

```
ssaraid -l ssaX -Iz -a state=wrong_cache
```

where X is the adapter number. Use the recovery procedure that is described for SRN 42520. You must recover all the devices that are listed.

Chapter 6. SSA Error Logs

This chapter describes:
- Error logging
- Error logging management
- Error log analysis
- Good housekeeping

Each topic is discussed as a *summary*, then as a *detailed description*.

The summaries provide all the information that you need for routine service operations on SSA subsystems. For these operations, you have no need to inspect the system error log, or to attempt to analyze the contents of the log.

The detailed descriptions help you understand the meaning of the error log data so that you can further analyze the error log. For example, you might decide to fail-over an HACMP system when particular critical failures are logged.

Error Logging

Summary

Hardware errors can be detected by an SSA disk drive, an SSA Adapter, or the SSA device driver. The SSA adapter performs error recovery for disk drive errors; the SSA device driver performs error recovery for the SSA adapter. When a problem is detected that needs to be logged, all the relevant data is sent to the error logging service in the device driver. The error logging service then sends the data to the system error logger.

SSA errors are logged asynchronously; that is, independently of any system I/O activity. For example, if an SSA cable is unexpectedly disconnected, an Open Serial Link error is logged immediately. The SSA subsystem does not wait for a read or write command before it logs the error.

Sometimes, on the SSA network, the SSA adapter and SSA disk drives detect errors that were possibly caused by activities elsewhere on the network. (Such activities might be the rebooting of another using system, a system upgrade, or maintenance.) These errors do not need any service action, and should not cause any problem unless the automatic error log analysis determines that the error is critical.

Because SSA subsystems are designed for high availability, most subsystem errors do not cause I/O operations to fail. Some errors, therefore, might not be obvious to the user. To ensure that the user knows about such errors, a health-check is run to the adapter each hour. This health-check is started by a cron table entry that instructs the run_ssa_healthcheck shell script to run once each hour. When an SSA adapter receives a health-check, it logs any currently-active errors and conditions that it knows exist on the SSA subsystem.

Detailed Description

SSA error logs are grouped into types of errors. Each type of error is assigned to an AIX Error Label and an Error ID. The Error Label specifies the text that appears when the error log is displayed. It also specifies the priority that is applied to each error type when the cause of a problem is determined. The Error ID is a numeric identifier for the Error Label. Table 1 shows the error labels that SSA subsystems use.

Table 1. Error Labels

Error Label	Error ID	Error Description
DISK_ERR1	368AE575	An unrecovered media error has been detected. The problem will be solved automatically when data is next written to the failing block. If you are using RAID-5, no application has failed. If you are not using RAID-5, an application might have had a media error. Run error log analysis to determine whether the disk drive has become unreliable and should be exchanged for a new one.
DISK_ERR4	5173762C	A recovered media error has been detected. An occasional recovered media error is not serious. Multiple media errors per day on one disk drive, however, might indicate that the disk drive is failing. Run error log analysis to determine whether the disk drive should be exchanged for a new one.
SSA_DISK_ERR1	C939BCA6	An SSA disk drive has received a command or parameter that is not valid. This error might be caused by: • A software error in the adapter • A software error in the disk drive • A hardware error
SSA_DISK_ERR2	99DEBE79	The disk drive has performed an internal error recovery operation. No action is needed.
SSA_DISK_ERR3	808CB45E	The disk drive has performed internal media maintenance. No action is needed.
SSA_DISK_ERR4	CD815F62	One of the following has occurred: • The disk drive has had an unrecovered hardware error. • The disk drive has had a hardware error that is now recovered, but the disk drive is reporting that it might be going to fail.
SSA_LINK_ERROR	7FFB7C60	Link errors might be detected by any node in the SSA loop. The adapter is notified of these errors. It performs any necessary error recovery, and logs the error. Link errors are normally associated with some other failure on the SSA loop. Link errors might be logged when other devices on the loop are switched on or off, or when cables or devices are disconnected during service activity. Intermittent link errors are not serious. If many link errors occur, however, one of the SSA links might be going to fail. Run error log analysis to determine whether any repair action is needed.

| *Table 1. Error Labels (continued)*

Error Label	Error ID	Error Description
SSA_LINK_OPEN	D9EBBAEF	SSA devices are normally configured in a closed loop. The loop consists of a series of links, each link connecting two SSA devices. A device can be an adapter card or a disk drive. If this loop becomes broken, the alternative signal path round the loop is automatically used. A link might be broken if:
		• A device is removed from the loop
		• A device on the loop is reset or switched off, or it fails
		• An SSA cable is removed, or it fails
		Each SSA device has a Ready light that indicates the operational status of the SSA loop to which that device is attached. The light is permanently on when the device can communicate with the two SSA devices that are logically next to it on the SSA loop. The light flashes if the device can communicate with only one of those two devices. The light is off if the device cannot communicate with either of the two SSA devices. Usually, an SSA device is present at each side of the point where the SSA loop is broken. Each of those devices has its Ready light flashing.
SSA_DETECTED_ERROR	B8ED86C4	Errors of this type are logged by the adapter when a device failure has been reported via SSA asynchronous messages. Because the system name of the device, or devices, that are sending these messages is not known, the error is logged against the adapter. The SRN indicates the service procedures to be performed.
SSA_DEVICE_ERROR	F5CF7C4B	This error can be logged against the adapter or disk drive resource.
		When the error is logged against a disk drive, it indicates that the adapter has detected a failure on the disk drive. It is possible, however, that the failure was detected because the disk drive was unavailable for a short period. Run the error log analysis to determine whether the disk drive should be exchanged for a new one.
		When the error is logged against the adapter, it indicates that the adapter has received a report of a status that is not valid. The adapter cannot, however, determine which disk drive sent the bad data. Run diagnostics to all SSA disk drives. If no failure is found, the log might have been caused by a link error.
SSA_DEGRADED_ERROR	36E69D82	An error or condition has occurred that might cause some of the SSA functions to be unavailable or to be working with reduced performance.
SSA_HDW_ERROR	0EA8952E	A hardware failure has occurred. Run diagnostics in Problem Determination mode to determine which FRUs to exchange for new FRUs.
SSA_HDW_RECOVERED	B8AEC405	A hardware error has occurred that has been recovered by the error recovery procedures. Run error log analysis to determine whether a FRU needs to be exchanged for a new FRU.

Table 1. Error Labels (continued)

Error Label	Error ID	Error Description
SSA_SOFTWARE_ERROR	EE34C798	The software has detected an unexpected condition. If you have just installed the SSA subsystem, ensure that the latest versions of microcode and software have been installed. If the system is still operational and you have any hot spare disk drives attached to the adapter, an automatic dump might have been performed. Run ssa_getdump -l to see if any dump data is present. Software errors can result from hardware failures. Always solve hardware problems, therefore, before looking for software errors.
SSA_LOGGING_ERROR	6A5A3542	The adapter has passed error log data for a disk drive to the device driver error logger, but the disk drive to which the data is related is not configured into the AIX system. This problem usually occurs because the disk drive was not available to the adapter when the **cfgmgr** command was previously run.
SSA_ARRAY_ERROR	B4C00618	A RAID array failure has been detected, and the array is not fully operational. Usually, the data on the array is safe, but ensure that you follow the service procedures exactly so that you do not lose any data.
SSA_SETUP_ERROR	48489B00	A user procedure has not been performed correctly. Use the SRN to determine the procedure that has caused the problem.
SSA_CACHE_ERROR	BC31DEA7	These errors indicate that the fast-write cache has detected a problem. Usually, the problem has been caused by user or service actions, such as moving a Fast-Write Cache Option card from one adapter to another, or moving a disk drive between adapters before the data in the cache card has been synchronized with the data on the disk drive. Take care when moving cache cards, or adapters that contain cache cards, because they might contain data that needs to be synchronized. Always follow the service procedures for the SRN carefully to ensure that you do not lose any data.

Disk drive errors on SSA subsystems are logged against the physical disk drive (pdisk) rather than the logical disk drive (hdisk). If you are looking for the cause of a problem where the failing hdisk is known, you can use either of the following methods to find that cause:

- Use the Configuration Verification service aid, or give the **ssaxlate -l   hdisk** command, to determine which pdisks are associated with the hdisk.
- Give the **ssa_ela -l hdisk** command to run error log analysis. When ssa_ela is run to an hdisk, it performs an error log analysis for all the devices that support that hdisk. Those devices are one or more adapters and one or more pdisks.

The following example shows a part of an SSA error log. See the using-system documentation for a detailed description of all the fields that appear in the error log display.

```
LABEL:          SSA_LINK_OPEN
IDENTIFIER:     625E6B9A

Date/Time:      Tue 23 Sep 03:00:00
Sequence Number: 640
```

```
Machine Id:      00400076C400
Node Id:         identity
Class:           H
Type:            PERM
Resource Name:   ssa0
Resource Class:  adapter
Resource Type:   ssa
Location:        04-07
```

The Type field can have the following flags: PEND, PERF, PERM, TEMP, UNKN, and
INFO. These flags are described in the using-system documentation. The PERM flag,
however, is also described here because the SSA definition of the flag is slightly
different from the AIX definition.

The PERM flag is used to log many SSA errors. AIX defines the PERM flag as an error
from which recovery is not possible. For SSA devices, the error, although possibly
permanent, is not necessarily obvious to the customer. The PERM flag is used here to
ensure that when diagnostics are run in Problem Determination mode, the SSA error
log analysis runs, and any problems that need service action are identified.

Detail Data Formats

The Detail Data fields of SSA error logs use two data formats:
- SCSI Sense Data format
- SSA Error Code format

SCSI Sense Data Format: Errors that are logged with the following labels have SCSI
sense data in the detail data field in the error log:

DISK_ERR1	DISK_ERR4
SSA_DISK_ERR1	SSA_DISK_ERR2
SSA_DISK_ERR3	SSA_DISK_ERR4

SCSI sense data consists of 32 bytes of data. See "Error Log Analysis" on page 108 to
find out how this data is used.

SSA Error Code Format: Errors that are logged with the following labels have SSA
error code data in the detail data field in the error log:

SSA_HDW_ERROR	SSA_ARRAY_ERROR
SSA_CACHE_ERROR	SSA_DEGRADED_ERROR
SSA_REMOTE_ERROR	SSA_HDW_RECOVERED
SSA_SOFTWARE_ERROR	SSA_DETECTED_ERROR
SSA_LINK_OPEN	SSA_SETUP_ERROR
SSA_LINK_ERROR	SSA_DEVICE_ERROR
SSA_LOGGING_ERROR	

The SSA Error code data format consists of three bytes of error code followed by up to
153 bytes of debug data. See "Error Log Analysis" on page 108 to find out how this
data is used.

run_ssa_healthcheck cron

The run_ssa_healthcheck cron checks for SSA subsystem problems that do not cause I/O errors, but cause some loss or redundancy or functionality. It reports such errors each hour until the problem is solved. During SSA device driver installation, the following entry is added to the cron table:

```
0 * * * * /usr/lpp/diagnostics/bin/run_ssa_healthcheck 1>/dev/null 2>/dev/null
```

This cron entry sends a command to the adapter. The command causes the adapter to write a new error log entry for any problems that it can detect, although those problems might not be causing any failure in the user's applications. Such problems include:

- Adapter hardware faults
- Adapter configuration problems
- RAID array problems
- Fast-write cache problems
- Open serial link conditions
- Link configuration faults
- Disk drives that are returning Check status to an inquiry command
- Redundant power failures in SSA enclosures

The test runs hourly at a specific time in the hour.

Duplicate Node Test

The **node_number** attribute of the ssar can be set to enable SSA disk fencing or SSA target mode operations. It is important, however, that duplicate node numbers do not exist on the subsystem. Each hour, therefore, the device driver performs a duplicate-node-number test. If this test finds a duplicate node number, it logs an error code under the SSA_SETUP_ERROR label. The device driver continues to log this error each hour until the problem is solved. This test runs separately from the run_ssa_healthcheck. The test is run hourly but not at any specific time in the hour.

Error Logging Management

Summary

If an error is permanent, it is reported each time that the health check is run. If an error is intermittent, it is logged each time that it occurs. Because a particular error need be logged only a defined number of times for the automatic error log analysis to determine that service activity is needed, the device driver stops the repeated logging of the same error. If error logging were not managed in this way, a repeated error could fill the error log and hide other errors that other components in the system might have logged. If error logging management is active for one type of error, a different type of error can still be sent to the error log. All types of error are, therefore, logged.

Detailed Description

Error logging management is performed for the following error types:

DISK_ERR4	DISK_ERR1
SSA_DISK_ERR4	SSA_LINK_ERROR
SSA_LINK_OPEN	SSA_HDW_ERROR
SSA_HDW_RECOVERED	SSA_SOFTWARE_ERROR
SSA_DETECTED_ERROR	SSA_DEVICE_ERROR
SSA_DEGRADED_ERROR	SSA_LOGGING_ERRORS

If one of these error types is permanent on a particular device, it is reported each time that the health check is run. The SSA adapter sends the resulting error-log entries to the device driver. The device driver error logger permits these error-log entries to be sent on to the AIX error log until the number of entries for that error reaches a predetermined *threshold value.* After that value is reached, no more entries of that type are made for that device until the first error has been in the log for at least six hours.

The example in Figure 19 shows an open-link error occurring. This type of error has a logging threshold value of three. The error is logged when the link is first broken (in this example, at about 04:30). The error is then logged each hour as a result of the heath check.
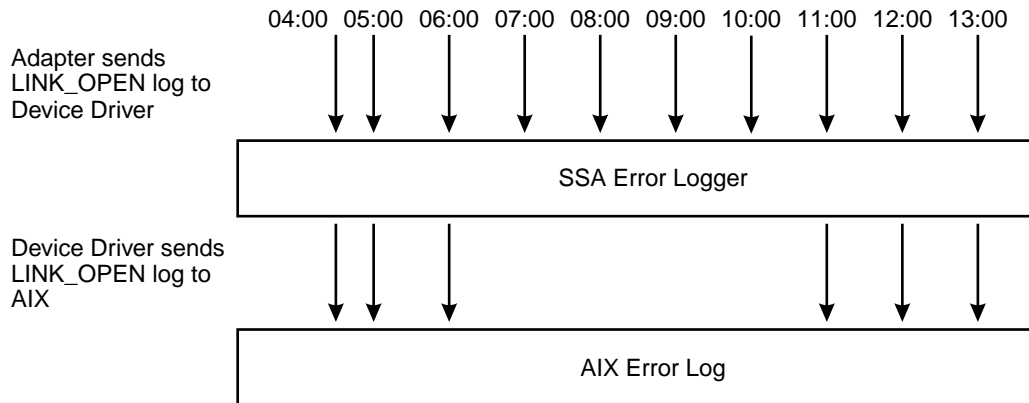
Figure 19. Example of an Open Link Error

The example also shows that, during any six hour period, no more than three errors of this type are sent to the error log. If other types of error occur for this device, or errors occur for another device, they are sent immediately to the error log. The actual threshold values that are used for any given error type are regularly reviewed, and might change with any new version of the device driver. They always permit, however, enough errors to be logged to ensure that the error log analysis produces an SRN when any service action is required.

Error Log Analysis

Summary

The error log is analyzed automatically every 24 hours. This automatic error log analysis is started by the run_ssa_ela cron job. If the results of the analysis show that any service activity is needed, the automatic error log analysis:

1. Sends an operator message (OPMSG) to the error log.
2. Displays an error message on /dev/console.
3. Sends a mail message to ssa_adm. The name ssa_adm is an alias (alternative) address that is set up in /etc/aliases. By default, ssa_adm is set to root. You can, however, change this alias to any valid mail address for your using system. See your using-system documentation for information about how to change alias addresses.

Error log analysis also runs automatically each time that diagnostics run in Problem Determination mode. In this mode, the error log analysis runs before any diagnostic test is run to the SSA devices. Diagnostics in Problem Determination mode, therefore, generate an SRN if any SSA error logs show that service activity is need.

If you run the **ssa_ela** command from the command line, you can also run error log analysis to *all* SSA devices that are attached to a system.

If Service Director is installed on the system, it runs error log analysis whenever a hardware error is logged, and raises an incident if problems are found that need service activity.

Detailed Description

Error log analysis determines whether the data that is in the error log indicates that service activity is needed on the subsystem. The analysis uses the detailed data that is logged with each error. If service activity is needed, an SRN is produced. This SRN provides an entry point into the maintenance procedures that are given either in this book or in the *Service Guide* for the SSA subsystem. (See "Service Request Numbers (SRNs)" on page 229 for more information about SRNs.)

Error log analysis can be started in several ways:

- If you run diagnostics in Problem Determination mode to an SSA device, one of the following procedures occurs:
  - An error log analysis is performed for all SSA devices if any SSA device has a permanent (PERM) error in the error log.
  - An error log analysis is performed for that device before the physical device is tested. If errors are found, no test is performed on the hardware.
- Error log analysis is performed every 24 hours by the run_ssa_ela cron (see "run_ssa_ela cron" on page 110).
- You can use the AIX **diag** command to run error log analysis. On the command line, enter:

```
diag -ecd [device]
```

Error log analysis runs for the selected device. If the analysis determines that service action is needed, a message is displayed. This message indicates that a problem was detected, and requests that diagnostics be run to that device.

- You can run error log analysis to all SSA devices. On the command line, enter:

```
ssa_ela
```

A list of SRNs for all SSA devices that need service action is displayed.

- You can run error log analysis for selected SSA devices. On the command line, enter:

```
ssa_ela [device]
```

The device that is selected can be an SSA adapter, a pdisk, or an hdisk. If an hdisk is selected, the error log analysis runs for the adapters that control the selected hdisk and the pdisk (or pdisks if it is a RAID array) that makes up the hdisk.

- If Service Director is installed on the using system, and a hardware error is logged, the Service Director runs error log analysis and reports an incident if problems are found that need service activity.

Error Log Analysis Routine

The purpose of the SSA error log analysis routine that is contained in the diagnostics is to generate an SRN for any logged errors that need service action. Normally, the error-log-analysis is related to the previous 24-hour period. If you want to perform an error log analysis that is related to a period longer than 24 hours, use the **ssa_ela** command (see "Command Line Error Log Analysis" on page 110).

If the **detail data** field for the error record contains SCSI sense data:

- SSA_DISK_ERR2 or SSA_DISK_ERR3 type errors do not generate an SRN.
- DISK_ERR1 or DISK_ERR4 type errors (media errors) generate an SRN if more than a predetermined number of these errors exist in the log. The SRN is 1XXXX, where XXXX is the contents of bytes 20 and 21 of the detail data.
- SSA_DISK_ERR1 or SSA_DISK_ERR4 type errors generate the SRN 1XXXX, where XXXX is the contents of bytes 20 and 21 of the detail data.

If the **detail data** field contains SSA error code data, the first character of the data is used as an error-log-analysis threshold value. If the number of times that a particular error has been logged during the previous 24 hours is greater than the threshold value for that error, an SRN is generated. This SRN is generated from the next 5 characters of the detail data.

Examples:

- The following is logged for ssa0:

```
0400 0000 0000 00.. .... .... ....
```

Error log analysis produces SRN 40000.

- The following is logged for ssa0:

  ```
  2450 1000 0000 00.. .... .... ....
  ```

  Error log analysis produces SRN 45010 only if this error has occurred three times for ssa0 during the previous 24 hours.

If more than one type of error exists in the error log for a device, the error log analysis determines which error code has the highest priority, and returns this as the result of the analysis. Usually, the action of correcting the highest-priority error also corrects the lower-priority problems.

Command Line Error Log Analysis

A command line utility has been provided that allows you to run SSA error log analysis from a manually-entered command or from shell scripts. The utility is ssa_ela. It can perform SSA error log analysis on:

- All SSA devices
- A selected hdisk
- A selected pdisk
- A selected adapter
- Any of the above items for a history period of up to seven days

See "ssa_ela Command" on page 193 for details of how to use the utility.

run_ssa_ela cron

During installation of the SSA device drivers, the following entry is added to the cron table:

```
01 5 * * * /usr/lpp/diagnostics/bin/run_ssa_ela 1>/dev/null 2>/dev/null
```

This cron entry instructs the run_ssa_ela shell script to run at 05:01 each day for all SSA devices that are configured in the using system. The shell script analyzes the error log. If it finds any problems, the script warns the user in the following ways. It sends:

- A message to /dev/console. This message is displayed on the system console.
- An OPMSG to the error log. This message indicates the source of the error.
- A mail message to ssa_adm.

  Note: ssa_adm is an alias address that is set up in /etc/aliases. By default this address is set to "root", but you can change it to any valid mail address for the using system.

Good Housekeeping

The items described here can help you ensure that your SSA subsystem works correctly.

- When you are installing your SSA subsystem, ensure that ssa_adm is set to an address that is suitable for your installation.
- Regularly view the mail messages or OPMSGs that are in the error log, to determine whether the automatic error log analysis has detected any errors.
- If the automatic error log analysis has detected errors, but the diagnostics do not generate an SRN, run an error log analysis with the history option set. Type:

  `ssa_ela -l Device [-h timeperiod]`

  where `timeperiod` is the number of 24-hour periods.

  Set `timeperiod` to include at least the 24 hours that preceded the error. For example, if at 09:00 on Monday you find that the error log analysis has reported an error on pdisk3 at 05:01 on Sunday, type:

  `ssa_ela -l pdisk3 -h 3`

  where `3` is the number of 24-hour periods. An SRN for the error is generated.

  Note: The error occurred on Sunday. When running the error log analysis, you need to include at least the 24 hours that preceded the error; that is, Saturday. In this example, therefore, `timeperiod` includes Saturday, Sunday, and Monday.
- If application programs fail, run diagnostics in Problem Determination mode to find the SRN.
- Have no concerns about events that occur in the error log, unless an application program fails, or error log analysis generates an SRN.

Chapter 7. Using the SSA Command Line Interface for RAID Configurations

You can use the **ssaraid** command from the command line instead of the from the SMIT panels (see "Chapter 4. Using the RAID Array Configurator" on page 41) to configure and manage your arrays. The Command Line Interface includes a README file that explains the syntax for the **ssaraid** command. The README file is located at:

```
/usr/lpp/devices.ssa.IBM_raid/ssaraid.README
```

Using the Command Line Interface, you can:
- List all RAID managers in a system
- List RAID objects:
    - List all objects of a given type (for example, RAID 5 arrays)
    - Give the preferred name for an object
    - List all objects that are members of an object
    - List all objects that are parents of an object
- Give information about an object:
    - Give information in colon-separated format
    - Give information in a summary format
    - Give information for a specified device, its members, or its parents
    - Give information for all objects of a particular type
    - Limit the list to objects that have particular attribute values
- Create an object:
    - Create a particular type of object that is built from the specified members
    - Assign values for attributes of the created object
    - Create AIX customized device objects for the new object and, if required, use the option that allows you to specify the AIX device name
- Delete an object:
    - Delete the named RAID object
    - Use the option that allows you to delete the AIX device that is associated with the deleted RAID object
- Change an object by specifying new values for attributes of that object
- Perform an action on an object (for example, exchange, remove, or add disk drives in an array)
- List the objects that have support from a particular RAID manager:
    - List all the types of array objects
    - List all the types of objects that can be created
    - List all types of object

Notes:

1. You can specify RAID object names (arrays or member disk drives) as either the 15-character connection location, or as the AIX device name.

   The preferred name is the 15-character connection location. This name is the same as the SSA serial number for the device.

2. You can specify Boolean attribute values as any of the following:

0	1
f	t
false	true
n	y
no	yes
off	on

The attributes must be in lowercase.

Options

You can use the following options with the **ssaraid** command:

Option   Description
-?   Print a short usage message.
-M   List all the available SSA RAID managers that are on the system.
-C   Create an object.
-D   Delete an object.
-H   Change an object.
-I   Report information on an object.
-A   Perform an action on an object.
-Ya   List all array types.
-Yc   List all create types.
-Yo   List all objects.
-l   The name of the SSA RAID manager to use.
-n   The name of an object, for example an array, or member disk drive.
-m   List the member objects for the named object.
-x   List exchange candidates for the named object.
-p   List the parent objects for the named object.
-t   The type of the object to list or create.
-o   Information is presented in colon-separated format.
-z   Information is presented in summary format.
-a   An attribute and its desired value.
-d   Create the AIX device for the specified RAID object.
-k   The AIX device name to use.
-u   Remove the AIX device for the specified RAID object.
-i   The instruct action to perform.
-s   The disks that are to become members of the array.

Instruct Types

You can give the following instruct type as an argument to the -i option when that option is used with the -A option:

exchange
        Add, remove, or exchange member disk drives in an array.

SSARAID Command Attributes

When using the **ssaraid** command, you can specify the following types of attribute:
- RAID 5 Creation and Change attributes
- RAID 5 Change attributes
- Physical Disk Drive Change attributes

RAID 5 Creation and Change Attributes

You can specify the following attributes with the -a option when you are using the **ssaraid** command with the -C or -H option to *create or change* a RAID 5 array:

spare=yes/no (default=yes)

If the array enters the Exposed state, and a hot spare disk drive is available to the RAID manager, the hot spare disk drive is added to the array.

spare_exact=yes/no (default=no)

If the array enters the Exposed state, and hot spare disk drives are enabled, only a hot spare disk drive that has exactly the same capacity as that of the failing disk drive can be used as the replacement drive. For example, if a 1 GB disk drive is failing, only a 1 GB hot spare disk drive can be used as the replacement drive.

read_only_when_exposed=yes/no (default=no)

With the attribute set to "no":

If the array enters the Exposed state, and write operations are made to the array:

- The first write operation causes the array to enter the Degraded state. The written data is not protected. If another disk drive in the array fails, or the power fails during a write operation, data might be lost. While the array is in the Degraded state, however, operations to the array continue.
- The rebuilding operation that runs on the replacement disk drive takes a long time to complete.

With the attribute set to "yes":

- If the array enters the Exposed state, and hot spare disk drives are not enabled, the array operates in read-only mode until the failing disk drive is exchanged for a replacement drive.
- If the array enters the Exposed state, and hot spare disk drives are enabled, a hot spare disk drive is added to the array when the first write operation to that array is attempted. If no suitable hot spare disk drive is available, the array operates in read-only mode.

allow_page_splits=yes/no (default=yes)

With the attribute set to "yes":

When large blocks of data are sent to an array, those blocks can be internally split into smaller, 4096-byte blocks that can then be written in parallel to the

member disk drives of the array. This action greatly improves the performance of write operations to the array, although the blocks are not written sequentially to the member disk drives.

With the attribute set to "no":

The blocks of data are written sequentially to the member disk drives of the array. This action can have a negative effect on the performance of write operations to the array. The sequence in which the data is written to the array might be critical to the application program that is using the data, if an error occurs during the write operation.

fastwrite=on/off (default=off)
This attribute enables and disables the fast-write cache.

When using the fast-write cache, you can use the following attributes to control the operation of the cache:

fw_start_block (default=0)
See the definition for **fw_end_block**.

fw_end_block (default=array size)
This attribute and the **fw_start_block** attribute control the range of blocks for which the fast-write cache is enabled. Write operations that are outside the default range of 0 through array size write data directly to the array, and do not use the fast-write cache.

fw_max_length (default=128)
This attribute sets the maximum size, in blocks, of write operations to the cache. Write operations that are larger than the specified value write data directly to the array, and do not use the fast-write cache.

RAID 5 Change Attributes

You can specify the following attributes with the -a option only when you are using the **ssaraid** command with the -H option to *change* a RAID 5 array:

use=system/free
With the attribute set to "system":

The array is made usable by the AIX operating system. If you specify also the -d option, a corresponding AIX hdisk device is created for the array.

With the attribute set to "free":

The array has no use assigned to it, and AIX cannot use it as an hdisk. If you specify the -u option, you ensure that no corresponding AIX device exists for the array.

force=yes/no
If an array is using a fast-write cache that is failing, you must specify this attribute as "yes" to allow the fast-write cache to be disabled.

Physical Disk Drive Change Attributes

You can specify the following attributes with the -a option when you are using the **ssaraid** command with the -H option to change a physical disk drive.

use=system/spare/free

> *With the attribute set to "system":*
>
> The physical disk drive can be used directly by the AIX operating system. If you specify also the -d option, a corresponding AIX hdisk device is created for the physical disk drive.
>
> *With the attribute set to "spare":*
>
> The physical disk drive becomes a hot spare disk drive. It is, therefore, available for addition to any arrays on the RAID manager that are in the Exposed state. Specify also the -u option to ensure that no corresponding AIX hdisk device exists for the physical disk drive.
>
> *With the attribute set to "free":*
>
> The physical disk drive has no use assigned to it. It is, therefore, available for any new arrays that are to be created. Specify also the -u option.
>
> If you use the **ssaraid** command with the -I option to display information about a physical disk drive, the following values for the **use** attribute can also be displayed:
>
> **member**
>> The disk drive is a member of an array.
>
> **rejected**
>> The disk drive was a member of an array. It was rejected from the array because it reported a problem.
>
> You cannot change the use of member disk drives. You must first remove the disk drives from their array, either by deleting the array, or by exchanging them out of the array with the -A -i exchange options of the **ssaraid** command.
>
> You can assign new uses to disk drives that have been rejected. You must, however, first check the disk drives to find the cause of the problem.

fastwrite=on/off (default=off)
> This attribute enables and disables the fast write cache.

When using the fast write cache, you can use the following attributes to control the operation of the cache:

fw_start_block (default=0)
> See the definition for **fw_end_block**.

fw_end_block (default=array size)
> This attribute and the **fw_start_block** attribute control the range of blocks for

which the fast-write cache is enabled. Write operations that are outside the default range of 0 through array size write data directly to the disk, and do not use the fast-write cache.

fw_max_length (default=128)

This attribute sets the maximum size, in blocks, of write operations to the fast-write cache. Write operations that are larger than the specified value write data directly to the disk, and do not use the fast-write cache.

Action Attributes

You can specify the following attributes with the -a option when you are using the **ssaraid** command with the -A and -i exchange options to do maintenance on an array.

new_member=disk

This attribute specifies the disk drive that is to be added to the array, either in exchange for a failing disk drive that has caused the array to enter the Exposed state, or in exchange for a disk drive that the **old_member** attribute has specified.

old_member=disk

This attribute specifies the member disk drive that is to be removed from the array. You can use the attribute on its own, or with the **new member** attribute.

Use the **old_member** attribute on its own if you want only to remove the disk drive from the array.

Use the **old_member** attribute and the **new_member** attribute together if you want to exchange the disk drives in one action, *and the subsystem has a spare slot available for the new disk drive*.

If no spare slot is available, use the following method to exchange the disk drives:

1. Logically remove the failing disk drive. For this action, use the **ssaraid** command with only the **old_member** attribute specified.
2. Physically remove the disk drive from the slot.
3. Install the new disk drive into the slot that contained the old disk drive.
4. Logically add the new disk drive to the array. For this action, use the **ssaraid** command with only the **new_member** attribute specified.

Notes:

1. If you specify the **new_member** attribute and the **old_member** attribute together, an in-place exchange is attempted; the old_member disk drive is replaced by the new_member disk drive in one operation.
2. You can remove disk drives only from arrays that are not in the Exposed state. When you remove a disk drive, the array enters the Exposed state, and remains in that state until you add the new disk drive.
3. RAID 5 arrays cannot operate if they lose more than one disk drive at a time.
4. To generate a list of suitable exchange candidates, use the -x flag with the **list** command.

Return Codes

Code	Description
0	Successful.
1	Some changes made, but finally not successful.
2	General problem accessing the object data manager (ODM).
3	Specified object (file, record, ODM object) not found.
4	Heap allocation failed.
5	Open/ioctl failure for RAID manager.
6	Bad Transaction result.
7	Array already known to AIX cfgmgr.
8	System call failed.
9	Internal logic error.
10	Method not found, not executable, or not correct.
11	Problem communicating with back-end method.
12	Problem with environment variable, message catalog, and so on
100	Problem with self-defining structure for RDVs.
101	The argument in the command line is not valid and given to back end.
102	Problem with FC_CandidateList transaction.
103	Problem with FC_ResrcList transaction.
104	Problem with FC_ResrcView transaction.

Chapter 8. Using the Programming Interface

SSA Subsystem Overview

Device Drivers

Two types of device driver provide support for all SSA subsystems:

- The SSA adapter device driver, which deals with the SSA adapter.
- The SSA head device drivers, which deal with devices that are attached to the SSA adapter. The SSA disk device driver is an example of an SSA head device driver.

For subsystems that use Micro Channel SSA Multi-Initiator/RAID EL Adapters or PCI SSA Multi-Initiator/RAID EL Adapters, the Target-Mode SSA (TMSSA) device driver is also available. This device driver provides support for communications from using system to using system. For information about SSA Target Mode and the TMSSA device driver, see "SSA Target Mode" on page 152.

Responsibilities of the SSA Adapter Device Driver

The SSA adapter device driver provides a consistent interface to all SSA head device drivers, of which the SSA disk device driver is an example.

The SSA adapter device driver sends commands for SSA devices to the adapter that is related to those devices. When the SSA adapter device driver detects that the commands have completed, it informs the originator of the command.

Responsibilities of the SSA Disk Device Driver

The SSA disk device driver provides support for the SSA disk drives that are connected to an SSA adapter. That support consists of:

- Standard block I/O to SSA logical disks, which are represented as hdisks
- Character mode I/O to SSA logical disks, which are represented as rhdisks
- Error reporting from SSA physical disks, which are represented as pdisks
- Diagnostics and service interface to SSA physical disks that are represented as pdisks
- Re-issue of commands in the event of an adapter reset

Interface between the SSA Adapter Device Driver and Head Device Driver

To communicate with the SSA adapter device driver, the SSA head device driver:

1. Uses the **fp_open** kernel service to open the required instance of the SSA adapter device driver.
2. Calls the **fp_ioctl** kernel service to issue the **SSA_GET_ENTRY_POINT** operation to the opened adapter.

3. Calls the function **SSA_Ipn_Directive** whose address was returned by the **ioctl** operation. These calls to **SSA_Ipn_Directive** are used for all communication with the SSA device.

4. Uses the **fp_close** kernel service to close the adapter.

   Note: When **fp_close** is called, **SSA_Ipn_Directive** cannot be called.

Trace Formatting

The SSA adapter device driver and the SSA disk device driver can both make entries in the kernel trace buffer. The hook ID for the SSA adapter device driver is 45A. The hook ID for the SSA disk device driver is 45B. For information on how to use the kernel trace feature, refer to the **trace** command for the kernel debug program. With the PCI SSA Multi-Initiator/RAID EL Adapter and Micro Channel SSA Multi-Initiator/RAID EL Adapter, the Target-Mode SSA device driver can make entries in the kernel trace buffer; its hook ID is xxx.

SSA Adapter Device Driver

Purpose

To provide support for the SSA adapter.

Syntax

#include /usr/include/sys/ssa.h
#include /usr/include/sys/devinfo.h

Description

The **/dev/ssa**n special files provide an interface that allows client application programs to access SSA adapters and the SSA devices that are connected to those adapters. Multiple-head device drivers and application programs can all access a particular SSA adapter and its connected devices at the same time.

Configuring Devices

All the SSA adapters that are connected to the using system are normally configured automatically during the system boot sequence.

SSA Micro Channel Adapter ODM Attributes

The SSA Micro Channel adapter has a number of object data manager (ODM) attributes that you can display by using the **lsattr** command:

ucode   Holds the file name of the microcode package file that supplies the adapter microcode that is present in an SSA adapter.

bus_intr_level
> Holds the value of the bus interrupt level that the SSA adapter device driver for this adapter will use.

dma_lvl
> Holds the value of the DMA arbitration level that the SSA adapter device driver for this adapter will use.

bus_io_addr
> Holds the value of the bus I/O base address of the adapter registers that the SSA adapter device driver for this adapter will use.

dma_bus_mem
> Holds the value of the bus I/O base address of the adapter DMA address that the SSA adapter device driver for this adapter will use.

dbmw Holds the size of the DMA area that the SSA adapter device driver for this adapter will use. You can use the **chdev** command to change the value of this attribute. The default value provides a DMA area that is large enough to allow the adapter to perform efficiently, yet allows other adapters to be configured.

> The default value is practical for normal use. If, however, a particular SSA device that is attached to the using system needs large quantities of outstanding I/O to get best performance, a larger DMA area might improve the performance of the adapter.

bus_mem_start
> Holds the value of the bus-memory start address that the SSA adapter device driver for this adapter will use.

intr_priority
> Holds the value of the interrupt priority that the SSA adapter device driver for this adapter will use.

daemon
> Specifies whether to start the SSA adapter daemon. If the attribute is set to TRUE, the daemon is started when the adapter is configured.

> The daemon holds the adapter device driver open although the operating system might not be using that adapter device driver at the time. This action allows the adapter device driver to reset the adapter card if the software that is running on it finds an unrecoverable problem. It also allows the adapter device driver to log errors against the adapter.

> The ability of the device driver to log errors against the adapter is especially useful if the adapter is in an SSA loop that is used by another adapter, because failure of this adapter can affect the availability of the SSA loop to the other adapter.

> You can use the **chdev** command to change the value of this attribute.

host_address
> This attribute can be used to specify the TCPIP address that is used by the SSA network agent on remote using systems to contact this using system. If

set, the value is passed to remote using systems via the SSA network. If this attribute is not set, the value returned by the **hostname** command is passed to remote using systems.

This might be useful on systems that have more than one tcpip address and where the specific TPCIP address that is used by the SSA network agent is important.

This attribute is functional only for the PCI SSA Multi-Initiator/RAID EL Adapter and the Micro Channel SSA Multi-Initiator/RAID EL Adapter.

PCI SSA Adapter ODM Attributes

The PCI SSA adapter has a number of object data manager (ODM) attributes that you can display by using the **lsattr** command:

ucode   Holds the file name of the microcode package file that supplies the adapter microcode that is present in an SSA adapter.

bus_intr_level

Holds the value of the bus interrupt level that the SSA adapter device driver for this adapter will use.

bus_io_addr

Holds the value of the bus I/O base address of the adapter registers that the SSA adapter device driver for this adapter will use.

bus_mem_start

Holds the value of the bus-memory start address that the SSA adapter device driver for this adapter will use.

bus_mem_start2

Holds the value of the bus-memory start address that the SSA adapter device driver for this adapter will use.

intr_priority

Holds the value of the interrupt priority that the SSA adapter device driver for this adapter will use.

daemon

Specifies whether to start the SSA adapter daemon. If the attribute is set to TRUE, the daemon is started when the adapter is configured.

The daemon holds the adapter device driver open although the operating system might not be using that adapter device driver at the time. This action allows the adapter device driver to reset the adapter card if the software that is running on it finds an unrecoverable problem. It also allows the adapter device driver to log errors against the adapter.

The ability of the device driver to log errors against the adapter is especially useful if the adapter is in an SSA loop that is used by another adapter, because failure of this adapter can affect the availability of the SSA loop to the other adapter.

You can use the **chdev** command to change the value of this attribute.

Device-Dependent Subroutines

The SSA adapter device driver provides support only for the **open**, **close**, and **ioctl** subroutines. It does not provide support for the **read** and **write** subroutines.

open and close Subroutines

The **open** and **openx** subroutines must be called by any application program that wants to send **ioctl** calls to the device driver.

You can use the **open** or the **openx** subroutine call to open the SSA adapter device driver. If you use the **openx** subroutine call, set the *ext* parameter to 0, because the call does not use it.

Summary of SSA Error Conditions

If an **open** or **ioctl** subroutine that has been issued to an SSA adapter fails, the subroutine returns -1, and the global variable **errno** is set to a value from the file **/usr/include/sys/errno.h**.

Possible **errno** values for the SSA adapter device driver are:

EINVAL
> An unknown ioctl was attempted or the parameters supplied were not valid.

EIO An I/O error occurred.

ENOMEM
> The command could not be completed because not enough real memory or paging space was available.

ENXIO The requested device does not exist.

Managing Dumps

The SSA adapter device driver is a target for the system dump facility.

The **DUMPQUERY** option returns a minimum transfer size of 0 bytes and a maximum transfer size that is appropriate for the SSA adapter.

To be processed, calls to the SSA adapter device driver **DUMPWRITE** option should use the *arg* parameter as a pointer to the **SSA_Ioreq_t** structure, which is defined in **/usr/include/sys/ssa.h**. Using this interface, commands for which the adapter provides support can be run on a previously started (opened) target device. The SSA adapter device driver ignores the *uiop* parameter.

Note: Only the `SsaMCB.MCB_Result` field of the **SSA_Ioreq_t** structure is set at completion of the **DUMPWRITE**. During the dump, no support is provided for error logging.

If the **dddump** entry point completes successfully, it returns a 0. If the entry point does not complete successfully, it returns one of the following:

EINVAL
A request that is not valid was sent to the adapter device driver; for example, a request for the **DUMPSTART** option was sent before a **DUMPINIT** option had been run successfully.

EIO The adapter device driver was unable to complete the command because the required resources were not available, or because an I/O error had occurred.

ETIMEDOUT
The adapter did not respond with status before the passed command time-out value expired.

Files

/dev/ssa0, /dev/ssa1,..., /dev/ssa*n*
Provide an interface to allow SSA head device drivers to access SSA devices or adapters.

IOCINFO (Device Information) SSA Adapter Device Driver ioctl Operation

Purpose

To return a structure that is defined in the **/usr/include/sys/devinfo.h** file.

Description

The **IOCINFO ioctl** operation returns a structure that is defined in the **/usr/include/sys/devinfo.h** header file. The caller supplies the address to an area that is of the type struct devinfo. This area is in the *arg* parameter to the **IOCINFO** operation. The device-type field for this component is **DD_BUS**; the subtype is **DS_SDA**.

The **IOCINFO** operation is defined for all device drivers that use the **ioctl** subroutine, as follows:

The operation returns a **devinfo** structure. The caller supplies the address of this structure in the argument to the **IOCINFO** operation. The device type in this structure is **DD_BUS**, and the subtype is **DS_SDA**. The flags field is set to **DF_FIXED**.

Files

/dev/ssa0, /dev/ssa1,..., /dev/ssa*n*

SSA_TRANSACTION SSA Adapter Device Driver ioctl Operation

Purpose

To send an SSA transaction to an SSA adapter.

Description

The **SSA_TRANSACTION** operation allows the caller to issue an IPN (Independent Packet Network) transaction to a selected SSA adapter. IPN is the language that is used to communicate with the SSA adapter. The caller must be root, or have an effective user ID of root, to issue this operation.

IPN is described in the *Technical Reference* for the adapter.

The *arg* parameter for the **SSA_TRANSACTION** operation specifies the address of a **SSA_TransactionParms_t** structure. This structure is defined in the **/usr/include/sys/ssa.h** file.

The **SSA_TRANSACTION** operation uses the following fields of the **SSA_TransactionParms_t** structure:

DestinationNode
> Contains the target node for the transaction.

DestinationService
> Contains the target service on that node.

MajorNumber
> Major number of the transaction.

MinorNumber
> Minor number of the transaction.

DirectiveStatusByte
> Contains the directive status byte for the transaction. This contains a value that is defined in the **/usr/include/ipn/ipndef.h** file. A non-zero value indicates an error.

TransactionResult
> Contains the IPN result word that is returned by IPN for the transaction. This contains values that are defined in the **/usr/include/ipn/ipntra.h** file. A non-zero value indicates an error.

ParameterDDR
> Set by the caller to indicate the buffer for parameter data.

TransmitDDR
> Set by the caller to indicate the buffer for transmit data.

ReceiveDDR
> Set by the caller to indicate the buffer for received data.

StatusDDR
> Set by the caller to indicate the buffer for status data.

TimeOutPeriod
> Number of seconds after which the transaction is considered to have failed. A value of 0 indicates no time limit.

> **Note:** If an operation takes longer to complete than the specified timeout, the adapter is reset to purge the command.

Attention: This is a very low-level interface. It is for use only by configuration methods and diagnostics software. Use of this interface might result in system hangs, system crashes, system corruption, or undetected data loss.

Return Values

When completed successfully, this operation returns a value of 0. Otherwise, a value of -1 is returned, and the **errno** global variable is set to one of the following values:

EIO   Indicates an unrecoverable I/O error.

ENXIO   Indicates an unknown device.

EINVAL
> Indicates an unknown command. Indicates a bad buffer type.

EACCESS
> Indicates user does not have root privilege.

ENOMEM
> Indicates not enough memory.

ENOSPC
> Indicates not enough file blocks.

EFAULT
> Indicates bad user address.

Files

/dev/ssa0, /dev/ssa1,..., /dev/ssan

SSA_GET_ENTRY_POINT SSA Adapter Device Driver ioctl Operation

Purpose

To allow another kernel extension, typically a SSA head device driver, to determine the direct call entry point for the SSA adapter device driver. This operation is the entry point through which the head device driver communicates with the adapter device driver. The address that is supplied is valid only while the calling kernel extension holds an open file descriptor for the SSA adapter device driver. This operation is not valid for a user process.

Description

The *arg* parameter specifies the address of a **SSA_GetEntryPointParms_t** structure in kernel address space. The **SSA_GetEntryPointParms_t** structure is defined in the **/usr/include/sys/ssa.h** file.

On completion of the operation, the fields in the **SSA_GetEntryPointParms_t** structure are modified as follows:

EntryPoint
> Address of the direct call entry point for the SSA adapter device driver, which is used to submit operations from a head device driver.

InterruptPriority
> The off level interrupt priority at which the calling kernel extension is called back for completion of commands that are started by calling the direct call entry point.

Return Values

When completed successfully, this operation returns a value of 0. Otherwise, a value of -1 is returned and the **errno** global variable is set to the following value:

EINVAL
> Indicates that the caller was not in kernel mode.

Files

/dev/ssa0, /dev/ssa1,..., /dev/ssa*n*

SSA Adapter Device Driver Direct Call Entry Point

Purpose

To allow another kernel extension to send transactions to the SSA adapter device driver. This function is not valid for a user process. When the function completes its run, an off-level interrupt notifies the caller. See **SSA_GET_ENTRY_POINT SSA** adapter ioctl operation.

Description

The entry point address is the address that is returned in *EntryPoint* by the **SSA_GET_ENTRY_POINT** ioctl operation. The function takes a single parameter of type **SSA_Ioreq_t**, which is defined in the **/usr/include/sys/ssa.h** file.

The fields of the **SSA_Ioreq_t** structure are used as follows:

SsaDPB An array of size SSA_DPB_SIZE, which is used by the SSA adapter device driver, and should be initialized to all NULLs.

SsaNotify
> The address of the function in the SSA head device driver that the SSA adapter device driver calls when the directive has completed.

u0 The transaction to be executed. Valid transactions are described in the *Technical Reference* for the adapter.

Return Values

This function does not return errors. You can determine success or failure of the directive by examining the directive status byte and transaction result fields, which are set up in the SSA MCB. For details, see the *Technical Reference* for the adapter.

---

ssadisk SSA Disk Device Driver

Purpose

To provide support for Serial Storage Architecture (SSA) disk drives.

Syntax

> **#include <sys/devinfo.h>**
> **#include <sys/ssa.h>**
> **#include <sys/ssadisk.h>**

Configuration Issues

SSA Logical Disks, SSA Physical Disks, and SSA RAID Arrays

Serial Storage Architecture (SSA) disk drives are represented in AIX as SSA logical disks (**hdisk0, hdisk1.....hdisk***N*) and SSA physical disks (**pdisk0,pdisk1.....pdisk***N*). SSA RAID arrays are represented as SSA logical disks (**hdisk0, hdisk1.....hdisk***N*). SSA logical disks represent the logical properties of the disk drive or array, and can have volume groups and file systems mounted on them. SSA physical disks represent the physical properties of the disk drive.

By default:
- One pdisk is always configured for each physical disk drive.
- One hdisk is configured either for each disk drive that is connected to the using system, or for each array.

By default, all disk drives are configured as system (AIX) disk drives. The array management software deletes hdisks to create arrays.

SSA physical disks have the following properties. They:
- Are configured as **pdisk0, pdisk1.....pdisk***n*
- Have errors logged against them in the system error log

- Provide support for a character special file (**/dev/pdisk0 /dev/pdisk1..../dev/pdisk***n*)
- Provide support for the **ioctl** subroutine for servicing and diagnostics functions
- Do not accept **read** or **write** subroutine calls for the character special file

SSA logical disks have the following properties. They:
- Are configured as **hdisk0, hdisk1.....hdisk***n*
- Provide support for a character special file (**/dev/rhdisk0, /dev/rhdisk1..../dev/rhdisk***n*)
- Provide support for a block special file (**/dev/hdisk0, /dev/hdisk1..../dev/hdisk***n*)
- Provide support for the **ioctl** subroutine call for nonservice and diagnostics functions only
- Accept the **read** and **write** subroutine call to the special files
- Can be members of volume groups, and have file systems mounted on them

Multiple Adapters

Some SSA subsystems (see "Rules for SSA Loops" on page 29) allow a disk drive to be controlled by up to two adapters in a particular using system. The disk drive has, therefore, two paths to each using system, and the SSA subsystem can continue to function if an adapter fails. If an adapter fails or the disk drive cannot be accessed from the original adapter, the SSA disk device driver switches to the alternative adapter without returning an error to any working application.

When a disk drive has been successfully opened, takeover by the alternative adapter does not occur simply because a drive becomes reserved or fenced out. However, during an open of an SSA logical disk, the device driver does attempt to access the disk drive through the alternative adapter if the path through the original adapter experiences reservation conflict or fenced-out status.

A medium error on the disk drive does not cause takeover to occur. Takeover occurs only after extensive error-recovery activity within the adapter and several retries by the device driver. Intermittent errors that last for only approximately one second usually do not cause adapter takeover.

When takeover has successfully occurred and the device driver has accessed the disk drive through the alternative adapter, the original adapter becomes the standby adapter. Takeover can, therefore, occur repeatedly from one adapter to another so long as one takeover event is completed before the next one starts. Completion of a takeover event is considered to have occurred when the device driver successfully accesses the disk drive through the alternative adapter.

When takeover has occurred, the device driver continues to use the alternative adapter to access the disk drive until either the system is rebooted, or takeover occurs back to the original adapter.

Each time the SSA disks are configured, the SSA disk device driver is informed which path or paths are available to each disk drive, and which adapter is to be used as the

primary path. By default, primary paths to disk drives are shared equally among the adapters to balance the load. This static load balancing is performed once, when the devices are configured for the first time. You can use the **chdev** command to modify the primary path.

Because of the dynamic nature of the relationship between SSA adapters and disk drives, SSA pdisks and hdisks are not children of an adapter but of an SSA router. This router is called **ssar**. It does not represent any actual hardware, but exists only to be the parent device for the SSA logical disks and SSA physical disks.

Note: When the SSA disk device driver switches from using one adapter to using the other adapter to communicate with a disk, it issues a command that breaks any SSA-SCSI reserve condition that might exist on that disk. The reservation break is performed only if this using system has successfully reserved the disk drive through the original adapter. This check is to prevent adapter takeover from breaking reservations that are held by other using systems. If multiple using systems are connected to the SSA disks, SSA-SCSI reserve should not, therefore, be used as the only method for controlling access to the SSA disks. Fencing is provided as an alternative method for controlling access to disks that are connected to multiple using systems.

PCI SSA Multi-Initiator/RAID EL Adapters and Micro Channel SSA Multi-Initiator/RAID EL Adapters can reserve to a node number rather than to an adapter (see "Reserving Disk Drives" on page 34). It is highly recommended that you make use of this ability by setting the SSA router node_number attribute if multiple adapters are to be configured as described here.

Configuring SSA Disk Drive Devices

SSA disk drives are represented in AIX as SSA logical disks (**hdisk0, hdisk1.....hdisk***n*) and SSA physical disks (**pdisk0, pdisk1.....pdisk***n*). The properties of each are described in the SSA Subsystem Overview.

Normally, the system boot process automatically configures all the disk drives that are connected to the using system. You do not need to take any action to configure them.

Because SSA devices might be added to the SSA network while the using system is running and online, you might need to configure SSA disks after the boot process has completed. Under these conditions, use the **cfgmgr** command to configure the devices.

An exception is to configure a specific device with a specific name. You can do this with the **mkdev** command.

Using mkdev to Configure a Physical Disk

To use **mkdev** to configure an SSA *physical* disk, specify the following information:

Parent   ssar

Class   pdisk

Subclass
>
> ssar

Type   You can list the types by typing: `lsdev -P -c pdisk -s ssar`

ConnectionLocation
> 15-character unique identifier of the disk drive. You can determine the unique identifier in three ways:
>
> * If the disk drive is already defined, you can use the **lsdev** command to determine the unique identity, as follows:
>   1. Type `lsdev -Ccpdisk -r connwhere` and press Enter.
>   2. Select the 15-character unique identifier (UID) for which characters 5 through 12 match the serial number that is on the front of the disk drive.
> * Construct the 15-character unique identifier from the 12-character SSA UID that is shown on the label that is on the side of the disk drive. You can recognize the UID by its three-character suffix "00D".
> * Run the **ssacand** command, and specify the adapter to which the physical disk is connected. For example:
>
>   `ssacand -a ssa0 -P`

Using mkdev to Configure a Logical Disk

To use **mkdev** to configure an SSA *logical* disk, specify the following information:

Parent   ssar

Class   disk

Subclass
>
> ssar

Type   hdisk

ConnectionLocation
> 15-character unique identifier of the logical disk.
>
> If the logical disk is a system (AIX) disk, you can determine the unique identifier in three ways:
>
> * If the logical disk is already defined, you can use the **lsdev** command to determine the unique identity, as follows:
>   1. Type `lsdev -Ccdisk -r connwhere` and press Enter.
>   2. Select the 15-character unique identifier (UID) for which characters 5 through 12 match the serial number that is on the front of the disk drive.
> * Construct the 15-character unique identifier from the 12-character SSA UID that is shown on the label that is on the side of the disk drive. You can recognize the UID by its three-character suffix "00D".
> * Run the **ssacand** command, and specify the adapter to which the logical disk is connected. For example:
>
>   `ssacand -a ssa0 -L`

If the logical disk is an array, you can determine the unique identifier in two ways:

- If the logical disk is already defined, you can use the **lsdev** command to determine the unique identity, as follows:
    1. Type `lsdev -Ccdisk -r connwhere` and press Enter.
    2. Select the 15-character unique identifier (UID) that was given by the RAID configuration program when the array was created.

- Run the **ssacand** command, and specify the adapter to which the logical disk is connected. For example:

    `ssacand -a ssa0 -L`

Device Attributes

SSA logical disks and SSA physical disks and the ssar router have several attributes. You can use the **lsattr** command to display these attributes.

Attributes of the SSA Router, ssar

node_number

> This attribute must be set on systems that are using the SSA Fencing facility or the SSA Disk Concurrent Mode of Operation Interface facility. These facilities of the SSA disk device driver are used only in configurations where the SSA disk drives are connected to more than one using system. Therefore, in configurations where the SSA disk drives are connected to only one using system, the **node_number** attribute has no effect.

> For configurations that use SSA Fencing or the SSA Disk Concurrent Mode of Operation Interface, set the **node_number** to a different value on each using system that is in the configuration.

Attributes Common to SSA Logical and SSA Physical Disks

adapter_a

> Specifies either the name of one adapter that is connected to the device, or **none** if no adapter is connected as adapter_a now.

adapter_b

> Specifies either the name of one adapter that is connected to the device, or **none** if no adapter is connected as adapter_b now.

primary_adapter

> Specifies whether adapter_a or adapter_b is to be the primary adapter for this device.

> You can use the **chdev** command to modify this attribute to one of the values: adapter_a, adapter_b or **assign**. If you set the value to **assign**, static load balancing is performed when this device is made available, and the system sets the value to either adapter_a, or adapter_b.

connwhere_shad

> Holds a copy of the value of the *connwhere* parameter for this disk drive. SSA disks drives cannot be identified by the location field that the **lsdev** command

gives, because they are connected in a loop, and do not have the hardware-selectable addresses of SCSI devices. The serial numbers of the disk drives are the only method of identification. The serial number of a particular disk drive is written in the connwhere field of the CuDv entry for that disk drive. This **connwhere_shad** attribute, which shadows the *connwhere* value, allows you to display the *connwhere* value for an SSA device for a pdisk or hdisk.

location
Describes, in text, the descriptions of the disk drives and their locations (for example, drawer number 1, slot number 1). The user enters the information for this attribute.

Attributes for SSA Logical Disks Only

pvid Holds the ODM copy of the PVID for this disk drive for an hdisk.

queue_depth
Specifies the maximum number of commands that the SSA disk device driver dispatches for a single disk drive for an hdisk. You can use the **chdev** command to modify this attribute. The default value is correct for normal operating conditions.

reserve_lock
Specifies whether the SSA disk device driver locks the device with a reservation when it is opened for an hdisk.

size_in_mb
Specifies the size of the logical disk in megabytes.

max_coalesce
The maximum number of bytes that the SSA disk device driver attempts to transfer to or from an SSA logical disk in one operation.

The default value is appropriate for most environments. For applications that perform very long sequential write operations, performance improves when data is written in blocks of 64 KB multiplied by (n-1), where n is the number of disks in the array. For example, if the array contains six member disks, the data would be written in blocks of 64 KB x 5. (These operations are known as *full-stride writes.)* To use full-stride writes, increase the value of this attribute to 64 KB x (n-1), or to some multiple of this number.

write_queue_mod
Alters the way in which write commands are queued to SSA logical disks. The default value is 0 for all SSA logical disks that do not use the fast-write cache; with this setting the SSA disk device driver maintains a single seek-ordered queue of queue_depth operations on the disk. Read operations and write operations are queued together in this mode.

If write_queue_mod is set to a non-zero value, the SSA disk device driver maintains two separate seek-ordered queues: one for read operations, and one for write operations. In this mode, the device driver issues up to queue_depth read commands and up to write_queue_mod write commands to the logical disk.

This facility is provided because, in some environments, it might be beneficial to hold back write commands in the device driver so that they can be coalesced into larger operations that can be handled as full-stride writes by the RAID software in the adapter.

This facility is not likely to be useful, unless a large percentage of the workload to a RAID-5 device consists of sequential write operations.

Device-Dependent Subroutines

The **open**, **read**, **write**, and **close** subroutines start typical physical volume operations.

open, read, write and close Subroutines

The **open** subroutine is mainly for use by the diagnostic commands and utilities. Correct authority is required for execution. If an attempt is made to run the **open** subroutine without the correct authority, the subroutine returns a value of -1, and sets the **errno** global variable to a value of **EPERM**.

The *ext* parameter that is passed to the **openx** subroutine selects the operation for the target device. The **/usr/include/sys/ssadisk.h** file defines possible values for the *ext* parameter.

The *ext* parameter can contain any combination of the following flag values logically ORed together:

SSADISK_PRIMARY
> Opens the device by using the primary adapter as the path to the device. As a result of hardware errors, the device driver might automatically switch to the secondary path, if one exists. You can prevent this switch by additionally specifying the **SSADISK_NOSWITCH** flag.
>
> This flag has support both for SSA logical disk drives and for SSA physical disk drives. You cannot specify this flag and the **SSADISK_SECONDARY** flag together.

SSADISK_SECONDARY
> Opens the device using the secondary adapter as the path to the device. As a result of hardware errors, the device driver might automatically switch to the primary path, if one exists. You can prevent this switch by additionally specifying the **SSADISK_NOSWITCH** flag.
>
> This flag has support both for SSA logical disk drives and for SSA physical disk drives. You cannot specify this flag and the **SSADISK_PRIMARY** flag together.

SSADISK_NOSWITCH
> If more than one adapter provides a path to the device, the device driver normally switches from one adapter to the other as part of its error recovery. This flag prevents the switch.
>
> This flag has support both for SSA logical disk drives and for SSA physical disk drives.

SSADISK_FORCED_OPEN

Forces the open whether another initiator has the device reserved or not. If another initiator has the device reserved, the reservation is broken. Otherwise, the **open** operation runs normally.

This flag has support only for SSA logical disks. You cannot specify this flag and the **SSADISK_FENCEMODE** flag together.

SSADISK_RETAIN_RESERVATION

Retains the reservation of the device after a **close** operation by not issuing the release. This flag prevents other initiators from using the device unless they break the using system reservation.

Note: This flag does not cause the device to be explicitly reserved during the close if it was not reserved while it was open.

This flag has support only for SSA logical disk drives. You cannot specify this flag and the **SSADISK_FENCEMODE** together.

SSADISK_NO_RESERVE

Prevents the reservation of a device during an **openx** subroutine call to that device. This operation is provided so a device can be controlled by two processors that synchronize their activity by their own software procedures.

This flag overrides the setting of the attribute reserve_lock if the value of the attribute is "yes". This flag has support only for SSA logical disk drives. You cannot specify this flag and the **SSADISK_FENCEMODE** flag together.

SSADISK_SERVICEMODE

Opens an SSA physical disk in service mode. This flag wraps the SSA links on each side of the indicated physical so that the disk can be removed from the loop for service, and no errors are caused on the loops.

This flag has support only for SSA physical disk drives. You cannot specify this flag and the **SSADISK_SCSIMODE** flag together.

SSADISK_SCSIMODE

Opens an SSA physical disk in SCSI passthrough mode. This action allows **SSADISK_IOCTL_SCSI** ioctls to be issued to the physical disk.

This flag has support only for SSA physical disk drives. You cannot specify this flag and the **SSADISK_SERVICEMODE** flag together.

SSADISK_NORETRY

Opens a device in no-retry mode.

When a device is opened in this mode, commands are not retried if an error occurs.

SSADISK_FENCEMODE

Opens an SSA logical disk drive in fence mode. The open subroutine succeeds although the using system might be fenced out from access to the disk drive. Only ioctls can be issued to the device while it is open in this mode. Any attempt to read from, or write to, a device that is opened in this mode is rejected with an error.

This flag has support only for SSA logical disk drives. You cannot specify this flag and the **SSADISK_NO_RESERVE** flag, **SSADISK_FORCED_OPEN** flag, or **SSADISK_RETAIN_RESERVATION** flag together.

You can find more specific information about the open operations in "SSA Options to the openx Subroutine" in the *Kernel Extensions and Device Support Programming Concepts* manuals for AIX versions 4.1 and upward.

readx and writex Subroutines

The **readx** and **writex** subroutines provide additional parameters that affect the transfer of raw data (that is, data that has not been processed or reduced). These subroutines pass the *ext* parameter, which specifies request options. The options are constructed by logically ORing zero or more of the following values:

HWRELOC
Request for hardware relocation that is safe.

UNSAFEREL
Request for hardware relocation that is not safe.

WRITEV
Request for write verification.

Error Conditions

Possible **errno** values that occur for **ioctl**, **open**, **read**, and **write** subroutines when the SSA disk device driver is used include:

EBUSY
One of the following conditions has occurred:
- An attempt was made to open an SSA physical device that has already been opened by another process.
- The target device is reserved by another initiator.

EFAULT
Illegal user address.

EINVAL
One of the following circumstances has occurred:
- The **read** or **write** subroutine supplied an *nbyte* parameter that is not an even multiple of the block size.
- The data buffer length exceeded the maximum length that is defined in the **devinfo** structure for an **ioctl** subroutine operation.
- The **openext** subroutine supplied a combination of extension flags that has no support.
- An **ioctl** subroutine operation that has no support was attempted.
- An attempt was made to configure a device that is still open.
- An illegal configuration command has been given.

- The data buffer length exceeded the maximum length that is defined for a **strategy** operation.

EIO One of the following conditions has occurred:
- The target device cannot be located or is not responding.
- The target device has indicated an unrecovered hardware error.

ESOFT The target device has reported a recoverable media error.

EMEDIA
The target device has found an unrecovered media error.

ENODEV
One of the following conditions has occurred:
- An attempt was made to access a device that is not defined.
- An attempt was made to close a device that is not defined.

ENOTREADY
An attempt was made to open an SSA physical device in Service mode while an SSA logical device that uses it was in use.

ENXIO One of the following conditions has occurred:
- The **ioctl** subroutine supplied a parameter that is not valid.
- The **openext** subroutine supplied extension flags that selected a non-existent or nonfunctional adapter path.
- A **read** or **write** operation was attempted beyond the end of the fixed disk drive.

EPERM
The attempted subroutine requires appropriate authority.

ENOCONNECT
The using system has been fenced out from access to this device.

ENOMEM
The system does not have enough real memory or enough paging space to complete the operation.

ENOLCK
An attempt was made to open a device in Service mode, and the device is in an SSA network that is not a loop.

Special Files

The **ssadisk** device driver uses raw and block special files to perform its functions.

Attention: Corruption of data, loss of data, or loss of system integrity (system crash) occurs if block special files are used to access devices that provide support for paging, logical volumes, or mounted file systems. Block special files are provided for logical volumes and for disk devices. They must be used only by the using system for managing file systems, for paging devices, and for logical volumes. These files should not be used for other purposes.

The special files that the **ssadisk** device driver uses include the following (listed by type of device):

- SSA logical disk drives:

  /dev/hdisk0, /dev/hdisk1,..., /dev/hdisk*n*
  > Provide an interface that allows SSA device drivers to have block I/O access to logical SSA disk drives.

  /dev/rhdisk0, /dev/rhdisk1,..., /dev/rhdisk*n*
  > Provide an interface that allows SSA device drivers to have character access (raw I/O access and control functions) to logical SSA disk drives.

- SSA physical disk drives:

  /dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
  > Provide an interface that allows SSA device drivers to have character access (control functions only) to physical SSA disk drives.

Note: The prefix **r** on a special file name indicates that the drive is accessed as a raw device rather than as a block device. To perform raw I/O with an SSA logical disk, all data transfers must be in multiples of the device block size. Also, all **lseek** subroutines that are made to the raw device driver must result in a file pointer value that is a multiple of the device block size.

IOCINFO (Device Information) SSA Disk Device Driver ioctl Operation

Purpose

To return a structure that is defined in the **/usr/include/sys/devinfo.h** file.

Description

The **IOCINFO** operation returns a structure that is defined in the **/usr/include/sys/devinfo.h** header file. The caller supplies the address to an area of type struct devinfo in the *arg* parameter to the **IOCINFO** operation. The device-type field for this component is **DD_SCDISK**; the subtype is **DS_PV**. The information that is returned includes the block size in bytes and the total number of blocks on the disk drive.

Files

/dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
> Provide an interface that allows SSA device drivers to have access to SSA physical disk drives.

/dev/pdisk0, /dev/pdisk1,..., /dev/pdisk*n*
> Provide an interface that allows SSA device drivers to have access to SSA logical disk drives.

SSADISK_ISAL_CMD (ISAL Command) SSA Disk Device Driver ioctl Operation

Purpose

To provide a method of sending Independent Network Storage Access Language (ISAL) commands to an SSA physical or logical disk drive. ISAL consists of a set of commands that allow a program to control and access a storage device.

The ISAL command set is described in the *Technical Reference* for the adapter.

Description

The **SSADISK_ISAL_CMD** operation allows the caller to issue an ISAL command to a selected logical or physical disk drive. The caller must be root, or have an effective user ID of root, to issue this ioctl.

The following ISAL commands (minor function codes) that are defined in the **/usr/include/ipn/ipnsal.h** file can be issued:

FN_ISAL_Read
> **FN_ISALWrite**

FN_ISAL_Format
> **FN_ISAL_Progress**

FN_ISAL_Lock
> **FN_ISAL_Unlock**

FN_ISAL_Test
> **FN_ISAL_SCSI**

FN_ISAL_Download
> **FN_ISAL_Fence**

Notes:

1. Some of these commands are not valid for SSA hdisks, but are valid for SSA pdisks; others are valid for SSA hdisks, but are not valid for SSA pdisks. The adapter card (not the device driver) checks whether the commands are valid. If the caller attempts to send a command to a device for which that command is not valid, the adapter returns a non-zero result. The exception to this procedure occurs when any attempt is made to send a **FN_ISAL_Fence** command to a SSA physical disk. The device driver rejects any such attempt with **EINVAL**.

2. The adapter rejects the **FN_ISAL_SCSI** command with a non-zero result if that command is sent to a device that has not been opened with the **SSADISK_SCSIMODE** extension parameter.

The *arg* parameter for the **SSADISK_ISAL_CMD** ioctl is the address of an **ssadisk_ioctl_parms** structure. This structure is defined in the **/usr/include/sys/ssadisk.h** file.

The **SSADISK_ISAL_CMD** ioctl uses the following fields of the **ssadisk_ioctl_parms** structure:

dsb   Contains the directive status byte that is returned for the command. The byte contains a value from the **/usr/include/ipn/ipndef.h** file. A non-zero value indicates an error.

`result` Contains the Independent Packet Network (IPN) result word that is returned by IPN for the command. The word contains values from the **/usr/include/ipn/ipntra.h** file. A non-zero value indicates an error.

`u0.isal.parameter_descriptor`
          Set by the caller to indicate the buffer for parameter data.

`u0.isal.transmit_descriptor`
          Set by the caller to indicate the buffer for transmit data.

`u0.isal.receive_descriptor`
          Set by the caller to indicate the buffer for received data.

`u0.isal.status_descriptor`
          Set by the caller to indicate the buffer for status data.

`u0.isal.minor_function`
          Set by the caller to one of the ISAL commands that is defined in the **/usr/include/ipn/ipnsal.h** file and listed at the start of the description of this operation.

Note: Structures that are provided in the **/usr/include/ipn/ipnsal.h** file can be used to format the contents of the parameter buffer for the various commands. The device driver always overwrites, with the correct handle, the handle that is located in the first four bytes of the parameter buffer.

Return Values

If the command was successfully sent to the adapter card, this operation returns a value of 0. Otherwise, a value of -1 is returned, and the **errno** global variable set to one of the following values:

EIO   An unrecoverable I/O error has occurred.

EINVAL
          Either the caller has specified an ISAL command that is not in the list of supported ISAL commands, or the caller has attempted to send an **FN_ISAL_FENCE** command to an SSA physical disk.

EPERM
          The caller did not have an effective user ID (EUID) of 0.

ENOMEM
          The device driver was unable to allocate or pin enough memory to complete the operation.

If the return code is 0, the result field of the **ssadisk_ioctl_parms** structure is valid. This indicates whether the adapter was able to process the command successfully.

Files

files

/dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
>   Provide an interface to allow SSA device drivers to access SSA physical disk
>   drives.

/dev/hdisk0, /dev/hdisk1,..., /dev/hdisk*n*
>   Provide an interface to allow SSA device drivers to access SSA logical disk
>   drives.

SSADISK_ISALMgr_CMD (ISAL Manager Command) SSA Disk Device Driver ioctl Operation

Purpose

To provide a method of sending Independent Network Storage Access Language (ISAL) Manager commands to an SSA physical or logical disk drive. ISAL consists of a set of commands that allow a program to control and access a storage device.

The ISAL command set is described in the *Technical Reference* for the adapter.

Description

The **SSADISK_ISALMgr_CMD** operation allows the caller to issue an ISAL command to a selected logical or physical disk. The caller must be root, or have an effective user ID of root, to issue this ioctl.

The following ISAL commands (minor function codes) that are defined in the **/usr/include/ipn/ipnsal.h** file can be issued:

FN_ISALMgr_Inquiry
>   **FN_ISALMgr_HardwareInquiry**

FN_ISALMgr_GetPhysicalResourceIDs
>   **FN_ISALMgrVPDInquiry**

FN_ISALMgr_Characteristics
>   **FN_ISALMgr_Statistics**

FN_ISALMgr_FlashIndicator

The *arg* parameter for the **SSADISK_ISALMgr_CMD** ioctl is the address of an **ssadisk_ioctl_parms** structure. This structure is defined in the **/usr/include/sys/ssadisk.h** file.

The **SSADISK_ISALMgr_CMD** ioctl uses the following fields of the **ssadisk_ioctl_parms** structure:

dsb   Contains the directive status byte that is returned for the command. The byte contains a value from the **/usr/include/ipn/ipndef.h** file. A non-zero value indicates an error.

result   Contains the IPN result word that is returned by IPN for the command. The word contains values from the **/usr/include/ipn/ipntra.h** file. A non-zero value indicates an error.

u0.isal.parameter_descriptor
Set by the caller to indicate the buffer for parameter data.

u0.isal.transmit_descriptor
Set by the caller to indicate the buffer for transmit data.

u0.isal.receive_descriptor
Set by the caller to indicate the buffer for received data.

u0.isal.status_descriptor
Set by the caller to indicate the buffer for status data.

u0.isal.minor_function
Set by the caller to one of the ISAL Manager Commands that is defined in the **/usr/include/ipn/ipnsal.h** file and listed at the start of the description of this operation.

Note: Structures are provided in the **/usr/include/ipn/ipnsal.h** file. This file can be used to format the contents of the parameter buffer for the various commands. The resource ID that is located in the first four bytes of the parameter buffer is always overwritten with the correct Resource ID for the device by the device driver.

Return Values

If the command was successfully sent to the adapter card, this operation returns a value of 0. Otherwise, a value of -1 is returned, and the **errno** global variable set to one of the following values:

EIO   Indicates an unrecoverable I/O error.

EINVAL
Indicates that the caller has specified an ISAL manager command that is not in the list of supported ISAL manager commands. (The commands are listed at the start of the description of this operation.)

EPERM
Indicates that caller did not have an effective user ID (EUID) of 0.

ENOMEM
Indicates that the device driver was unable to allocate or pin enough memory to complete the operation.

If the return code is 0, the result field of the **ssadisk_ioctl_parms** structure is valid. The return code indicates whether the adapter was able to process the command successfully.

Files

/dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
> Provide an interface to allow SSA device drivers to access physical SSA disks.

/dev/hdisk0, /dev/hdisk1,..., /dev/hdisk*n*
> Provide an interface to allow SSA device drivers to access logical SSA disks.

SSADISK_SCSI_CMD (SCSI Command) SSA Disk Device Driver ioctl Operation

Purpose

To provide a method of sending Serial Storage Architecture - Small Computer Systems Interface (SSA-SCSI) commands to an SSA physical disk drive that has been opened with the **SSADISK_SCSIMODE** extension flag.

Description

The **SSADISK_SCSI_CMD** operation allows the caller to issue an SSA-SCSI command to a selected physical disk. The caller must be root, or have an effective user ID of root, to issue this ioctl.

The *arg* parameter for the **SSADISK_ISALMgr_CMD** operation is the address of an **ssadisk_ioctl_parms** structure. This structure is defined in the **/usr/include/sys/ssadisk.h** file.

The **SSADISK_SCSI_CMD** operation uses the following fields of the **ssadisk_ioctl_parms** structure:

`dsb`   Contains the directive status byte that is returned for the command. The byte contains a value from the **/usr/include/ipn/ipndef.h** file. A non-zero value indicates an error.

`result`   Contains the IPN result word that is returned by IPN for the command. The word contains values from the **/usr/include/ipn/ipntra.h** file. A non-zero value indicates an error.

`u0.scsi.data_descriptor`
> Set by the caller to describe the buffer for any data that is transferred by the SCSI command. If no data is transferred, the length of the buffer should be set to 0.

`u0.scsi.direction`
> Set by the caller to indicate the direction of the transfer. Valid values are:

> **SSADISK_SCSI_DIRECTION_NONE**
>> No data transfer is involved for the command.

> **SSADISK_SCSI_DIRECTION_READ**
>> Data is transferred from the subsystem into the using system memory.

SSADISK_SCSI_DIRECTION_WRITE
>> Data is transferred from the using system memory into the
subsystem.

`u0.scsi.identifier`
> Identifies the SSA-SCSI logical unit number to which the command should be
sent. The format of this field is as defined for SSA_SCSI (bit 7=1 identifies the
Target routine, bits 6-0 identify the Logical Unit routine).

`u0.scsi.cdb`
> Set by the caller to define the SCSI Command Descriptor Block (CDB) for the
command.

`u0.scsi.cdb_length`
> Set by the caller to indicate the length of the CDB.

`u0.scsi.scsi_status`
> Contains the SCSI status that is returned for the command.

The device driver does not know the contents of the CDB. The driver only passes on
the CDB to the hardware. See the relevant hardware documentation to determine what
CDBs are valid for a particular SSA physical disk.

Return Values

If the command was successfully sent to the adapter card, this operation returns a
value of 0. Otherwise, it returns a value of -1, and sets the **errno** global variable set to
one of the following values:

EIO   Either an unrecoverable I/O error has occurred, or the hardware did not
recognize the SCSI command as valid.

EINVAL
> Either the `u0.scsi.cdb_length` field in the `ssadisk_ioctl_parms` structure was
set to a length that is not valid, or the `u0.scsi.direction` field in the
`ssadisk_ioctl_parms` structure was set to a value that is not valid.

EPERM
> The caller did not have an effective user ID (EUID) of 0.

ENOMEM
> The device driver was unable to allocate or pin enough memory to complete
the operation.

If the return code is 0, the result field of the **ssadisk_ioctl_parms** structure is valid.
The return code indicates whether the adapter was able to process the command
successfully.

Files

/dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
> Provide an interface to allow SSA device drivers to access physical SSA disks.

/dev/hdisk0, /dev/hdisk1,..., /dev/hdisk*n*
> Provide an interface to allow SSA device drivers to access logical SSA disks.

SSADISK_LIST_PDISKS SSA Disk Device Driver ioctl Operation

Purpose

To provide a method of determining which SSA physical disk drives make up a SSA logical disk drive.

Description

The **SSADISK_LIST_PDISKS** operation can be issued by any user to an SSA logical disk (hdisk). The operation returns a list of the SSA physical disks (pdisks) that make up the specified logical disk drive.

The *arg* parameter for the **SSADISK_LIST_PDISKS** operation is the address of an **ssadisk_ioctl_parms** structure. This structure is defined in the **/usr/include/sys/ssadisk.h** file.

The **SSADISK_LIST_PDISKS** operation uses the following fields of the **ssadisk_ioctl_parms** structure:

u0.list_pdisks.name_array
> Pointer to the array of **ssadisk_name_desc_t** structures that is in the caller memory. On return from the ioctl, this array is filled with the names of the hdisks.

u0.list_pdisks.name_array_elements
> Set by the caller to indicate the number of elements that are in the array at which the u0.list_pdisks.name_array parameter is pointing.

u0.list_pdisks.name_count
> On return from the ioctl, this field indicates the number of names that are in the name array at which the u0.list_pdisks.name_array parameter is pointing.

u0.list_pdisks.resource_count
> On return from the ioctl, this field indicates the number of physical disk drives that make up the logical disk drive. This number might be less than u0.list_pdisks.name_count if, in the user memory, not enough elements were allocated in the named array to hold all the pdisk names, or if one or more physical disks that make up the logical disk have not been configured as AIX physical disk drives.

Return Values

If the command was successfully sent to the adapter card, this operation returns a value of 0. Otherwise, a value of -1 is returned, and the **errno** global variable is set to one of the following values:

EIO An unrecoverable I/O error has occurred.

ENOMEN
The device driver was unable to allocate or pin enough memory to complete the operation.

Files

/dev/pdisk0, /dev/pdisk1, ..., /dev/pdisk*n*
Provide an interface to allow SSA device drivers to access SSA physical disks.

/dev/hdisk0, /dev/hdisk1,..., /dev/hdisk*n*
Provide an interface to allow SSA device drivers to access SSA logical disks.

SSA Disk Concurrent Mode of Operation Interface

The SSA subsystem provides support for the broadcast of one-byte message codes from one using system to all other using systems that are connected to the same disk drive. This ability to pass messages can be used to synchronize access to the disk drive. The operating system has a concurrent mode interface to handle the sending and receiving of messages.

The concurrent mode of operation requires that a top kernel extension run on all the using systems that are sharing a disk drive. The top kernel extensions use the concurrent mode interface of the SSA disk device driver to communicate with each other through the SSA subsystem. The interface allows a top kernel extension to send and receive messages between using systems.

The concurrent mode interface consists of an entry point in the SSA disk device driver and an entry point in the top kernel extension. Two ioctls register and unregister the top kernel extension with the SSA disk device driver. The SSA Disk Device Driver entry point provides the method of sending messages, and of locking, unlocking, and testing the disk drive. The top kernel extension entry point processes interrupts, which might include the receiving of messages from other using systems.

Note: To ensure that the concurrent mode interface works, set the **node_number** attribute of the ssar router to a different non-zero value for each using system that is sharing a disk drive. To enable the **node_number** to take effect after you have assigned it, reboot the system.

Device Driver Entry Point

The SSA disk device driver concurrent mode entry point sends commands from the top kernel extension that is related to a specified SSA disk drive. The top kernel extension calls this entry point directly. The **DD_CONC_REGISTER** ioctl operation registers entry points.

This entry point function takes one argument that is defined in the **/usr/include/sys/ddconc.h** file. The argument is a pointer to a **conc_cmd** structure. The **conc_cmd** structures must be allocated by the top kernel extension. The

concurrent mode command operation is specified by the cmd_op field in the **conc_cmd** structure. For each operation, the devno field of the **conc_cmd** structure specifies the appropriate SSA disk drive. The concurrent mode command operation can have the following values:

DD_CONC_SEND_REFRESH

Broadcasts the one-byte message code that is specified by the message field of the **conc_cmd** structure. The code is sent to all using systems that are connected to the SSA disk drive.

DD_CONC_LOCK

Locks the specified SSA disk drive for this using system only. No other using systems can modify data that is on the disk drive.

DD_CONC_UNLOCK

Unlocks the SSA disk drive. Other using systems can lock and modify data that is on the disk drive.

DD_CONC_TEST

Issues a test disk command to verify that the SSA disk drive is still accessible to this using system.

The concurrent mode entry point returns a value of **EINVAL** if any of the following is true:

- The top kernel extension did not perform a **DD_CONC_REGISTER** operation.
- The **conc_cmd** pointer is null.
- The devno field in the **conc_cmd** structure is not valid.
- The cmd_op field of the **conc_cmd** structure is not one of the four valid values that were previously listed.

If the concurrent mode entry point accepts the **conc_cmd** structure, the entry point returns a value of 0. If the SSA disk device driver does not have resources to issue the command, the driver queues the command until resources are available. The concurrent commands that are queued in the SSA disk device driver are issued before any read or write operations that are queued by the strategy entry point of the device driver.

The completion status of the concurrent mode commands are returned to the concurrent mode interrupt handler entry point of the top kernel extension.

Top Kernel Extension Entry Point

The top kernel extension must have a concurrent mode command interrupt handler entry point, which is called directly from the interrupt handler of the SSA disk device. This entry point function can take four arguments:

- **conc_cmd** pointer
- cmd_op field
- message_code field
- devno field

The **conc_cmd** pointer points at a **conc_cmd** structure. These arguments must be of the same type that is specified by the `conc_intr_addr` function pointer field of the **dd_conc_register** structure.

The following valid concurrent mode commands are defined in the **/usr/include/sys/ddcon.h** file. For each command, the `devno` field specifies the appropriate SSA disk drive.

DD_CONC_SEND_REFRESH
> The **DD_CONC_SEND_REFRESH** device driver entry point has completed. The error field in the **conc_cmd** structure contains the return code that is necessary for the completion of this command. The possible values are defined in the **/usr/include/sys/errno.h** file. The **conc_cmd** pointer argument to the special interrupt handler entry point of the top kernel extension is non-null. The `cmd_op`, `message_code`, and `devno` fields are 0.

DD_CONC_LOCK
> The **DD_CONC_SEND_LOCK** device driver entry point has completed. The error field of the **conc_cmd** structure contains the return code that is necessary for the completion of this command. The possible values are defined in the **/usr/include/sys/errno.h** file. The **conc_cmd** pointer argument to the special interrupt handler entry point of the top kernel extension is non-null. The `cmd_op`, `message_code`, and `devno` fields are zero.

DD_CONC_UNLOCK
> The **DD_CONC_UNLOCK** device driver entry point has completed. The error field in the **conc_cmd** structure contains the return code that is necessary for the completion of this command. The possible values are defined in the **/usr/include/sys/errno.h** file. The **conc_cmd** pointer argument to the special interrupt handler entry point of the top kernel extension is non-null. The `cmd_op`, `message_code`, and `devno` fields are zero.

DD_CONC_TEST
> The **DD_CONC_TEST** device driver entry point has completed. The error field in the **conc_cmd** structure contains the return code that is necessary for the completion of this command. The possible values are defined in the **/usr/include/sys/errno.h** file. The **conc_cmd** pointer argument to the special interrupt handler entry point of the top kernel extension is non-null. The `cmd_op`, `message_code`, and `devno` fields are zero.

DD_CONC_RECV_REFRESH
> A message with **message_code** was received for the SSA disk drive that is specified by the **devno** argument. The **conc_cmd** argument is null for this operation.

DD_CONC_RESET
> The SSA disk drive that is specified by the **devno** argument was reset, and all pending messages or commands have been flushed. The argument **conc_cmd** is null for this operation.

- The concurrent command interrupt handler routine must have a short path length because it runs on the SSA disk device driver interrupt level. If much command processing is needed, this routine should schedule an off-level interrupt to its own off-level interrupt handler.

- The top kernel extension must have an interrupt priority that is no higher than the interrupt priority of the SSA disk device driver.
- The concurrent command interrupt handler routine might need to disable interrupts at INTCLASS0 if it is expected to use concurrent mode on SSA disk drives and on other types of disk drives. The other types of disk drives need their own device drivers to provide support for concurrent mode.
- A kernel extension that uses the **DD_CONC_REGISTER** ioctl must issue a **DD_CONC_UNREGISTER** ioctl before it closes the SSA disk drive.

SSA Disk Fencing

SSA disk fencing is a facility that is provided in the SSA subsystem. It allows multiple using systems to control access to a common set of disks.

Using the fencing commands that are provided by the hardware, you can prevent particular using systems from accessing a particular disk drive. Each disk drive has an access list that is independent of the access lists for the other disk drives.

Fencing is a function that is provided by the hardware and manipulated by hardware commands. The device driver also has some effect.

The SSA disk device driver provides support for fencing by allowing the **SSADISK_ISALCMD ioctl** operation to issue the **FN_ISAL_FENCE** command to SSA logical disk drives.

The **FN_ISAL_FENCE** command is defined in the *Technical Reference* for the adapter.

To use fencing, set the **node_number** attribute of the **ssar** router to a different value on each using system that is included in fencing. To enable the **node_number** to take effect after you have set it, reboot the system.

By default, the value of **node_number** is 0. This value has particular importance, because it is not possible to exclude a using system with node number 0 from access to the disk drive. Therefore, if a disk drive is moved from a machine that has been using fencing to a machine that has not been using fencing, the new machine can communicate with the disk drive.

If a using system attempts to use the **open** subroutine to open a disk drive to which it is not allowed access, the return code is -1 and the global variable **errno** is set to the value **ENOCONNECT**. Similarly, if an application already has a SSA logical disk open but that logical disk has been fenced out since the open, calls to the read or write subroutine fail, with errno set to **ENOCONNECT**.

The hardware fencing commands provide a method by which you can break through a fence. You can use the **SSADISK_ISALCMD** ioctl operation to give the command, but you must first open the disk drive. To open a disk drive from which the using system has been excluded, use the **openx** subroutine, and specify **SSADISK_FENCEMODE**

extension flag as described in the section on SSA disk device driver device-dependent subroutines. While the disk drive is open in this mode, no read or write operations are permitted.

If fencing has excluded a using system from access to a disk drive, but that disk drive is also reserved to another using system, the reservation takes priority. The return code from the **open** subroutine is -1, and the global variable **errno** is set to **EBUSY**. If the using system attempts to break through the reservation by passing the ext parameter **SSADISK_FORCED_OPEN** to the **openx** subroutine, the reservation is broken, but the open fails with **errno** set to **ENOCONNECT**. To break through the fence, the SSA logical disk must be opened in **SSADISK_FENCEMODE** and the **SSADISK_ISALCMD** ioctl operation used to issue the appropriate hardware command to break the fence condition.

SSA Target Mode

The SSA Target-Mode interface (TMSSA) provides node-to-node communication through the SSA interface. The interface uses two special files that provide a logical connection to another node. One of the special files (the initiator-mode device) is used for write operations; the other (the target-mode device) is used for read operations. Data that is sent to a node is written to the initiator. Data that is read from a node is read from the target. The special files are:

/dev/tmssaXX.im
> The initiator-mode device, which has an even, minor device number, and is write only.

/dev/tmssaXX.tm
> The target-mode device, which has an odd, minor device number, and is read only.

The device is **tmssa*XX***, where ***XX*** is the node number of the using system with which these files communicate. You are not aware of which path connects the two nodes. The path can change if, for example, SSA loops are changed, nodes are switched off, or any other physical change is made to the connected SSA loops. The TMSSA device driver can use any available path to the other node, but does not tell you which path is being used. Each node must have in its device configuration database a unique node number that is defined by the **node_number** attribute of the ssar device.
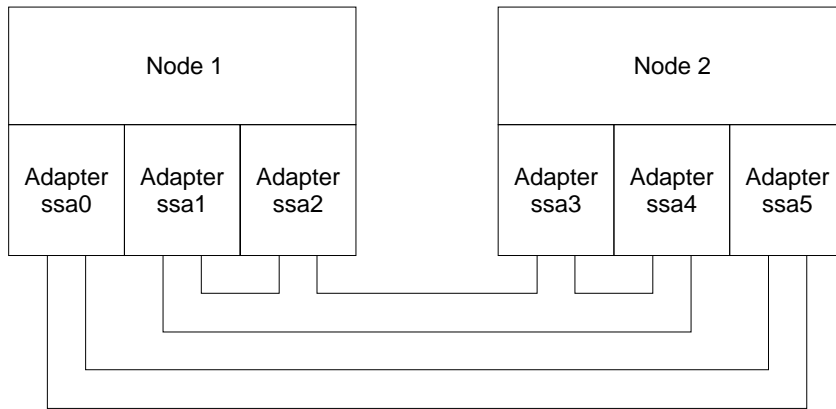
Figure 20. An Example of Node-to-Node Communications

Figure 20 shows an example configuration of two nodes. In this example, tmssa is, at first, using adapter ssa0 on node 1 and adapter ssa5 on node 2. Suddenly, the link between the adapters fails. The tmssa device driver automatically switches to adapters ssa1 and ssa3 or adapters ssa1 and ssa4. The connections between nodes can be modified while they are in use, and the target-mode interface tries to recover.

The TMSSA uses either of two methods to read and write data:

- The blocking method, which waits until the I/O is complete or an error occurs before it returns control to you.
- The nonblocking method, which returns control to you immediately. With this method, the write operation occurs at a later time. The read, operation returns the amount of data that is available at the time of the operation. The amount of returned data is not necessarily the same as the amount that you requested.

The tmssa device driver provides support for multiple concurrent read and write operations for different devices. It does not provide support for multiple read or write operations on the same device. The device driver blocks the operation until the device is free. Read and write operations can run concurrently on a particular device.

If a working path exists between two nodes, communication works. The path must be stable long enough for the driver to transmit the data. The maximum time taken to fail a write operation is (A * R * T), where A is the number of adapters in the using system, R is the number of retries as defined by TM_MAXRETRY in the **/usr/include/sys/tmscsi.h** file, and T is the retry time-out period. The minimum time taken to fail a write operation is the write time-out period. You can adjust the write time-out period and the retry time-out period; see "TMCHGIMPARM (Change Parameters) tmssa Device Driver ioctl Operation" on page 167.

You can use the select and poll routines to check for read and write capability, and can also be notified of the possibility of a read or write operation.

The amount of data that can be sent by one write operation in blocking mode has no limit, but the driver and adapter interface has been optimized for transfers of 512 bytes or less. In nonblocking mode, enough buffer space must be available for the write operation.

Each separate write operation is treated separately by the target, so, when reading, each separate write operation requires a separate read operation.

Configuring the SSA Target Mode

Each using system requires its own unique node number. The SSA adapter software specifies this node number, which is used by Target Mode SSA. The configuration database contains the ssar device. The **node_number** attribute sets the number for the node. Failure to have unique node numbers in the SSA loops causes unpredictable results with the target-mode interface. Node numbers that are not unique cause error logs. You can use the **ssavfynn** command to check for duplicate node numbers.

When the node is configured, it automatically inspects the existing SSA loops. It detects all nodes that are using the target mode SSA interface now. Each detected node is then added to the configuration database, if it is not already part of it. For each node that is added, **tmssa**XX is created, where **XX** is the node number of the detected node.

When configuration is complete, special files exist in the /dev directory. These files allow you to use the target mode interface with each node that is defined in the configuration database. Configuration does not need communication to be actually possible between the relevant using systems. Communication is needed only for the write operation.

Buffer Management

You can set the buffer sizes that are used by each device:
- To set the transmit buffer sizes, use the **chdev** command to adjust the **XmitBuffers** and **XmitBufferSize** attributes in the configuration database.
- To set the receive buffer size, use the **chdev** command to adjust the **RecvBuffers** and **RecvBufferSize** attributes in the configuration database.

The buffer sizes must be multiples of 128 bytes. The maximum buffer size is 512 bytes. A device can have as many buffers as it needs.

Data can be written into the buffers for the initiator-mode device at any time, whether or not nonblocking write operations are also transferring data from these buffers. The buffers for the target-mode device can be read at any time, even if a write operation to those buffers is occurring at the same time. It is not important if the sizes of the initiator-mode device buffers are different from the sizes of the target-mode device buffers to which the data is being sent. The total buffer space for the target-mode device, however, must be equal to, or greater than, the size of the initiator-mode device buffer size.

The SSA interface for target-mode transfers has been tuned for 512-byte transfers. Each write operation can send as much data as is required, unless that write operation is nonblocking. In a nonblocking write operation, the data that is being written must be completely transferred to the device buffers. Therefore, the maximum amount of data that can be written during a nonblocking write operation is determined by the size of the device buffers.

Understanding Target-Mode Data Pacing

An initiator-mode device can send data faster than the associated target-mode device application can read it. This condition occurs when:

- The previous write operation is complete, but all the device buffers are in use, and no space is available for the next write operation.
- The write operation is not yet completed, and the device has no available buffers.

In both these instances, the target-mode device driver stops the write operation temporarily, and uses the retry mechanism to try again later. These actions can cause the write operation to fail. As a result, the initiator-mode device is unable to send any data to the target-mode device for the whole of the retry period. Alternatively, the write operation might time out.

Think about these possibilities when you set the buffer sizes and the number of buffers for the devices. Determine carefully the retry period, total write time-out period, and the amount of data that is being sent. For example, to write 64 KB of data with no retry operations, you need 64 KB read and write buffers. If you allow one retry operation, you need only 32 KB buffers.

Using SSA Target Mode

SSA Target Mode does not attempt to manage the data transfer between devices. It does, however, take action if buffers become full, and it ensures that read operations can read data from only one write operation. Any protocol that is needed to manage the communication of data must be implemented in user-supplied programs. The only delays that can occur when data is being received are delays that are characteristics of the SSA system and of the environment in which it operates, and delays that are caused by full buffers.

SSA Target Mode can concurrently send data to, and receive data from, all attached nodes. Blocking-read and blocking-write operations do nothing until data is available to be read, or until the write operation is complete.

Execution of Target Mode Requests

The write operation transfers the data into the device buffers. When a buffer is full, the SSA adapter starts to transfer the data to the remote using system. At the same time, the user's application program continues to fill the device buffer with the remaining data that is being transferred. If the amount of data that is being written is larger than the available buffer space, the application program waits until more space becomes available in the device buffers. As each buffer is sent, the tmssa device driver checks

whether any more data is to be sent. If more data is to be sent, the device driver continues to send that data. If no more data is to be sent, and the write operation is in blocking mode, the device driver starts the waiting application program. If the write operation is in nonblocking mode, the write status is updated. If an unrecoverable error occurs, the write operation is ended, and the remaining buffers are discarded.

The read operation transfers received data from the device buffers to your application program. When the read operation ends, or the write operation stops sending data, the read operation returns the number of bytes read.

SSA tmssa Device Driver

Purpose

To provide support for using-system to using-system communications through the SSA target-mode device driver.

Syntax

#include /usr/include/sys/devinfo.h
#include /usr/include/sys/tmscsi.h
#include /usr/include/sys/scsi.h
#include /usr/include/sys/tmssa.h

Description

The Serial Storage Architecture (SSA) target-mode device driver provides an interface to allow using-system to using-system data transfer by using an SSA interface.

You can access the data transfer functions through character special files that are named **dev/tmssa*nn.xx***, where **nn** is the node number of the node with which you are communicating. The **xx** can be either **im** (initiator-mode interface), or **tm** (target-mode interface). The caller uses the initiator-mode to transmit data, and the target-mode interface to receive data.

When the caller opens the initiator-mode special file, a logical path is set up. This path allows data to be transmitted. The user-mode caller issues a **write**, **writev**, **writex**, or **writevx** system call to start sending data. The kernel-mode user issues an **fp_write** or **fp_rwuio** service call to start sending data. The SSA target-mode device driver then builds a **send** command to describe the transfer, and the data is sent to the device. The data can be sent as a blocking write operation, or as a nonblocking write operation. When the write entry point returns, the calling program can access the transmit buffer.

When the caller opens the target-mode special file, a logical path is set up. This path allows data to be received. The user-mode caller issues a **read**, **readv**, **readx**, or **readvx** system call to start receiving data. The kernel-mode caller issues an **fp_read** or **fp_rwuio** service call to start receiving data. The SSA target-mode device driver then returns data that has been received for the application program.

The SSA target mode device driver allows an initiator-mode device to get access to the data transfer functions through the write entry point; it allows a target-mode device to get access through the read entry point.

The only rules that the SSA target mode device driver observes to manage the sending and receiving of data are:

- Separate write operations need separate read operations.
- Receive buffers that are full, delay the send operation when it tries to resend after a delay.

The calling program must observe any other rules that are needed to maintain, or otherwise manage, the communication of data. Delays that occur when data is received or sent through the target mode device driver are that are characteristics of the hardware and software driver environment.

Configuration Information

When **tmssan** is configured (where **n** is the remote node number), the **tmssan.im** and **tmssan.tm** special files are both created. An initiator-mode pair, or a target-mode pair, must exist for each device, whether either or both modes are being used. The target-mode node number for an attached device must be the same as the initiator-mode node number.

Each time that you use the **cfgmgr** command to configure the node, the target-mode device driver finds the remote nodes that are already connected, and automatically configures them. Each node is expected to be identified by a unique node number.

The target-mode device driver configuration entry point must be called only for the initiator-mode device number. The device driver configuration routine automatically creates the configuration data for the target-mode device minor number. This data is related to the initiator-mode data.

Device-Dependent Subroutines

The target-mode device driver provides support for the following subroutines:

- **open**
- **close**
- **read**
- **write**
- **ioctl**
- **select**

open Subroutine

The **open** subroutine allocates and initializes target, or initiator, device-dependent structures. No commands are sent to the device as a result of running the **open** subroutine.

The initiator-mode device or target-mode device must be configured but not already opened for that mode; otherwise, the **open** subroutine does not work. Before the initiator-mode device can be successfully opened, its special file must be opened for write operations only. Before the target-mode device can be successfully opened, its special file must be opened for read operations only.

Possible return values for the **errno** global variable include:

EBUSY

Attempted to run an **open** subroutine for a device instance that is already open.

EINVAL

Attempted to run an **open** subroutine for a device instance, but either a wrong open flag was used, or the device is not yet configured.

EIO   An I/O error occurred.

ENOMEM

The SSA device does not have enough memory resources.

close Subroutine

The **close** subroutine deallocates resources that are local to the target device driver for the target or initiator device. No commands are sent to the device as a result of running the **close** subroutine.

Possible return values for the **errno** global variable include:

EINVAL

Attempted to run a **close** subroutine for a device instance that is not configured or not opened.

EIO   An I/O error occurred.

EBUSY

The device is busy.

read Subroutine

Support for the **read** subroutine is provided only for the target-mode device. Support for data scattering is provided through the user-mode **readv** or **readvx** subroutine, or through the kernel-mode **fp_rwuio** service call. If the **read** subroutine is not successful, the return value is set to -1, and the **errno** global variable is set to the return value from the device driver. If the return value is something other than -1, the read operation was successful, and the return code indicates the number of bytes that were read. The caller should verify the number of bytes that were read. File offsets are not applicable and are ignored for target-mode read operations.

The adapter write operations provide the boundary that determines how read requests are controlled. If more data is received than is requested in the current read operation, the requested data is passed to the caller, and the remaining data is retained and returned for the next read operation for this target device. If less data is received in the

send command than is requested, the received data is passed for the read request, and the return value indicates how many bytes were read.

If a write operation has not been completely received when a read request is made, the request blocks and waits for data. However, if the target device is opened with the O_NDELAY flag set, the read does not block; it returns immediately. If no data is available for the read request, the read is not successful, and the **errno** global variable is set to **EAGAIN**. If data is available, it is returned. The return value indicates the number of bytes that were received, whether the write operation for this data has ended or not.

Note: If the O_NDELAY flag is not set, the **read** subroutine can block for an undefined time while it waits for data. Because, in a read operation, the data can come at any time, the device driver does not maintain an internal timer to interrupt the read. Therefore, if a time-out function is required, it must be started by the calling program.

If the calling program wants to break a blocked **read** subroutine, the program can generate a signal. The target-mode device driver receives the signal and ends the current **read** subroutine. If no bytes were read, the **errno** global variable is set to **EINTR**; otherwise, the return value indicates the amount of data that was read before the interrupt occurred. The read operation returns with whatever data has been received, whether the write operation has completed or not. If the remaining data for the write operation is received, it is put into a queue, where it waits for either another read request or a **close** command. When the target receives the signal and the current read is returned, another read operation can be started, or the target can be closed. If the read request that the calling program wants to break ends before the signal is generated, the read operation ends normally, and the signal is ignored.

The target-mode device driver attempts to queue received data in front of requests from the application program. A read-ahead buffer area is used to store the queued data. The length of this read-ahead buffer is determined by multiplying the value of the **RecvBufferSize** attribute by the value of the **RecvBuffers** attribute. These values are in the configuration database. While the application program runs **read** subroutines, the queued data is copied to the application data buffer, and the read-ahead buffer space is again made available for received data. If an error occurs while he data is being copied to the caller data buffer, the read operation fails, and the **errno** global variable is set to **EFAULT**. If the **read** subroutines are not run quickly enough to fill almost all the read-ahead buffers for the device, data reception is delayed until the application program runs a **read** subroutine again. When enough area is freed, data reception capability is restored from the device. Data might be delayed, but it is not lost or ignored.

The target-mode device driver controls only received data into its read entry point. The read entry point can optionally be used with the select entry point to provide a means of asynchronous notification of received data on one or more target devices.

Possible return values for the **errno** global variable include:

EAGAIN

Indicates that a nonblocking read request would have blocked, because data is available.

EFAULT

An error occurred while copying data to the caller buffer.

EINTR Interrupted by a signal.

EINVAL

Attempted to run a read operation for a device instance that is not configured, not open, or is not a target-mode minor device number.

EIO An I/O error occurred.

write subroutine

Support for the write entry point is provided only for the initiator-mode device driver. The write entry point generates one write operation in response to a calling program write request. If the device is opened with the O_NDELAY flag set, and the write request is for a length that is greater than the total buffer size of the device, the write request fails. The **errno** global variable is set to **EINVAL**. The total buffer size for the device is determined by multiplying the value of the **XmitBufferSize** attribute by the value of the **XmitBuffers** attribute. These values are in the configuration database.

Support for data gathering is through the user-mode **writev** or **writevx** subroutine, or through the kernel-mode **fp_rwuio** service call. The write buffers are gathered so that they are transferred, in sequence, as one write operation. The returned **errno** global variable is set to **EFAULT** if an error occurs while the caller data is being copied to the device buffers.

If the write operation is unsuccessful, the return value is set to -1 and the **errno** global variable is set to the value of the return value from the device driver. If the return value is other than -1, the write operation was successful and the return value indicates the number of bytes that were written. The caller should validate the number of bytes that are sent to check for any errors. Because the whole data transfer length is sent in a single write operation, you should suspect that a return code that is not equal to the expected total length is an error. File offsets are not applicable, and are ignored for target-mode write operations.

If the calling program needs to break a blocked write operation, a signal is generated. The target-mode device driver receives that signal, and ends the current write operation. The write operation that is in progress fails, and the **errno** global variable is set to **EINTR**. The write operation returns the number of bytes that were already sent, before the signal was generated. The calling program can then continue by issuing another write operation or an ioctl operation, or it can close the device. If the write operation that the caller attempts to break completes before the signal is generated, the write operation ends normally, and the signal is ignored.

If the buffers of remote using systems are full, or no device response status is received for the write operation, the target-mode device driver automatically retries the write

operation. It retries the operation up to the number of times that is specified by the value **TM_MAXRETRY**. This value is defined in the **/usr/include/sys/tmscsi.h** file. By default, the target mode device driver delays each retry attempt by approximately two seconds to allow the target device to respond successfully. The caller can change the time delayed through the **TMCHGIMPARM** operation. If the write operation is still unsuccessful after the specified number of retries, it tries another SSA adapter. If this write operation has already tried all the SSA adapters, it fails. The calling program can retry the write operation, or perform other appropriate error recovery. No other error conditions are retried, but are returned with the appropriate **errno** global variable.

The target-mode device driver, by default, generates a time-out value, which is the amount of time allowed for the write operation to end. If the write operation does not end before the time-out value expires, the write operation fails. The time-out value is related to the length of the requested transfer, in bytes, and is calculated as follows:

```
timeout_value = ((transfer_length / 65536) + 1) * 20
```

In the calculation, 20 is the default scaling factor that generates the time-out value. The caller can customize the time-out value through the **TMCHGIMPARM** operation. The actual period that elapses before a time-out occurs can be up to 10 seconds longer than the calculated value, because it is related to the operation of the hardware at the time of the write operation. A time-out value of zero means that no time-out occurs. A value of zero is not allowed when the write operation is nonblocking, because a deadlock might occur. Under this condition, **EINVAL** is returned for the write operation.

If the caller opened the initiator-mode device with the O_NDELAY flag set, the write operation is nonblocking. In this mode, the device checks whether enough buffer space is available for the write operation. If enough buffer space is not available, the write operation fails, and the **errno** global variable is set to **EAGAIN**. If enough buffer space is available, the write operation immediately ends with all the data written successfully. The write operation now occurs asynchronously. If you want to track the progress of this write operation, use the **TMIOSTAT** operation. The driver keeps the status of the last write operation, which is then reported by the **TMIOSTAT** operation.

Possible return values for the **errno** global variable include:

EFAULT
> The write operation was unsuccessful because of a kernel service error. This value is applicable only during data gathering.

EINTR Interrupted by signal.

EINVAL
> Attempted to execute a write operation for a device instance that is not configured, not open, or is not an initiator-mode minor device number. If a nonblocking write operation, the transfer length is too long, or the time-out period is zero. If the transfer length is too long, try the operation again with a smaller transfer length. If the time-out period is zero, use **TMCHGIMPARM** to set the time-out value to another value.

EAGAIN

A nonblocking write operation could not proceed because not enough buffer space was available. Try the operation again later.

EIO One of the following I/O errors occurred:

- An error that cannot be produced again.
- The number or retried operations reached the limit that is specified in **TM_MAXRETRY** without success on an error that cannot be reproduced.
- The target-mode device of the remote node is not initialized or open.

Do the appropriate error recovery routine.

ETIMEDOUT

The command has timed out. Do the appropriate error recovery routine.

ioctl Subroutine

The following ioctl operations are provided by the target-mode device driver. Some are specific to either the target-mode device or the initiator-mode device. All require the respective device instance be open for the operation run.

IOCINFO

Returns a structure defined in the **/usr/include/sys/devinfo.h** file.

TMCHGIMPARM

Allows the caller to change some parameters that are used by the target mode device driver for a particular device instance.

TMIOSTAT

Allows the caller to get status information about the previously run write operation.

Possible return values for the **errno** global variable include:

EFAULT

The kernel service failed when it tried to access the caller buffers.

EINVAL

The device not open or not configured. The operation is not applicable to mode of this device. A parameter that is not valid was passed to the device driver.

select Entry Point

The select entry point allows the caller to know when a specified event has occurred on one or more target-mode devices. The event *input* parameter allows the caller to specify about which of one or more conditions it wants to be notified by a bitwise OR of one or more flags. The target-mode device driver provides support for the following select events:

POLLIN

Check whether received data is available.

POLLSYNC
> Return only events that are currently pending. No asynchronous notification occurs.

The additional events, POLLOUT and POLLPRI, are not applicable. The target-mode device driver does not, therefore, provide support for them.

The *reventp* output parameter points to the result of the conditional checks. The device driver can return a bitwise OR of the following flags:

POLLIN
> Received data is available.

The *chan* input parameter is used for specifying a channel number. This parameter is not applicable for nonmultiplexed device drivers. It should be set to 0 for the target-mode device driver.

The POLLIN event is indicated by the device driver when any data is received for this target instance. A nonblocking **read** subroutine, if subsequently issued by the caller, returns data. For a blocking read subroutine, the read does not return until either the requested length is received, or the write operation ends, whichever comes first.

Asynchronous notification of the POLLIN event occurs when received data is available. This notification occurs only if the select event POLLSYNC was not set.

The initiator-mode device driver provides support for the following select events:

POLLOUT
> Check whether output is possible.

POLLPRI
> Check whether an error occurred with the write operation.

POLLSYNC
> Return only events that are currently pending. No asynchronous notification occurs.

An additional event POLLIN is not applicable and has no support from the initiator-mode device driver.

The *reventp* output parameter points to the result of the conditional checks. The device driver can return a bitwise OR of the following flags:

POLLOUT
> If the initiator device is opened with the O_NDELAY flag, some buffer space is not being used now. Otherwise, this event is always set for the initiator-mode device.

POLLPRI
> An error occurred with the latest write operation.

Asynchronous notification of the POLLOUT event occurs when buffer space is made available for further write operations.

Asynchronous notification of the POLLPRI event occurs if an error occurs with a write operation. Note that the error might be recovered successfully by the device driver.

Possible return values for the **errno** global variable include:

EINVAL
> A specified event has no support, or the device instance is not configured or not open.

Errors

Errors that are detected by the target-mode device driver can be one of the following:
- A hardware error that occurred while receiving data, and cannot be reproduced
- A hardware error that occurred during an adapter command, and cannot be reproduced
- A hardware error that has not been recovered
- A software error that has been detected by the device driver

The target-mode device driver passes error-recovery responsibility for all detected errors to the caller. For these errors, the target-mode device driver does not know if this type of error is permanent or temporary. These types of errors are handled as temporary errors.

Only errors that the target-mode device driver can itself recover through retry operations can be determined to be either temporary or permanent. The error is ignored if it succeeds during retry (a recovered error). The return code to the caller indicates success if a recovered error occurs, or failure if an unrecovered error occurs. The caller can retry the command or operation, but success is probably low for unrecovered errors.

TMSSA does no error logging. If an error occurs, that error might be logged by the adapter device driver.

tmssa Special File

Purpose

To provide access to the SSA tmssa device driver.

Description

The Serial Storage Architecture (SSA) target-mode device driver provides an interface that allows the SSA interface to be used for data transfer from using system to using system.

You can access the data transfer functions through character special files that are named **dev/tmssa*nn.xx***, where *nn* is the node number of the node with which you are communicating. The *xx* can be either **im** (initiator-mode interface), or **tm** (target-mode interface). The caller uses the initiator-mode to transmit data, and the target-mode interface to receive data.

The least significant bit of the minor device number indicates to the device driver which mode interface is selected by the caller. When the least significant bit of the minor device number is set to 1, the target-mode interface is selected. When the least significant bit is set to 0, the initiator-mode interface is selected. For example, **tmssa1.im** should be defined as an even-numbered minor device number to select the initiator-mode interface. **tmssa1.tm** should be defined as an odd-numbered minor device number to select the target-mode interface.

When the caller opens the initiator-mode special file, a logical path is set up. This path allows data to be transmitted. The user-mode caller issues a **write**, **writev**, **writex**, or **writevx** system call to start data transmission. The kernel-mode user issues an **fp_write** or **fp_rwuio** service call to start data transmission. The SSA target-mode device driver then builds a **send** command to describe the transfer, and the data is sent to the device. The transfer can be done as a blocking write operation or as a nonblocking write operation. When the write entry point returns, the calling program can access the transmit buffer.

When the caller opens the target-mode special file, a logical path is set up. This path allows data to be received. The user-mode caller issues a **read**, **readv**, **readx**, or **readvx** system call to start the receiving of data. The kernel-mode caller issues an **fp_read** or **fp_rwuio** service call to start the receiving of data. The SSA target-mode device driver then returns data that was received for the application program.

Implementation Specifics

The SSA tmssa device driver provides further information about implementation specifics. The **tmssa** special file is part of Base Operating System (BOS) Runtime. This file is in the **device.ssa.tm.rte** file set, which is in the **devices.ssa.tm** package.

Related Information

The **close** subroutine, **open** subroutine, **read** or **readx** subroutine, and **write** or **writex**.

IOCINFO (Device Information) tmssa Device Driver ioctl Operation

Purpose

To return information about the device in a structure that is defined in the **/usr/include/sys/devinfo.h** file.

Description

This operation allows you to supply a pointer to the address of an area of type **struct devinfo** in the *arg* parameter to the **IOCINFO** operation. This structure is defined in the **/usr/include/sys/devinfo.h** file. The SCSI target-mode union is used for this as follows:

Initiator-Device

buf_size
　　Size of transmit buffer.

num_bufs
　　Number of transmit buffers

max_transfer
　　Unused. Set to zero.

adap_devno
　　Major or Minor devno of SSA adapter to be used for the next transmit operation.

Use **TM_GetDevinfoNodeNum( )** to read the node number to which the data is sent.

Target-Device

buf_size
　　Size of receive buffer.

num_bufs
　　Number of receive buffers

max_transfer
　　Unused. Set to zero.

adap_devno
　　Major or Minor devno of SSA adapter initially used by the paired initiator-mode device.

Use **TM_GetDevinfoNodeNum( )** to read the node number from which the data is received.

The remainder of the structure is filled as follows:

devtype
　　DD_TMSCSI.

flags　Set to zero.

devsubtype
　　DS_TM.

TMIOSTAT (Status) tmssa Device Driver ioctl Operation

Purpose

To allow the caller to put the status information for the current or previous write operation into a structure that is defined in the **/usr/include/sys/tmscsi.h** file.

Description

This operation returns information about the last write operation. Because a nonblocking write operation might still be running, you must ensure that the status information applies to a particular write operation. The tm_get_stat structure in the **/usr/include/sys/tmscsi.h** file is used to indicate the status, as follows:

status_validity
Bit 0 set, scsi_status valid

scsi_status

SC_BUSY_STATUS Write operation in progress
SC_GOOD_STATUS Write operation completed successfully
SC_CHECK_CONDITION Write operation failed

general_card_status
Unused. Set to zero.

b_error
errno for a failed write operation, or zero.

b_resid
Updated uio_resid for the write operation.

resvd1 Unused. Set to zero.

resvd2 Unused. Set to zero.

Note: The tm_get_stat structure works only for the initiator device.

TMCHGIMPARM (Change Parameters) tmssa Device Driver ioctl Operation

Purpose

To allow the caller to change the *retry* parameter and the *time out* parameter that are used by the target-mode device driver.

Description

This operation allows the caller to change the default set up of the device. It is allowed only for the initiator-mode device. The *arg* parameter to the **TMCHGIMPARM** operation contains the address of the **tm_chg_im_parm** structure that is defined in the **/usr/include/sys/tmscsi.h** file.

Default values that are used by the device driver for the *retry* parameter and for the *time out* parameter usually do not require change. For some calling programs, however, default values can be changed to fine tune timing parameters that are related to error recovery.

When a parameter is changed, it remains changed until another **TMCHGIMPARM** operation occurs, or until the device is closed. When the device is opened, the parameters are set to the default values.

Parameters that can be changed with this operation are:
- The delay (in seconds) between device-driver-initiated retries of **send** commands (the *retry* parameter)
- The time allowed before the write operation times out (the *time out* parameter).

To indicate which of the possible two parameters the caller is changing, the caller sets the appropriate bit in the chg_option field. The caller can change either the *retry* parameter, or the *time out* parameter, or it can change both parameters.

To change the delay between **send** command retries, the caller sets the TM_CHG_RETRY_DELAY flag in the chg_option field and puts the required delay value (in seconds) into the new_delay field of the structure. With this command, the retry delay can be changed to any value 0 through 255, where 0 instructs the device driver to use as little delay as possible between retries. The default value is approximately two seconds.

To change the **send** command time-out value, the caller sets the TM_CHG_SEND_TIMEOUT flag in the chg_option field, sets the desired flag in the timeout_type field, and puts the desired time-out value into the new_timeout field of the structure. One flag must be set in the timeout_type field to indicate the required form of the time-out. If the TM_FIXED_TIMEOUT flag is set in the timeout_type field, the value that is put into the new_timeout field is a fixed time-out value for all **send** commands. If the TM_SCALED_TIMEOUT flag is set in the timeout_type field, the value that is put into the new_timeout field is a scaling-factor used in the calculation for time-outs as shown under the description of the write entry point. The default **send** command time-out value is a scaled time-out with a scaling factor of 20.

Regardless of the value of the timeout_type field, if the new_timeout field is set to a value of 0, the caller specifies "no time out" for the **send** command, allowing the command to take an indefinite amount of time. If the calling program wants to end a write operation, it generates a signal. This option is allowed only for blocking-type write operations.

Part 2. Maintenance Information

Chapter 9. SSA Adapter Information

For a description of the SSA adapter, port addresses, and the rules for SSA loops, see Chapter 1. Introducing SSA and the SSA Adapters.

Installing the SSA Adapter

1. Install the adapter and disk drive microcode from the diskettes that are supplied with the adapter. A README sheet of installation instructions is also supplied.
2. Install the adapter into a slot in the using system (see the *Installation and Service Guide* for the using system).
3. Connect the SSA cables to the adapter and to the devices that are to be attached to the adapter. For information about how the cables are to be attached, see the configuration plan that was created when the subsystem was ordered.

   If the configuration plan is not available, use the example configuration information that is given in the service information for the devices.

   See also "Chapter 2. Introducing SSA Loops" on page 19 for general information about SSA loops and links.

Note: If, for any reason, an adapter is exchanged for a replacement adapter, all associated arrays that were not synchronized when the adapter failed are rebuilt.

Cron Table Entries

During the installation of the SSA software, the following two entries are made in the system cron table:

```
01 5 * * * /usr/lpp/diagnostics/bin/run_ssa_ela 1>/dev/null 2>/dev/null
0 * * * * /usr/lpp/diagnostics/bin/run_ssa_healthcheck 1>/dev/null 2>/dev/null
```

The first entry instructs the run_ssa_ela shell script to run at 05:01 each day. This shell script analyzes the error log. If it finds any problems, the script warns the user in the following ways. It sends:

- An error message to /dev/console. This message is displayed on the system console.
- An OPMSG to the error log. This message indicates the source of the error.
- A mail message to ssa_adm.

   Note: ssa_adm is an alias mail address that is set up in /etc/aliases. By default, the address is set to "root", but you can set it to any valid mail address for the using system.

The second entry instructs the run_ssa_healthcheck shell script to run once each hour. This shell script causes the SSA adapter to log any errors that might exist in the SSA subsystem, but that are not causing application programs to fail.

Microcode Maintenance

For some problems, the service request number (SRN) might ask you to check the microcode package ID before you exchange any field-replaceable units (FRUs). You can determine the adapter microcode package ID in two ways:

- On the command line, give the following command:

  ```
  lsattr -E -l adapter  -a ucode
  ```

  where **adapter** is the ID of the adapter that you want to check; for example, `ssa0`.

  An example of a response to this command is:

  ```
  ucode 8F97.00.nn Name of adapter code download False
  ```

  where `nn` is the adapter microcode package ID.

- Use the Display or Change Configuration or Vital Product Data (VPD) service aid to display the VPD for the adapter (see the *Diagnostic Information for Micro Channel Bus Systems* manual or the *Diagnostic Information for Multiple Bus Systems*, as appropriate). The first two characters of the ROS Level field contain the adapter microcode package ID.

You can determine the disk drive microcode level by using the Display/Download Disk Drive Microcode SSA service aid (see "Display/Download Disk Drive Microcode Service Aid" on page 219).

Note: During the configuration of the complete system, all the VPD files in the system are updated *before* any microcode is downloaded from the using system to the SSA subsystem. If the using system later downloads a new level of microcode to the subsystem, the VPD files in the system for the adapter do not show the ID of the new microcode package until the next time the configuration manager (cfgmgr) is run.

Adapter Microcode Maintenance

Updates to microcode are loaded into the using system from diskettes. To load the microcode:

1. Log on as `root`.
2. Insert the SSA Adapter Microcode diskette into the drive rfd0.
3. Type the command: `installp -ac all`
4. Remove the SSA Adapter Microcode diskette.
5. Run the **cfgmgr** command.
6. If the subsystem has loops that contain two or more SSA adapters, and those adapters are installed in two or more using systems, load the adapter microcode, and run the **cfgmgr** command on each using system.

If the level of the microcode that is stored in the using system is higher than the level of the microcode that is installed on the SSA adapter, the higher-level microcode is automatically downloaded to the adapter when the using system runs its configuration method.

Disk Drive Microcode Maintenance

To download disk drive microcode, use the Display/Download Disk Drive Microcode SSA service aid (see "Display/Download Disk Drive Microcode Service Aid" on page 219).

Vital Product Data (VPD) for the SSA Adapter

The vital product data (VPD) for the SSA adapter can be displayed by using the using-system service aids. This section shows the types of information that are contained in the VPD.

Part number
> The part number of the adapter card field-replaceable unit (FRU).

Serial number
> The serial number of the adapter card.

Engineering change level
> The engineering change level of the adapter card.

Manufacturing location
> Manufacturer and plant code.

ROS level and ID
> The version of read-only storage (ROS) code that is loaded on the adapter.

Loadable microcode level
> The version of loadable code that is needed for the satisfactory operation of this card.

Device driver level
> The minimum level of device driver that is needed for this level of card.

Description of function
> A message that can be displayed.

Device specific (Z0)
> If the adapter contains additional dynamic random-access memory (DRAM) modules, Z0 indicates the total DRAM size in megabytes.

Device specific (Z1)
> If the adapter contains a pluggable fast-write cache module, Z1 indicates the cache size in megabytes.

Device specific (Z2)
> The SSA unique ID that is used to identify this adapter.

Adapter Power-On Self-Tests (POSTs)

Power-on self-tests (POSTs) are resident in the SSA adapter. These tests ensure that the adapter does not run the functional code until the hardware that uses the code has been tested. The hardware consists of only the adapter card and any memory modules and fast-write cache modules that are attached to the adapter. Some POST failures cause the adapter to become unavailable to the using system. Other POST failures allow the adapter to be available, although some function might not be enabled. The particular tests that are run are related to the type of SSA adapter that is being used. If a POST fails and prevents the adapter from becoming available, exchange the adapter card for a new one. If a POST fails, but does not prevent the adapter from becoming available, an error is logged. That error indicates which FRUs must be exchanged for new FRUs.

Chapter 10. Removal and Replacement Procedures

Exchanging Disk Drives

1. If you are removing a disk drive under concurrent maintenance (see the service information for the device that contains the disk drive), first ensure that no hdisk is using the pdisk (disk drive) that you want to remove. Use the Configuration Verification service aid (see "Configuration Verification Service Aid" on page 214) to determine whether the pdisk is related to an hdisk.

2. If the pdisk is related to an hdisk that is a RAID array, go to step 3.

   If the pdisk is related to an hdisk that is not a RAID array, make that hdisk unavailable to the using system, and go to step 7 on page 176.

   If the pdisk is not related to an hdisk, go to step 7 on page 176.

3. For fast path, type `smitty redssaraid` and press Enter.

   Otherwise:

   a. Select **Change Member Disks in an SSA RAID Array** from the SSA RAID Array menu.

   b. Select **Remove a Disk from an SSA RAID Array**.

4. A list of arrays is displayed in a window:

```
                    Change Member Disks in an SSA RAID Array

Move cursor to desired item and press Enter.

  Remove a Disk from an SSA RAID Array
  Add a Disk to an SSA RAID Array
  Swap Members of an SSA RAID Array




   ------------------------------------------------------------------------
  |                          SSA RAID Array                                |
  |                                                                        |
  | Move cursor to desired item and press Enter.                           |
  |                                                                        |
  |   hdisk3          095231779F0737K good       3.4G   RAID-5 array       |
  |   hdisk4          09523173A02137K good       3.4G   RAID-5 array       |
  |                                                                        |
  | F1=Help               F2=Refresh             F3=Cancel                 |
  | F8=Image              F10=Exit               Enter=Do                  |
  | /=Find                n=Find Next                                       |
   ------------------------------------------------------------------------
```

   Select the SSA RAID array from which you are removing the disk drive.

5. The following information is displayed:

```
                     Remove a Disk from an SSA RAID Array

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.

                                                     Entry Fields
   SSA RAID Manager                                ssa0
   SSA RAID Array                                  hdisk3
   Connection Address / Array Name                 095231779F0737K
 * Disk to Remove                                                           +








 F1=Help            F2=Refresh         F3=Cancel         F4=List
 F5=Reset           F6=Command         F7=Edit           F8=Image
 F9=Shell           F10=Exit           Enter=Do
```
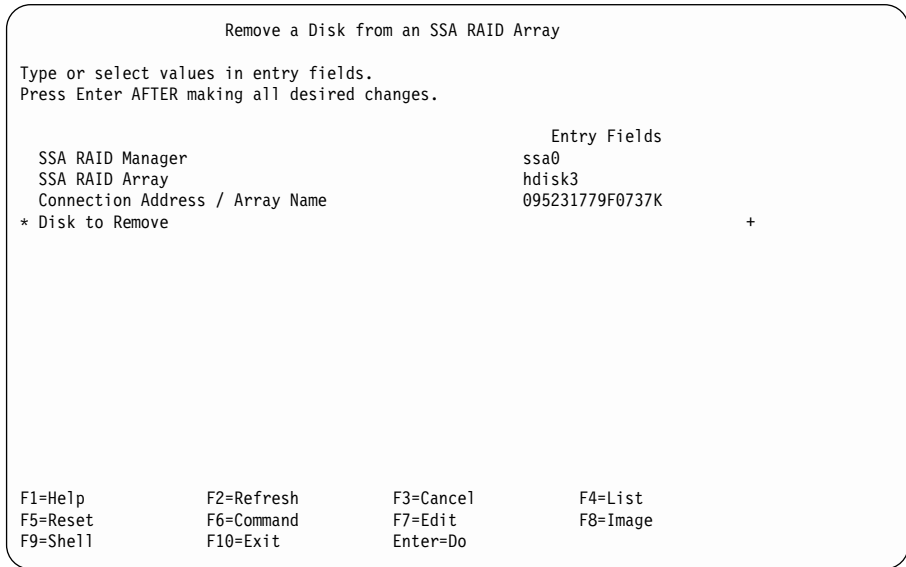
Press F4 to list the disk drives.

6. A list of disk drives is displayed.

   From the displayed list, select the disk drive, or drives, that you want to remove.

7. If necessary, use the Identify function to find the disk drive that you want to remove (see "Finding the Physical Location of a Device" on page 227).

8. Press Enter to remove the disk drive from the array.

9. If the Check light of the disk drive that you are removing is off, use the Set Service Mode service aid to put that disk drive into Service Mode (see "Set Service Mode Service Aid" on page 206).

   If the Check light of the disk drive that you are removing is on, you do not need to select Service Mode before you remove that disk drive.

10. Physically remove the disk drive. (See the service information for the device that contains the disk drive, then return to here.)

11. Physically install the replacement disk drive. (See the service information for the device that contains the disk drive, then return to here.)

12. If the disk drive is in Service Mode, reset Service Mode. (See "Set Service Mode Service Aid" on page 206, then return to here.)

13. Now you must remove from the system configuration the reference to the disk drive that you have just removed. Type:

    rmdev -l [pdisknumber] -d
    rmdev -l [hdisknumber] -d

    where [pdisknumber]is the pdisk number of the disk drive that you have just removed, and [hdisknumber] is the hdisk number of the disk drive that you have just removed.

14. If you installed the disk drive under concurrent maintenance, give the **cfgmgr** command to configure that disk drive.

    If you installed the disk drive while the using system was switched off, switch on the using system when you are ready to do so. When you switch on the using system, the disk drive is automatically configured.

15. The disk drive has been configured with *new* hdisk and pdisk numbers. You can change these numbers. For example, if the disk drive is a replacement disk drive, you might want to make its pdisk and hdisk numbers match those of the original disk drive.

    If you want to change the numbers, go to the next step.

    If you do not want to change the numbers, go no further with these instructions.

16. Run the Configuration Verification service aid. (See "Configuration Verification Service Aid" on page 214, then return to here.)

17. From the displayed list of pdisks and hdisks, find the serial number of the disk drive that you have just installed.

18. The serial number is shown twice: next to the new pdisk number and next to the new hdisk number.

    Make a note of the new pdisk and hdisk numbers.

19. If the disk drive that you are installing is a replacement for a disk drive that was a member of an SSA RAID array, go to step 20. Otherwise, go to step 25.

20. Type `smitty ssaraid` and press Enter.

21. Select **Change/Show Use of an SSA Physical Disk**.

    The pdisk that has been exchanged is listed under **SSA Physical Disks that are system disks**.

22. Select the pdisk from the list.

23. Change the Current Use parameter to **Hot Spare Disk** or to **Array Candidate Disk**.

    Note: It is the user who should make the choice of Current Use parameter. That choice should be:

    - **Hot Spare Disk** if the use of hot spares is enabled for the RAID arrays on the subsystem
    - **Array Candidate Disk** if the use of hot spares is disabled for the RAID arrays on the subsystem.

24. You have now finished installing the disk drive. Go no further with these instructions.

25. Give the following command:

    `lsdev -Cl [hdisknumber] -F [connwhere]`

    where [`hdisknumber`] is the new hdisk number (for example, hdisk12), and [`connwhere`] is the connection location number (for example, 0004AC5119E000D).

26. Make a note of the [connwhere] number; you will need it later in this procedure.

27. Remove the new hdisk number by giving the command:

```
rmdev -l [hdisknumber] -d
```

where [hdisknumber] is the hdisk number that you want to remove (for example, hdisk12).

28. Remove the definition of the *original* hdisk by giving the command:
```
rmdev -l [hdisknumber] -d
```

where [hdisknumber] is the hdisk number of the original disk drive (for example, hdisk7).

29. Give the command:
```
mkdev -p ssar -t hdisk -c disk -s ssar -w [connwhere] -l [hdisknumber]
```

where [connwhere] is the connection location number that you noted in step 26 on page 177, and [hdisknumber] is the hdisk number you want for the new disk drive (for example, hdisk7).

30. If you want to remove, from the system configuration, pdisk numbers that are not used, give the following command for pdisks that remain defined:
```
rmdev -l [pdisk] -d
```

where [pdisk] is the number of the pdisk that you want to remove from the configuration.

31. Use the Display/Download Microcode service aid to check the level of microcode that is present on the disk drive that you have just installed (see "Display/Download Disk Drive Microcode Service Aid" on page 219).

If necessary, use the Display/Download Microcode service aid to download the latest level of microcode to the disk drive.

Removing and Replacing an SSA Adapter

Attention: Adapter cards contain parts that are electrostatic-discharge (ESD) sensitive. Use the tools and procedures defined by your organization to protect such parts.

1. Remove the adapter from the using system (see the *Installation and Service Guide* for the using system).

2. If you are exchanging the adapter for another, check whether the adapter that you have removed contains DRAM modules or a Fast-Write Cache Option Card. If the adapter contains any of these items, you must remove those items, and install them onto the new adapter card.

   Note: The Fast-Write Cache Option Card, if present, might contain customer data.
   - See "Removing a DRAM Module of an SSA RAID Adapter" on page 179 if you are removing DRAM modules.
   - See "Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181 if you are removing a Fast-Write Cache Option Card.

3. If you have removed DRAM modules or a Fast-Write Cache Option Card, install the items onto the replacement adapter card.

- See "Installing a DRAM Module of an SSA RAID Adapter" on page 180 if you are installing DRAM modules.
- See "Installing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 184 if you are installing a Fast-Write Cache Option Card.

4. Install the adapter into the using system (see the *Installation and Service Guide* for the using system).

Removing a DRAM Module of an SSA RAID Adapter

Attention: Adapter cards contain parts that are electrostatic-discharge (ESD) sensitive. Use the tools and procedures defined by your organization to protect such parts.

The procedure given here applies to the following adapters:
- SSA 4-Port RAID Adapter (type 4–I)
- PCI SSA 4-Port RAID Adapter (type 4–J)
- Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)
- PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

Figure 21 on page 180 shows an adapter that might not be of the type you are servicing. The instructions, however, are suitable for all these types of adapter.

1. Remove the adapter from the using system (see the *Installation and Service Guide* for the using system).
2. Release the clips **1** by carefully pulling them past the ends of the DRAM module **2** .
3. Rotate the DRAM module away from the adapter card.
4. Pull the DRAM module out from the socket.
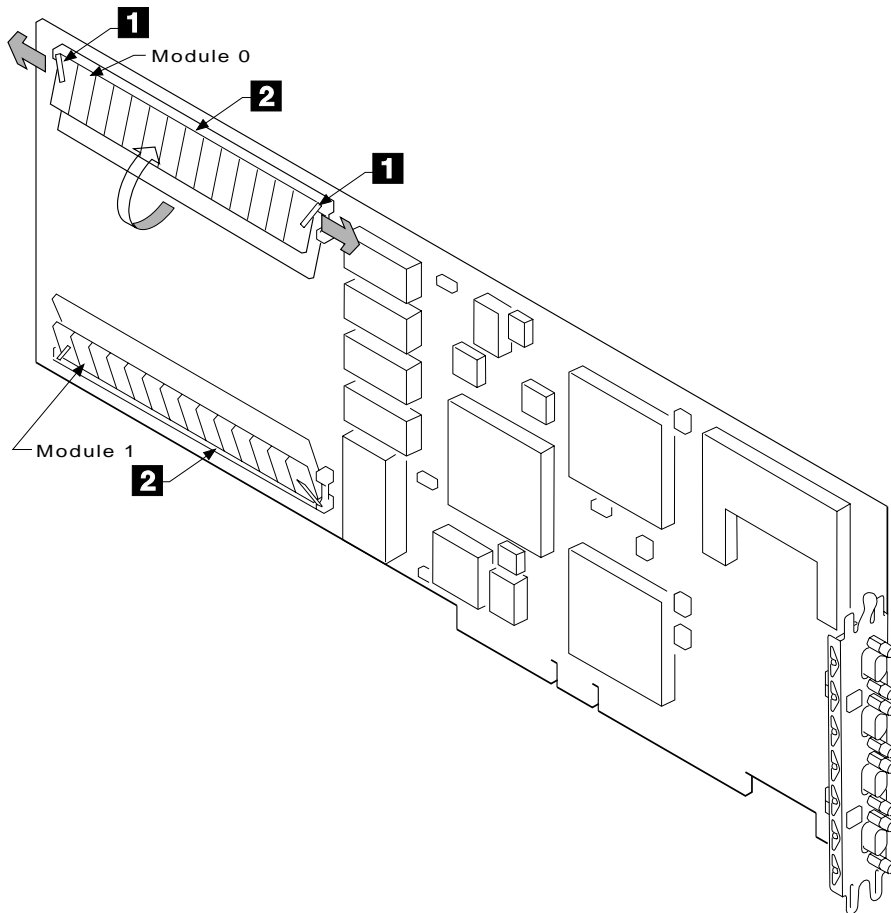
Figure 21. Removing a DRAM Module

Installing a DRAM Module of an SSA RAID Adapter

Attention: Adapter cards contain parts that are electrostatic-discharge (ESD) sensitive. Use the tools and procedures defined by your organization to protect such parts.

1. Refer to Figure 21.
2. Insert the DRAM module into the keyed socket.
3. Press the DRAM module into the socket, then rotate the module until the clips **1** click into place.
4. Reinstall the adapter into the using system (see the *Installation and Service Guide* for the using system).

Removing the Fast-Write Cache Option Card of an SSA RAID Adapter

Attention:

- Adapter cards contain parts that are electrostatic-discharge (ESD) sensitive. Use the tools and procedures defined by your organization to protect such parts.
- The Fast-Write Cache Option Card might contain customer data.

The procedure given here applies to the following adapters:

- Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)
- PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

1. Remove the adapter from the using system (see the *Installation and Service Guide* for the using system).

2. Refer to Figure 22 and to Figure 23 to identify the Fast-Write Cache Option card **1** on the type of adapter card that you are servicing.
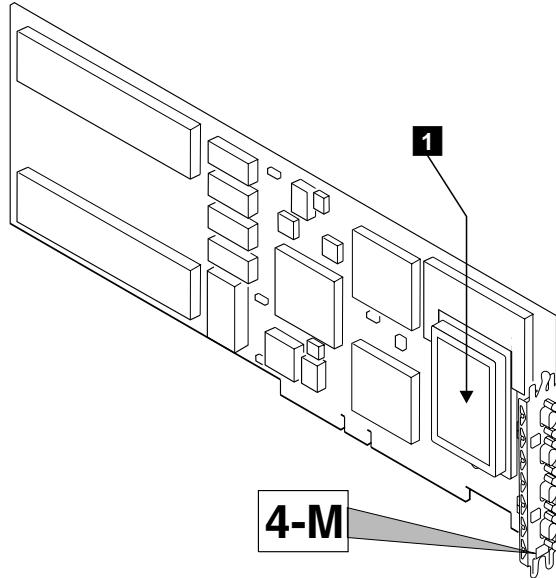
Figure 22. The SSA Fast-Write Option Card Installed on a Micro Channel SSA Multi-Initiator/RAID EL Adapter
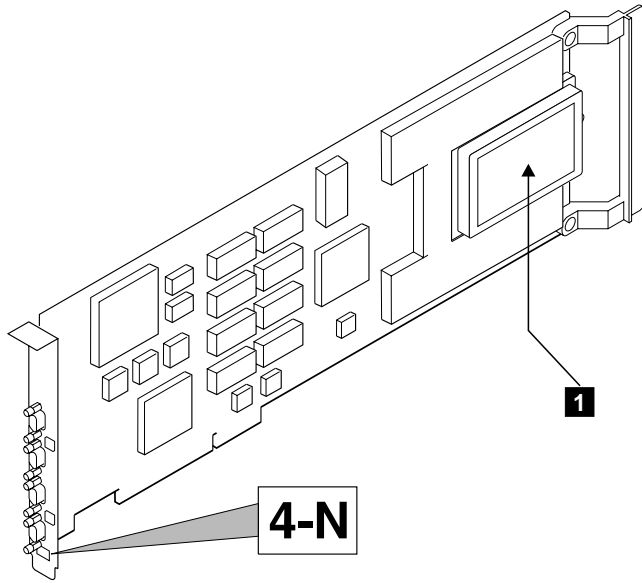
Figure 23. The SSA Fast-Write Option Card Installed on a PCI SSA Multi-Initiator/RAID EL Adapter

3. Refer to Figure 24.
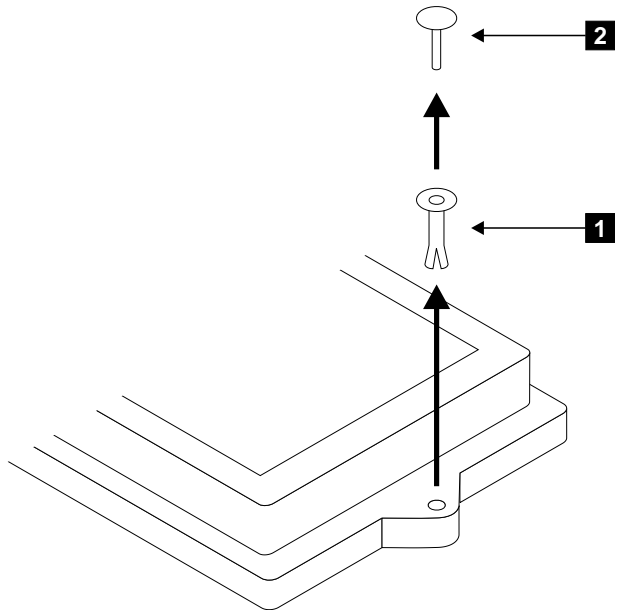
Figure 24. Releasing the Fast-Write Cache Option Card

4. Remove the pin **2** and the collar **1** from the Fast-Write Cache Option card.

5. Referring to Figure 25 or Figure 26, pull the Fast-Write Cache Option card **1** in the direction shown by the arrow in the diagram. This action unplugs the card from the connector on the adapter card.
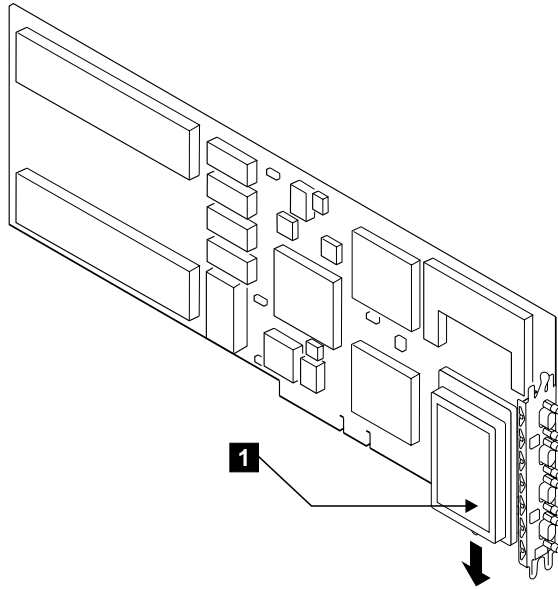
Figure 25. Removing the Fast-Write Cache Option Card from a Micro Channel SSA Multi-Initiator/RAID EL Adapter
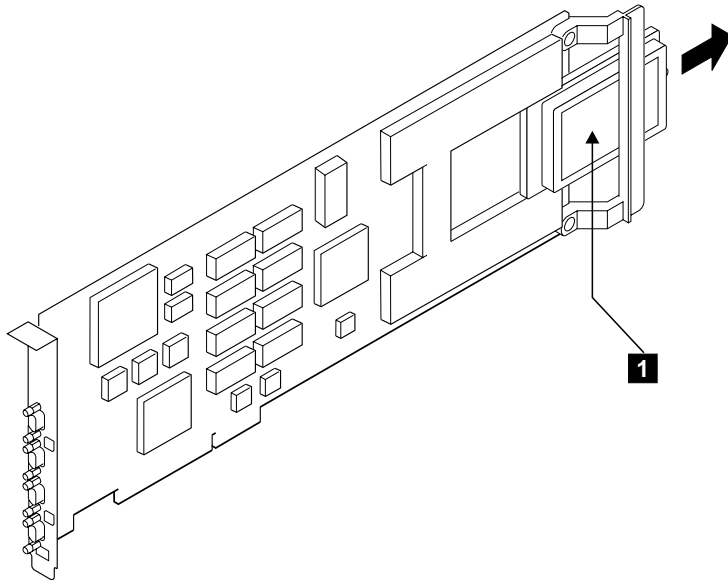
Figure 26. Removing the Fast-Write Cache Option Card from a PCI SSA Multi-Initiator/RAID EL Adapter

Installing the Fast-Write Cache Option Card of an SSA RAID Adapter

Attention: Adapter cards contain parts that are electrostatic-discharge (ESD) sensitive. Use the tools and procedures defined by your organization to protect such parts.

The procedure given here applies to the following adapters:

- Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)
- PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)

1. Remove the adapter from the using system, if not already removed (see the *Installation and Service Guide* for the using system).
2. Refer to Figure 27 and Figure 28, and identify the type of adapter card that you are servicing.
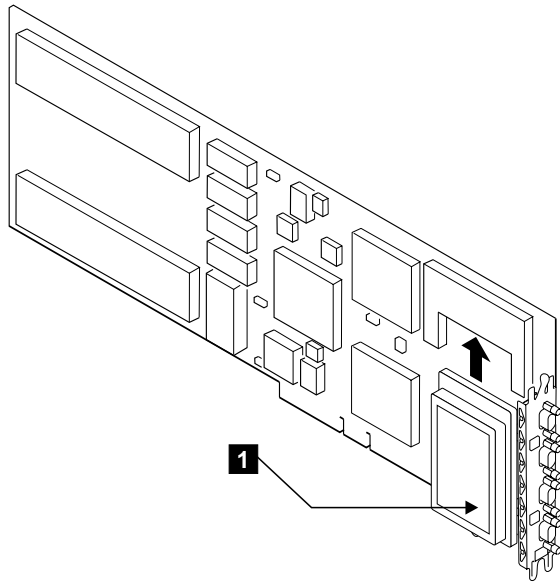
Figure 27. Installing the Fast Write Cache Option Card onto a Micro Channel SSA
Multi-Initiator/RAID EL Adapter
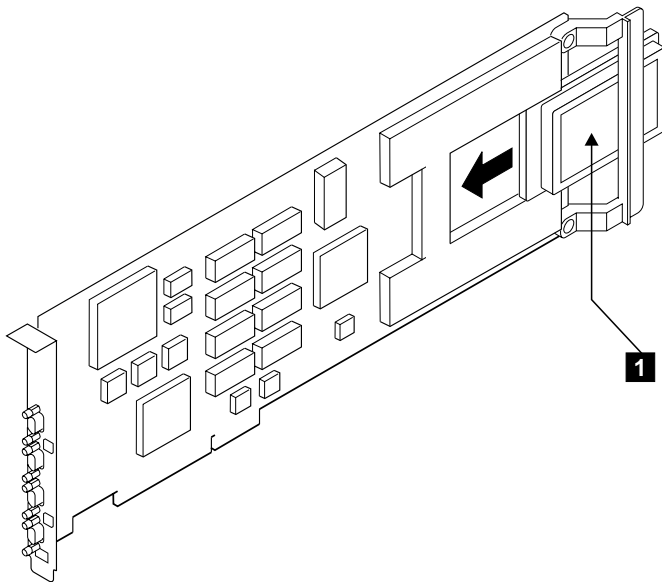
Figure 28. Installing the Fast Write Cache Option Card onto a PCI SSA
Multi-Initiator/RAID EL Adapter

3. Orient the Fast-Write Cache Option card as shown in the diagram, and place it onto the adapter card.

4. Push the card **1** in the direction shown by the arrow in the diagram, and plug it into the connector on the adapter card.

5. Refer to Figure 29.
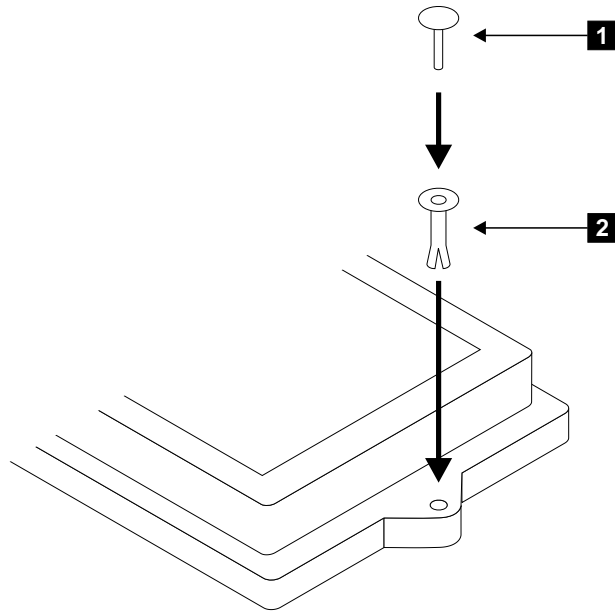
Figure 29. Installing the Collar and Pin of the Fast-Write Cache Option Card

6. Hold the collar **2** so that its split end is downward.

7. Install the collar into the Fast-Write Cache Option card so that its split end is downward.

8. Install the pin **1** into the collar, and push it fully home.

9. Reinstall the adapter card into the using system.

Chapter 11. Using the SSA Command Line Utilities

The commands that are described here allow you to get access from the command line to some of the functions that are available in the SSA service aids. The commands are very simple and are intended for use mainly from within shell scripts. They do not provide many error checking routines or error messages. If you need such facilities, use the SSA service aids (see "Chapter 12. SSA Service Aids" on page 203).

Under most conditions, a command prints a usage string if the syntax is incorrect. No message is printed, however, if the command fails. If the command runs without error, the return code is 0. If an error occurs, the return code is a value other than 0.

ssaxlate Command

Purpose

To translate between logical disks (hdisks) and physical disks (pdisks).

Syntax

```
ssaxlate -l LogicalDiskName
ssaxlate -l PhysicalDiskName
```

Description

If the parameter is a logical disk, the output is a list of names of the physical disks that provide support for that logical disk.

If the parameter is a physical disk, the output is a list of names of the logical disks that use that physical disk.

Flags

-l DiskName
Specifies the logical or physical disk.

ssaadap Command

Purpose

To list the adapters to which a logical disk or physical disk is connected.

Syntax

```
ssaadap -l LogicalDiskName
ssaadap -l PhysicalDiskName
```

Description

The output is the list of SSA adapters to which the logical or physical disk is connected. If the list contains more than one adapter, the first adapter in the list is the primary adapter.

Flags

-l DiskName
   Specifies the logical or physical disk.

---

ssaidentify Command

Purpose

To set or clear Identify mode for a physical disk.

Syntax

```
ssaidentify -l PhysicalDiskName -y
ssaidentify -l PhysicalDiskName -n
```

Description

If the -y parameter is specified, the disk is set into Identify mode. While the disk is in Identify mode, its amber Ready light flashes at approximately one-second intervals. The -n flag switches off Identify mode.

Flags

-l PhysicalDiskName
   Specifies the device to place into Identify mode.

-y   Switches on Identify mode.

-n   Switches off Identify mode.

---

ssaconn Command

Purpose

To display the SSA connection details for the physical disk.

Syntax

```
ssaconn -l PhysicalDiskName -a AdapterName
```

Description

The **ssaconn** command performs a function that is similar to the Link Verification service aid. The output from this command is:

```
PhysicalDiskName AdapterName hopcount1 hopcount2 hopcount3 hopcount4
```

The four hop counts represent the number of SSA devices that are between the physical disk and the A1, A2, B1, and B2 ports of the adapter, respectively. For example, if hop count 1 is 0, no devices are between the physical disk and the A1 port of the adapter. If hop count 4 is 5, five devices are between the physical disk and the B2 port of the adapter.

If the disk is not connected to a particular adapter port, the hop count is replaced by a – (dash) character.

Flags

-l PhysicalDiskName
    Specifies the physical disk whose connection details are to be listed.

-a AdapterName
    Specifies the adapter to whose ports the connection details are related.

---

ssacand Command

Purpose

To display the unused connection locations for an SSA adapter.

Syntax

ssacand -a AdapterName -P|-L

Description

The **ssacand** command lists the available connection locations of an SSA adapter. These connection locations are related to devices that are connected to the adapter, but for which no AIX devices are configured.

Flags

-a AdapterName
    Specifies the adapter whose connection locations are to be listed.

-P   Produce a list of possible connection locations for physical disks.

-L   Produce a list of possible connection locations for logical disks.

---

ssadisk Command

Purpose

To display the names of disk drives that are connected to an SSA adapter.

Syntax

ssadisk -a AdapterName -P|-L

Description

The **ssadisk** command lists the names of disk drives that are connected to an SSA adapter. These names are related to devices that are in the customized device data base, and have the SSA adapter as their **adapter_a** or **adapter_b** attribute.

Flags

-a AdapterName
> Specifies the adapter to which the disk drives are connected.

-P　　Produce a list of physical disks.

-L　　Produce a list of logical disks.

---

ssadload Command

Purpose

To download microcode to SSA physical disk drives.

Syntax

```
ssadload -d PhysicalDiskName -f CodeFileName
ssadload -u
ssadload -s [-d PhysicalDiskName]
```

Description

The **ssadload** command performs microcode downloads to physical disk drives. You can use the command in either of two modes:

- **Load a specific level of microcode into a specific physical disk drive**.

  Using the command in this mode, you can load any available level of microcode into any compatible disk drive.

- **Ensure that all the physical disk drives that are connected to the system are using the latest levels of microcode that are available on the system**.

  Using the command in this mode, you can ensure that the latest available level of microcode has been loaded onto all compatible disk drives in the system.

Notes:

1. The microcode files that this command can download have names of the pattern ssadisk.ros.XXXX, where XXXX identifies the microcode level (also known as the ROS id) that the file contains. Such microcode files are different from those with names of the pattern ssadisk.XXXXXXX.YY. These files contain a different type of disk microcode, and are automatically downloaded by the system configuration software as necessary. They cannot work with the **ssadload** command.

2. The microcode images are stored in the /etc/microcode directory.

Attention: Usually, you can download the microcode to disk drives that are in use. By doing so, however, you might cause a temporary delay in the AIX operating system or in the user's application program. ***Do not download microcode to a disk drive that is in use, unless you have the user's permission. Always refer to the download instructions that are supplied with the microcode, and check for any special restrictions that might be applicable. If you are not sure, do not download to disk drives that are in use.***

Flags

-d PhysicalName
    Specifies the physical disk drive that is to receive the microcode.

-f   Specifies the microcode file to be downloaded.

-u   Ensure that all physical disk drives are loaded with the latest level of microcode that is available on the system.

-s   Show the existing levels of microcode on all available disk drives.

-s [-d PhysicalDiskName
    Show the existing level of microcode on a specific disk drive.

Examples

- Using the -f flag:

  ```
  ssadload -d pdisk0 -f ssadisk.ros.7899
  ```

  In this mode, the command loads microcode file ssadisk.ros.7899 onto pdisk0.
- Using the -u flag:

  ```
  ssadload -u
  ```

  In this mode, the command identifies the latest level of SSA disk drive microcode that is available in the /etc/microcode directory. It then ensures that all the disk drives are using microcode that is at that level or at a higher level. If it finds a disk drive that is using a lower level of microcode, the command downloads the latest level of microcode to that disk drive.
- Using the -s flag:

  ```
  ssadload -s
  ```

  In this mode, the command lists the existing level of microcode of the available disk drives.

---

ssa_certify Command

Purpose

To certify the physical disk drive so that data can be read from, or written to, the disk drive without problems.

Syntax

```
ssa_certify -l pdisk
```

Description

The **ssa_certify** command certifies the disk drive by using the ISAL_Read, _Write, or _Characteristics commands. If a media-related problem occurs, the command attempts to reassign soft-error blocks.

Flags

-l Pdisk
> Specifies the physical disk drive (pdisk) that the user wants to certify.

Output

The **ssa_certify** command returns 0, unless a nonmedia-related problem occurs. If a nonmedia-related problem occurs, the command prints a message to stderr.

If the attempt to reassign soft-error blocks fails, or if the block has a hard media error, the **ssa_certify** command returns 0, but prints, to stdout, the LBA of the failing block, followed by the word "Failed".

For example:

```
>ssa_certify -l pdisk4
436537676 Failed
```

If the certify operation is successful, the **ssa_certify** command returns no output.

---

ssa_diag Command

Purpose

To run diagnostic tests to a specified device.

Syntax

```
ssa_diag -l pdiskX
ssa_diag -l ssaX
```

Description

The **ssa_diag** command is in /usr/lpp/diagnostics/bin.

Flags

-a   Causes the adapter to be reset if the device that is being tested is an adapter. This flag has no effect if the device is a disk drive.

-u   Forces a disk reservation to be broken if the device the device that is being tested is a disk drive. This flag has no effect if the device is an adapter, and is not valid for "SSA Enhanced RAID Adapters".

-s Requests the output of the power status. This flag can be used only with a disk drive. It cannot be used with the -a flag or with the -u flag. Power status output is:

Output

If an error occurs, the **ssa_diag** command generates an error message, for example: `ssa0 SRN 42500`, and sends it to stdout.

If no error occurs, the command sends no message to stdout.

A non-zero return code indicates an error. The command sends an error message to stderr.

Power status output to stdout is:

pdisk0 0
Pdisk0 power is good.

pdisk0 1
Pdisk0 has lost redundant power.

pdisk0 2
Pdisk0 has lost power.

---

ssa_ela Command

Purpose

To look for the most significant error in the error log.

Syntax

```
ssa_ela -l Device [-h timeperiod]
ssa_ela -l pdisk
ssa_ela -l hdisk
ssa_ela -l adapter
```

Description

The **ssa_ela -l device [-h timeperiod]** command scans the error log, and looks for all SSA errors. The command returns the SRN for the most significant error.

The **ssa_ela -l pdisk** command scans the error log, and looks for errors that are logged against the specified pdisk. The command returns the SRN for the most significant error.

The **ssa_ela -l hdisk** command scans the error log, and looks for errors that are logged against any hardware that provides support for the specified hdisk (pdisks and adapters). The command returns the SRN for the most significant error.

The **ssa_ela -l adapter** command scans the error log, and looks for errors that are logged against the specified adapter. The command returns the SRN for the most significant error.

Flags

-l Device

Specifies the device whose error log you want to analyze for the most significant error.

-h timeperiod

Instructs the program to start searching the error log from a previous time that is a multiple of 24 hours. For example, -h 1 (the default setting) starts a search through the previous 24 hours. -h 2 starts a search through the previous 48 hours.

Output

If an error occurs, the **ssa_ela** command sends an error message to stdout, such as:
```
ssa0 SRN 42500
```

If no error occurs, the command sends no message to stdout.

A non-zero return code indicates an error. The command sends an error message to stderr.

---

ssa_format Command

Purpose

To format the specified device.

Syntax

```
ssa_format -l pdisk
ssa_format -l SSA_Adapter
```

Description

The **ssa_format** command opens the pdisk special file, and uses the ISAL Format command to format the device. You can close the device while the format operation is running. If the command cannot format the device, it prints an error message.

If the specified device is an adapter, the **ssa_format** command attempts to format the Fast-Write Cache Option Card (if present). If the data that is on the cache card has been moved onto a disk drive (destaged), the formatting operation sets all the data on the cache card to zero, for security reasons. If the data has not been destaged, an error occurs.

Flags

-l Pdisk
> Specifies the pdisk that you want to format.

-l SSA_Adapter
> Specifies the adapter that you want to format.

Output

The **ssa_format** command sends all error messages to stderr.

If you attempt to format an adapter that does not have a cache-card, the **ssa_format** command returns the message: `This adapter cannot be formatted.`

If you attempt to format an adapter whose cache-card contains data, the **ssa_format** command returns the message: `Cannot be formatted because it is not empty.`

---

ssa_getdump Command

Purpose

To display SSA adapter dump locations, and to save the dump to a specified location.

Syntax

For the **List version** of the command:

```
ssa_getdump -l [-h] [-d pdiskxx] [-a AdapterName | -n AdapterUID | -s SlotNumber ]
```

For the **Copy version** of the command:

```
ssa_getdump -c [-h] -d pdiskxx
               {-a AdapterName | -n AdapterUID | -s SlotNumber } [-x] -o OutputFile
```

Description

The **ssa_getdump** command has two modes of operation: List mode and Copy mode.

List Mode
In List mode, the command searches for adapter dumps on unused SSA disk drives. It searches the disk drives sequentially, and provides information about all the dumps that it finds. An example of the output from List mode is shown here:

```
ADAPTER DUMPS

DATE     TIME         ADAPTER UID          DISK    SLOT  SIZE  STATUS  SEQ    ADAP

961031   10:31:12.123 1234567890ABCDEF pdisk22 12    1.5   4       12345  ssa0

???_xx   10:32:12.456 234567890ABCDEF1 pdisk22  3   13.5   3       12346  ssa1

961120   10:50:12.123 1234567890ABCDE7 pdisk22  7    1.5   4       12345
```

You can switch off the headings by using the -h flag.

Where possible, the **ssa_getdump** command translates the adapter UID into the adapter name, for example, ssa0. If the command cannot translate the adapter UID, it leaves the ADAP field blank (see the third line of output in the example).

You can limit the search to specific disk drives or adapters by adding various optional arguments to the command.

Attention:

The command uses space in the tmp file when it copies a file. If the available space is not large enough, the command fails. Some dumps can be large.

Copy Mode
In Copy mode, the command copies data from a specified disk drive to a specified output location. You must specify the disk drive and the output location.

Flags

The **ssa_getdump** command uses several types of flag:

- Required flags for both modes
- Required flags for Copy mode
- Optional flags for List mode
- Optional flags for Copy mode

Required Flags for Both Modes
You **must** use one of these flags:

-l   Specifies that the program is to operate in List mode. The program searches for dumps.

-c   Specifies that the program is to operate in Copy mode. The program copies the dump (if one is found) from the specified location to the specified output point.

Required Flags for Copy Mode
You **must** use both of these flags:

-d pdiskxx
Specifies the disk drive from which the data is to be copied (for example, pdisk2).

-o OutputFile
Specifies where the **tar** command is to write its output.

You **must** use at least one of these flags:

-a AdapterName
Specifies the adapter name for which the program must search (for example, ssa1). The adapter must be known to the searching machine.

-n AdapterUID

    Specifies the adapter UID for which the program must search. The adapter need not be known to the searching machine.

-s SlotNumber

    Specifies the slot that contains the disk drive, as shown in the List Output.

Optional Flags for List Mode

You can choose **either or both** of these flags:

-h   Prevents the heading lines from being displayed. This option is useful for scripts.

-d pdiskxx

    Allows the you to specify which disk drive is to be searched. By specifying the disk drive, you reduce the range of the search.

You can choose **either, but not both,** of these flags:

-a AdapterName

    Specifies the adapter name for which the program must search (for example, ssa1). The adapter must be known to the searching machine.

-n AdapterUID

    Specifies the adapter UID for which the program must search. The adapter need not be known to the searching machine.

-s SlotNumber

    Specifies the slot that contains the disk drive, as shown in the List Output.

Optional Flags for Copy Mode

You can choose **either or both** of these flags:

-h   Prevents the output of progress messages from the program.

-x   Prevents the actions of the **compress** command and of the **tar** command. The program copies the dump directly to the specified output point (-o).

        Note: You must ensure that the specified output point has enough free space to hold the dump.

Output

The **ssa_getdump** command sends all error messages to stderr, and the following to stdout.

- Header messages
- List mode output
- Copy progress messages

The command generates these return codes:

0   The command has completed successfully.

1   Some parameters are not correct.

2	The disk name is not valid, or the pdisk is not present.
3	The name of the SSA adapter is not correct or not valid.
4	The UID or slot number of the SSA adapter is not correct.
5	Cannot open the file or directory in the temporary file /tmp.
6	Not enough disk space is available, or an error occurred during a write operation to the temporary file.
7	Not enough memory is available.

> **Note:** When in Copy mode, the command reads data from the disk in blocks of approximately 256 KB.

8	An internal or object data manager (ODM) error has occurred.
9	An error occurred during a read operation in Copy mode.

ssa_progress Command

Purpose

To show how much (by percentage) of a format operation has been completed, and to show the status of the format operation. The status can be "Complete", "Formatting", or "Failed".

Syntax

```
ssa_progress -l pdisk
```

Description

The **ssa_progress** command opens the pdisk special file, and uses the ISAL Progress command to determine the percentage of the formatting operation that is complete.

Example 1: If the disk has been 30% formatted, the following messages are displayed:

```
> ssa_progress -l pdisk
Formatting 30
```

Example 2: If the disk is not formatting, and is not format degraded, the following messages are displayed:

```
> ssa_progress -l pdisk
Complete 100
```

Example 3: If the disk is format degraded, the following messages are displayed:

```
> ssa_progress -l pdisk
Failed 0
```

Flags

-l Pdisk
> Specifies the pdisk of whose format operation you want to check progress and status.

Output

The **ssa_progress** command sends error messages to stderr, and progress messages to stdout.

---

ssa_rescheck Command

Purpose

To report the reservation status of an hdisk.

Syntax

```
ssa_rescheck -l hdisk [-h]
```

Description

The **ssa_rescheck** command tests the access paths to the specified hdisk. It checks whether the disk is reserved. If the disk is reserved, the command attempts to determine why the disk is reserved.

Flags

-l hdisk
> Specifies the hdisk that you want to test.

-h   Switches off the header output.

Output

The **ssa_rescheck** command sends error messages to stderr. It sends header information and status output to stdout. The messages can be:

OK   Access to the disk drive is possible.

Open   Another program has opened the disk drive.

Fail   Access to the disk drive is not possible.

Busy   The disk drive is reserved to another adapter or using system.

> **Notes:**
> 1. For an "SSA Enhanced Adapter", Busy means that another adapter has reserved the disk drive. If both adapters are in the same using system, the other adapter shows OK or Open.
> 2. For an "SSA Enhanced RAID Adapter", Busy means that the disk drive is reserved. The Reserved To field provides more information.

N/A   The adapter cannot return reservation information. This occurs when the adapter is not an "SSA Enhanced RAID Adapter".

None The disk drive is not reserved. If an adapter name or UID is shown, the disk drive is reserved to a specific adapter. If a node number or using-system name is shown, the disk drive is reserved to a specific node.

Examples

The following examples show typical output from the **rescheck** command. The Adapter In Use field shows which adapter path the using system is using.

`ssa_rescheck -l hdisk1` produces this type of output:

```
Disk    Primary Secondary Adapter Primary Secondary Reserved
        Adapter Adapter   In Use  Access  Access    to

hdisk1  ssa0    ------    ssa0    OK      -----     none
```

`ssa_rescheck -l hdisk1 -h` produces this type of output:

```
hdisk1  ssa0    ------    ssa0    OK      -----     none
```

The next example shows the disk drive Open by adapter ssa1. The disk drive is reserved to ssa1, and adapter ssa0 has a Busy status. Because the two adapters are in the same using system, the Busy status indicates that the node number is not set:

```
Disk    Primary Secondary Adapter Primary Secondary Reserved
        Adapter Adapter   In Use  Access  Access    to

hdisk2  ssa1    ssa0      ssa1    Open    Busy      ssa1
```

The next example shows that the disk drive is reserved to a node, because the secondary access is OK (not Busy), and the Reserved To field shows the using system name:

```
Disk    Primary Secondary Adapter Primary Secondary Reserved
        Adapter Adapter   In Use  Access  Access    to

hdisk2  ssa1    ssa0      ssa1    Open    OK        abcd.location.com
```

Return Codes

0 The command has completed successfully.

1 A system error has occurred (usually when the adapter is not an "SSA Enhanced RAID Adapter").

Any other value
An error that is more serious that 0 or 1 has occurred.

ssa_servicemode Command

Purpose

To put the disk drive into Service Mode (set Service Mode), or to remove the disk drive from Service Mode (reset Service Mode).

Syntax

```
ssa_servicemode -l [-a AdapterName] -y|-n
```

Description

The **ssa_servicemode** command opens the adapter special file, and sends the appropriate IACL command to put the disk drive into, or remove it from, Service Mode. When the Service Mode has been successfully set or reset, the IACL command closes the adapter special file. If Service Mode cannot be set or reset for any reason, the **cop** command prints the appropriate error message.

Flags

-l Pdisk
  Specifies the pdisk that you want to put into, or remove from, Service Mode.

-a AdapterName
  Specifies the adapter to which the pdisk is connected.

-y Puts the pdisk into Service Mode (set Service Mode).

-n Removes the pdisk from Service Mode (reset Service Mode).

Output

The **ssa_servicemode** command sends all error messages to stderr.

ssavfynn Command

Purpose

To check for duplicated node numbers.

Note: It is recommended that this command be used only when all the adapters on the network are SSA RAID adapters.

Syntax

```
ssavfynn
```

Description

The **ssavfynn** command is in the **/usr/lpp/diagnostics/bin** file. It has no flags.

If the **ssavfynn** command runs and finds no duplicate node numbers on the SSA network, it returns no message.

If the command finds duplicate node numbers, it returns a message that is similar to that shown here:

```
SSA User Configuration Error:
Node Number 1 is set on both
Local Host 'abc.somewhere.ibm.com' and Remote Host 'xyz'
```

This message says that a problem exists between your machine (abc) and another machine (xyz) that is connected through the SSA network. The names shown are the DNS names of the machines.

Flags

None

Output

The **ssavfynn** command sends all error messages to stderr. It sends all configuration-problem messages to stdout.

Chapter 12. SSA Service Aids

> **Note:** For some problems, you can use the SSA command line utilities instead of the SSA service aids. For information about the command line utilities, see "Chapter 11. Using the SSA Command Line Utilities" on page 187.

SSA service aids are resident in the using system. They help you to service SSA subsystems. This section describes those service aids, and tells how to use them.

Attention: Do not run the service aids from more than one using system at a time; otherwise, unexpected results might occur.

The SSA service aids are:

- **Set Service Mode:** This service aid enables you to determine the location of a particular disk drive on the SSA loop, and to remove that disk drive from the loop.
- **Link Verification:** This service aid tells you the operational status of the links that make an SSA loop.
- **Configuration Verification:** This service aid lets you determine the relationship between physical and logical disk drives.
- **Format Disk:** This service aid formats an SSA disk drive.
- **Certify Disk:** This service aid verifies that all the data on a disk drive can be read correctly.
- **Display/Download Disk Drive Microcode:** This service aid allows the microcode level on all the SSA disk drives to be displayed and modified.

Before you use the service aids, ensure that you are familiar with the principles of SSA loops and physical disk drives (pdisks). If you are not familiar with these principles, first read "Chapter 2. Introducing SSA Loops" on page 19.

> **Note:** The service aids refer to adapters by shortened names as follows:

Full Adapter Name	Shortened Adapter Name
SSA 4-Port Adapter (type 4–D)	SSA Adapter
Enhanced SSA 4-Port Adapter (type 4–G)	SSA Enhanced Adapter
SSA 4-Port RAID Adapter (type 4–I)	SSA RAID Adapter
PCI SSA 4-Port RAID Adapter (type 4–J)	IBM SSA RAID Adapter (14104500)
Micro Channel SSA Multi-Initiator/RAID EL Adapter (type 4–M)	IBM SSA Enhanced RAID Adapter
PCI SSA Multi-Initiator/RAID EL Adapter (type 4–N)	IBM SSA Enhanced RAID Adapter (14104500)

The Identify Function

The Identify function can be accessed from any of the service aids.

This function enables you to determine the location of a particular disk drive that you want to identify, but do not want to remove. Identify causes the Check light of the disk drive to flash for identification (two seconds on, two seconds off), but has no effect on the normal operation of the disk drive. It also causes the Subsystem Check light (if present) of the unit containing the selected disk drive to flash. You can use the Identify function on any number of disk drives at the same time.

Instructions displayed by the service aids tell you when you can select the Identify function.

The service aids display the serial numbers of the devices. By checking the serial-number label on the device, you can verify that the correct device has its Check light flashing.

Note: You cannot use the Identify function on a device that has a 'Reserved' status.

Starting the SSA Service Aids

To start the SSA service aids:

1. Start the using-system diagnostics (see the *Diagnostic Information for Micro Channel Bus Systems* manual, or the *Diagnostic Information for Multiple Bus Systems* manual, as applicable), and go to the **Diagnostic Operating Instructions**.

   Note: If you are running stand-alone diagnostics from diskette or from CD-ROM, see "Installing SSA Extensions to Stand-Alone Diagnostics" on page 229.

2. Follow the instructions to select **Function Selection**.
3. Select **Service Aids** from the **Function Selection** menu.
4. Select **SSA Service Aids** from the Service Aids menu.

   The SSA Service Aids menu is displayed:

```
╭────────────────────────────────────────────────────────────────────────────
│ SSA SERVICE AIDS                                                      802380
│
│ Move cursor onto selection, then press Enter.
│
│
│             Set Service Mode
│             Link Verification
│             Configuration Verification
│             Format Disk
│             Certify Disk
│             Display/Download Disk Drive Microcode
│
│
│
│
│
│
│
│
│
│
│
│  F3=Cancel        F10=Exit
│
╰────────────────────────────────────────────────────────────────────────────
```

Notes:

a. In some configurations of the using-system console:

   Esc and **0** = Exit
   Esc and **3** = Cancel

   In such configurations, however, the displayed instructions for the function keys
   remain the same as those shown in the screen above.

b. For some versions of AIX and for stand-alone diagnostics, the format of the
   service aid displays might be slightly different from that shown in this chapter.
   Functionally, however, the displays remain the same.

5. Select the service aid that you require, then go to the relevant instructions in this
   chapter:

   "Set Service Mode Service Aid" on page 206

   "Link Verification Service Aid" on page 210

   "Configuration Verification Service Aid" on page 214

   "Format Disk Service Aid" on page 215

   "Certify Disk Service Aid" on page 217

   "Display/Download Disk Drive Microcode Service Aid" on page 219

Set Service Mode Service Aid

The Set Service Mode service aid enables you to determine the location of a particular disk drive, and to remove that disk drive from the unit in which it is installed. It causes the Check light of that disk drive to come on for identification, and stops all SSA loop activity through the disk drive. It also causes the Subsystem Check light (if present) of the unit containing the selected disk drive to come on. Only one disk drive at a time can be in Service Mode.

Before using this service aid, you must make the selected disk drive unavailable to the using system; otherwise, an error occurs.

SSA devices can be maintained concurrently; that is, they can be removed, installed, and tested on an SSA loop while the other devices on the loop continue to work normally. If a disk drive has its Check light on, you can remove that disk drive from the SSA loop without taking any special actions.

If a disk drive does *not* have its Check light on, the SSA loop that passes through it might still be active, although the disk drive itself might not be working. You must put that disk drive into Service Mode before you remove it from the SSA loop.

If you leave the Set Service Mode service aid, Service Mode is reset.

To use the Set Service Mode service aid:

1. Select **Set Service Mode** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). A list of physical disk drives (pdisks) is displayed:

```
┌─────────────────────────────────────────────────────────────────────┐
│  SET SERVICE MODE                                             802381  │
│                                                                       │
│  Move cursor onto selection, then press <Enter>.                      │
│                                                                       │
│   systemname:pdisk0              AC50AE43  2GB SSA C Physical Disk Drive │
│   systemname:pdisk1              AC706EA3  2GB SSA C Physical Disk Drive │
│   systemname:pdisk2              AC1DBE11  2GB SSA C Physical Disk Drive │
│   systemname:pdisk3              AC1DBEF4  2GB SSA C Physical Disk Drive │
│   systemname:pdisk4              AC50AE58  2GB SSA C Physical Disk Drive │
│   systemname:pdisk5              AC7C6E51  2GB SSA C Physical Disk Drive │
│   systemname:pdisk6              AC706E9A  2GB SSA C Physical Disk Drive │
│   systemname:pdisk7              AC1DEEE2  2GB SSA C Physical Disk Drive │
│   systemname:pdisk8              AC1DBE32  2GB SSA C Physical Disk Drive │
│                                                                       │
│                                                                       │
│                                                                       │
│                                                                       │
│                                                                       │
│      F3=Cancel       F10=Exit                                         │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

The columns of information displayed on the screen have the following meanings:

systemname	Name of the using system to which the disk drives are connected.
pdisk0 through pdisk8	Physical disk drive resource identifiers.
AC50AE43 through AC1DBE32	Serial numbers of the physical disk drives. The actual serial number of a disk drive disk drive is shown on a label on the disk drive.
2 GB SSA C Physical Disk Drive	Descriptions of the disk drives.

2. Select the pdisk that you want to identify or put into Service Mode (for example, pdisk3). The following display appears with details of the disk drive that you have just selected:

```
SET SERVICE MODE                                                     802382
   systemname:pdisk0                   AC50AE43  4GB SSA C Physical Disk Drive

Move cursor onto selection, then press <Enter>.



+ Set or Reset Identify Mode.
    Select this option to set or reset the Identify indicator
    on the disk drive.
> Set or Reset Service Mode.
    Select this option to set or reset Service Mode on the
    disk drive.
    ENSURE THAT NO OTHER HOST SYSTEM IS USING THIS DISK DRIVE
    BEFORE SELECTING THIS OPTION.








   F3=Cancel        F10=Exit
```

3. Select Service Mode or the Identify function. (For this example, assume that you have selected Service Mode.) The list of pdisks is displayed again, and the disk drive that you selected is marked by a >, which shows that the disk drive is in Service Mode.

```
SET SERVICE MODE                                                     802381

 Move cursor onto selection, then press <Enter>.


   systemname:pdisk0                   AC50AE43  2GB SSA C Physical Disk Drive
   systemname:pdisk1                   AC706EA3  2GB SSA C Physical Disk Drive
   systemname:pdisk2                   AC1DBE11  2GB SSA C Physical Disk Drive
 > systemname:pdisk3                   AC1DBEF4  2GB SSA C Physical Disk Drive
   systemname:pdisk4                   AC50AE58  2GB SSA C Physical Disk Drive
   systemname:pdisk5                   AC7C6E51  2GB SSA C Physical Disk Drive
   systemname:pdisk6                   AC706E9A  2GB SSA C Physical Disk Drive
   systemname:pdisk7                   AC1DEEE2  2GB SSA C Physical Disk Drive
   systemname:pdisk8                   AC1DBE32  2GB SSA C Physical Disk Drive





   F3=Cancel        F10=Exit
```

Notes:

a. You can select only one disk drive at time.

b. If you select Service Mode, and the selected disk drive is not in a closed loop or at the end of a string (see "Chapter 2. Introducing SSA Loops" on page 19), your

selection fails and an error message is displayed. Use the Link Verification service aid to identify any open-link problems before trying to reselect Service Mode.

c. If you select Service Mode, and a file system is mounted on the selected disk drive, your selection fails. Use the Configuration Verification service aid to determine which hdisk must be have its file system unmounted before you can select Service Mode.

d. If the Check light of the disk drive that you have put into Service Mode does not come on, and you are not sure of the location of that disk drive, use the Identify function to help you find it (see "The Identify Function" on page 203).

4. Select a second disk drive if required (for example, pdisk5). The following display appears again:

```
SET SERVICE MODE                                                802382

  systemname:pdisk5                    AC7C6E51  4GB SSA C Physical Disk Drive

Move cursor onto selection, then press <Enter>.


+ Set or Reset Identify Mode.
    Select this option to set or reset the Identify indicator
    on the disk drive.
>  Set or Reset Service Mode.
    Select this option to set or reset Service Mode on the
    disk drive.
    ENSURE THAT NO OTHER HOST SYSTEM IS USING THIS DISK DRIVE
    BEFORE SELECTING THIS OPTION.






  F3=Cancel        F10=Exit
```

5. Select Service Mode or the Identify function. If the original disk drive is to remain in Service Mode, you can select only the Identify function now. (Only one disk drive at a time can be in Service Mode.) The list of pdisks appears again. The pdisk that is in Identify Mode is identified by a +.

```
╭─────────────────────────────────────────────────────────────────────────────
│  SET SERVICE MODE                                                    802381
│
│   Move cursor onto selection, then press <Enter>.
│
│
│     systemname:pdisk0                    AC50AE43  2GB SSA C Physical Disk Drive
│     systemname:pdisk1                    AC706EA3  2GB SSA C Physical Disk Drive
│     systemname:pdisk2                    AC1DBE11  2GB SSA C Physical Disk Drive
│   > systemname:pdisk3                    AC1DBEF4  2GB SSA C Physical Disk Drive
│     systemname:pdisk4                    AC50AE58  2GB SSA C Physical Disk Drive
│   + systemname:pdisk5                    AC7C6E51  2GB SSA C Physical Disk Drive
│     systemname:pdisk6                    AC706E9A  2GB SSA C Physical Disk Drive
│     systemname:pdisk7                    AC1DEEE2  2GB SSA C Physical Disk Drive
│     systemname:pdisk8                    AC1DBE32  2GB SSA C Physical Disk Drive
│
│
│
│
│
│
│
│     F3=Cancel        F10=Exit
│
╰─────────────────────────────────────────────────────────────────────────────
```

6. Identify other disk drives in the same way, if required.

Link Verification Service Aid

The Link Verification service aid helps you determine:

- Where an SSA loop has been broken
- The status of the disk drives on that SSA loop
- The location of a power or cooling fault that has been detected by the disk drives on that SSA loop

To use the Link Verification service aid:

1. Select **Link Verification** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). The Link Verification adapter menu is displayed:

```
╭─────────────────────────────────────────────────────────────────────────────
│ LINK VERIFICATION                                                    802385
│
│ Move cursor onto selection, then press <Enter>.
│
│   systemname:ssa0                      00-04   SSA Enhanced RAID Adapter
│   systemname:ssa1                      00-05   SSA Enhanced RAID Adapter
│   systemname:ssa2                      00-07   SSA Enhanced RAID Adapter
│
│
│
│
│
│
│
│
│
│
│
│
│   F3=Cancel      F10=Exit
│
╰─────────────────────────────────────────────────────────────────────────────
```

2. Select the adapter that you want to test.

   The columns of information displayed on the screen have the following meanings:

systemname	Name of the using system that contains the SSA adapter.
ssa0 through ssa3	Adapter resource identifiers.
00-03 through 00-07	Adapter location codes. These codes specify the location of the SSA adapter in the using system.
SSA Enhanced RAID Adapter	Descriptions of the adapters.

3. When you have selected an adapter, a list is displayed showing the status of all the disk drives that are attached to the adapter:

```
LINK VERIFICATION                                                    802386


 SSA Link Verification for:
   systemname:ssa0                      00-04   SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

   Physical                          Serial#    Adapter Port
                                                A1 A2 B1 B2      Status

 [TOP]
   systemname:pdisk11                AC50AE43    0  5             Good
   systemname:pdisk8                 AC706EA3    1  4             Good
   systemname:pdisk2                 AC1DBE11    2  3             Good
   systemname:pdisk3                 AC1DBEF4    3  2             Good
   systemname:pdisk7                 AC50AE58    4  1             Good
   systemname:pdisk12                AC7C6E51    5  0             Good
   systemname:pdisk0                 AC706E9A          0  5       Good
   systemname:pdisk1                 AC1DEEE2          1  4       Good
   systemname:pdisk10                AC1DBE32          2  3       Good
 [MORE...3]

 F3=Cancel        F10=Exit
```

The columns of information displayed on the screen have the following meanings:

systemname	Name of the using system to which the disk drives are connected.
pdisk0 through pdisk12	Physical disk drive resource identifiers.
AC50AE43 through AC1DBE32	Serial numbers of the physical disk drives. The actual serial number of a disk drive is shown on a label on the disk drive.
A1 A2 B1 B2	Adapter connector number.
Status	Statuses are:

Good	The disk drive is working correctly.
Failed	The disk drive has failed.
Power	The disk drive has detected a loss of redundant power or cooling.

Reserved

> The disk drive is used by another using system or adapter.
> **Note:** In later levels of AIX, Reserved status is not displayed on the Link Verification screens. Use the **ssa_rescheck** command (see "ssa_rescheck Command" on page 199) if you need to check whether a disk drive is reserved.

An SSA link must be configured in a loop around which data can travel in either direction. The loop is broken if a cable fails or is removed, or if a disk drive fails. Because each disk drive on the loop can be accessed from either direction, the broken loop does not prevent access to any data, unless that data is on the failed disk drive. If the loop is broken between two disk drives, the Ready lights on those

disk drives flash to show that only one SSA path is active. Also, the Link Verification service aid shows that only one path is available to each disk drive on the broken loop.

You can find the physical location of any disk drive on the loop by using the Identify function (see "The Identify Function" on page 203).

Notes:

a. In the lists of physical disk drives (pdisks) that are displayed by the service aids, you might see:

????? These question marks show where an SSA loop is broken. No information is available about any devices that are beyond this point.

***** These asterisks indicate an unconfigured device. That device might be:

- Another SSA adapter that is in the same using system or in a different using system.

- An SSA device that is in the SSA network, but whose type is not known. Such a condition can occur if, for example, devices are added to the network, but **cfgmgr** is not run to configure those devices into the using system.

For example:

```
LINK VERIFICATION                                                    802386

 SSA Link Verification for:
   systemname:ssa0                       00-04    SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

   Physical                           Serial#     Adapter Port
                                                  A1  A2  B1  B2       Status

 [TOP]
   systemname:pdisk11                 AC50AE43    0                    Good
   systemname:pdisk8                  AC706EA3    1                    Good
 ?????
   systemname:pdisk3                  AC1DBEF4        2                Good
   systemname:pdisk7                  AC50AE58        1                Good
   systemname:pdisk12                 AC7C6E51        0                Good
   systemname:pdisk0                  AC706E9A            0   5        Good
   systemname:pdisk1                  AC1DEEE2            1   4        Good
   systemname:pdisk10                 AC1DBE32            2   3        Good
 [MORE...4]

 F3=Cancel       F10=Exit
```

Note that the missing disk drive (pdisk2) is represented by a line of question marks.

b. If you have just made changes to, or have just switched on, the unit in which the disk drive is installed, you might need to wait for up to 30 seconds before detailed information about the SSA network becomes available to the service aids.

4. When you have solved a problem, press the Cancel key to leave the display, then press Enter to reselect it. The display now shows the new status of the SSA links.

"Using the Service Aids for SSA-Link Problem Determination" on page 221 provides more examples of link problems and how to use this service aid to solve them.

Configuration Verification Service Aid

The Configuration Verification service aid enables you to determine the relationship between SSA logical units (hdisks) and SSA physical disk drives (pdisks). It also displays the connection information and operational status of the disk drive.

Notes:
1. User applications communicate with the hdisks; error data is logged against the pdisks.
2. If a disk drive that has been formatted on a machine of a particular type (for example, a Personal System/2) is later installed into a using system that is of a different type (for example, an RS/6000), that disk drive is configured only as a pdisk during the configuration of the using system.

   In such an instance, use the Format service aid to reformat the disk drive, then give the **cfgmgr** command to correct the condition.

To use the Configuration Verification service aid:
1. Select **Configuration Verification** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). A list of pdisks and hdisks is displayed:

```
CONFIGURATION VERIFICATION                                          802390

Move cursor onto selection, then press <Enter>.


  systemname:pdisk0                    AC51DB47  4GB SSA C Physical Disk Drive
  systemname:pdisk1                    AC9EDE7F  9.1GB SSA C Physical Disk Drive
  systemname:hdisk2                    AC51DB47  SSA Logical Disk Drive
  systemname:hdisk3                    AC9EDE7F  SSA Logical Disk Drive












  F3=Cancel        F10=Exit
```

2. Select the hdisk or pdisk that you want to verify.
3. If you select an hdisk, a list of pdisks is displayed:

```
╭──────────────────────────────────────────────────────────────────────────╮
│  CONFIGURATION VERIFICATION                                        802391  │
│                                                                            │
│    systemname:hdisk2                    AC51DB47  SSA Logical Disk Drive   Good │
│                                                                            │
│  To set or reset Identify, move cursor onto selection, then press <Enter>. │
│                                                                            │
│    Physical                          Serial# Adapter  Port  SSA_Addr  Status │
│                                                                            │
│    systemname:pdisk0                 AC51DB47 00-02    A1     0        Good │
│                                               00-02    A2     1        Good │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│    F3=Cancel       F10=Exit                                                │
│                                                                            │
╰──────────────────────────────────────────────────────────────────────────╯
```

If you select a pdisk, a list of hdisks is displayed:

```
╭──────────────────────────────────────────────────────────────────────────╮
│  CONFIGURATION VERIFICATION                                        802392  │
│                                                                            │
│    systemname:pdisk0                 AC51DB47  4GB SSA C Physical Disk Drive │
│                                                                            │
│  Move cursor onto selection, then press <Enter>.                           │
│                                                                            │
│    systemname:hdisk2                 AC51DB47  SSA Logical Disk Drive   Good │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│                                                                            │
│    F3=Cancel       F10=Exit                                                │
│                                                                            │
╰──────────────────────────────────────────────────────────────────────────╯
```

Note: If you select the hdisk from this screen, the hdisk configuration is displayed.

Format Disk Service Aid

The Format Disk service aid formats SSA disk drives.

Attention: Formatting a disk drive destroys all the data on that disk drive. Use this procedure only when instructed to do so by the service procedures.

To use the Format Disk service aid:

1. Select **Format Disk** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). A list of pdisks is displayed:

```
FORMAT DISK                                                        802395

Move cursor onto selection, then press <Enter>.


  systemname:pdisk11                AC50AE43  9.1GB SSA C Physical Disk Drive
  systemname:pdisk8                 AC706EA3  9.1GB SSA C Physical Disk Drive
  systemname:pdisk2                 AC1DBE11  4GB SSA C Physical Disk Drive
  systemname:pdisk3                 AC1DBEF4  4GB SSA C Physical Disk Drive
  systemname:pdisk7                 AC50AE58  9.1GB SSA C Physical Disk Drive
  systemname:pdisk12                AC7C6E51  9.1GB SSA C Physical Disk Drive
  systemname:pdisk0                 AC706E9A  4GB SSA C Physical Disk Drive
  systemname:pdisk1                 AC1DEEE2  4GB SSA C Physical Disk Drive
  systemname:pdisk10                AC1DBE32  4GB SSA C Physical Disk Drive







  F3=Cancel       F10=Exit
```

2. Select the pdisk that you want to format. The following instructions are displayed:

```
  ┌─────────────────────────────────────────────────────────────────────
  │ FORMAT DISK                                                   802396
  │
  │   systemname:pdisk2              AC1DBE11  4GB SSA C Physical Disk Drive
  │
  │ Move cursor onto selection, then press <Enter>.
  │
  │
  │
  │ + Set or Reset Identify Mode.
  │     Select this option to set or reset the Identify indicator
  │     on the disk drive.
  │   Format.
  │     Select this option only if you are sure that you have selected
  │     the correct disk drive.
  │     FORMATTING DESTROYS ALL DATA ON THE DISK DRIVE.
  │
  │
  │
  │
  │
  │
  │
  │
  │
  │
  │   F3=Cancel        F10=Exit
  │
  └─────────────────────────────────────────────────────────────────────
```

3. If you are not sure of the identification (pdisk number) of the disk drive that you want to format, use the Identify function to get a positive physical identification of the disk drive (see "The Identify Function" on page 203). You can further ensure that you have selected the correct disk drive by verifying that the serial number on the front of the disk drive is the same as the serial number that is displayed on the screen.

4. When you are sure that you have selected the correct disk drive, select **Format**.

Certify Disk Service Aid

The Certify service aid verifies that all the data on a disk drive can be read correctly. Other maintenance procedures tell you when you need to run this service aid.

To use the Certify Disk service aid:

1. Select **Certify Disk** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). A list of pdisks is displayed:

```
CERTIFY DISK                                                        802404

  Move cursor onto selection, then press <Enter>.


    systemname:pdisk11              AC50AE43  9.1GB SSA C Physical Disk Drive
    systemname:pdisk8               AC706EA3  9.1GB SSA C Physical Disk Drive
    systemname:pdisk2               AC1DBE11  4GB SSA C Physical Disk Drive
    systemname:pdisk3               AC1DBEF4  4GB SSA C Physical Disk Drive
    systemname:pdisk7               AC50AE58  9.1GB SSA C Physical Disk Drive
    systemname:pdisk12              AC7C6E51  9.1GB SSA C Physical Disk Drive
    systemname:pdisk0               AC706E9A  4GB SSA C Physical Disk D Drive
    systemname:pdisk1               AC1DEEE2  4GB SSA C Physical Disk D Drive
    systemname:pdisk10              AC1DBE32  4GB SSA C Physical Disk Drive







    F3=Cancel       F10=Exit
```

2. Select the pdisk that you want to certify. The following instructions are displayed:

```
CERTIFY DISK                                                        802405

    systemname:pdisk0               AC706E9A  4GB SSA C Physical Disk Drive

  Move cursor onto selection, then press <Enter>.


  + Set or Reset Identify Mode.
      Select this option to set or reset the Identify indicator
      on the disk drive.
    Certify.
      Select this option to start the Certify operation.









    F3=Cancel       F10=Exit
```

3. If you are not sure of the identification (pdisk number) of the disk drive that you
   want to certify, use the Identify function to get a positive physical identification of the
   disk drive (see "The Identify Function" on page 203). You can further ensure that
   you have selected the correct disk drive by verifying that the serial number on the
   front of the disk drive is the same as the serial number that is displayed on the
   screen.
4. When you are sure that you have selected the correct disk drive, select **Certify**.

Display/Download Disk Drive Microcode Service Aid

The Display/Download Disk Drive Microcode service aid allows you to:
- Display the level of microcode that is installed on all available disk drives.
- Change the level of microcode, for a specific available disk drive, to any level that is available in the using-system microcode directory or on diskette.
- Change the level of microcode, for all available disk drives, to the latest level that is available in the using-system microcode directory or on diskette.

Attention: Usually, you can download the microcode to disk drives that are in use. By doing so, however, you might cause a temporary delay in the AIX operating system or in the user's application program. ***Do not download microcode to a disk drive that is in use, unless you have the user's permission. Always refer to the download instructions that are supplied with the microcode, and check for any special restrictions that might be applicable. If you are not sure, do not download to disk drives that are in use.***

When you download new microcode to a disk drive, the new level of microcode is not shown by the **Display the Microcode Levels** option until the disk drives have been reconfigured. Run the **cfgmgr** command before you verify that the new level of microcode is correctly installed.

To use the Display/Download Disk Drive Microcode service aid:

1. Select **Display/Download Disk Drive Microcode** from the SSA Service Aids menu (see "Starting the SSA Service Aids" on page 204). The following menu is displayed:

```
MICROCODE DOWNLOAD                                                      802420

Move cursor onto selection, then press Enter.


  Display the Microcode levels of all SSA Physical Disk Drives
    Select this option to display the microcode levels installed
    on all 'Available' SSA disk drives.
  Download Microcode to selected SSA Physical Disk Drives
    Select this option to change the level of microcode that is
    installed on selected 'Available' SSA disk drives.
  Download Microcode to all SSA Physical Disk Drives
    Select this option to load the latest level of microcode
    on all 'Available' SSA disk drives.







    F3=Cancel        F10=Exit
```

2. To display the levels of microcode that are installed on the SSA disk drives, select **Display the Microcode levels of all SSA Physical Disk Drives**. A list of pdisks is displayed:

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│  MICROCODE DOWNLOAD                                            802421      │
│                                                                           │
│   To set or reset Identify, move cursor onto selection, then press <Enter>.│
│                                                                           │
│    Physical                        Serial#      ROSid                     │
│                                                                           │
│                                                                           │
│     systemname:pdisk0              AC51DB47      8877                      │
│     systemname:pdisk1              AC9EDE7F      9292                      │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│     F3=Cancel       F10=Exit                                              │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```
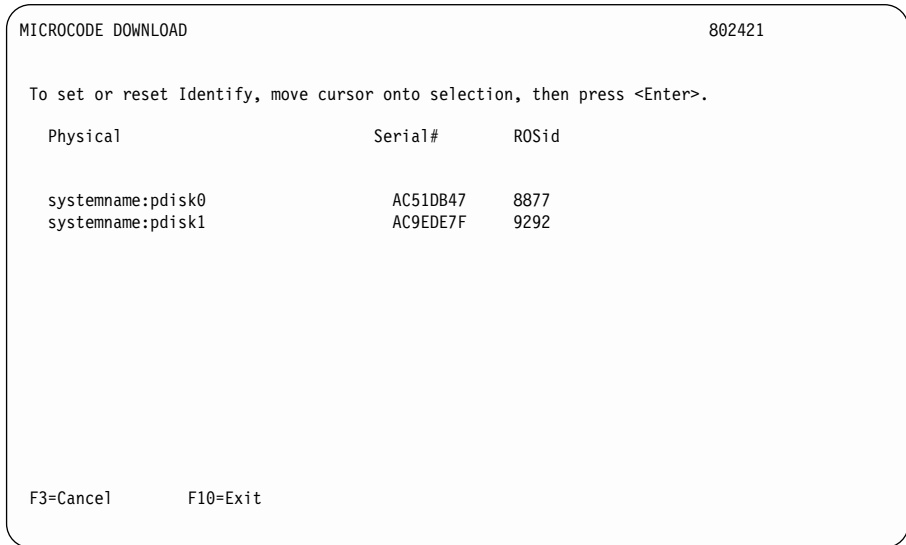
3. **Attention:** For several seconds during microcode download, new data is written to the disk drive EEPROM. If the power fails while that data is being written, the disk drive microcode might become corrupted. *The microcode cannot be corrected*. Normally, exchange the disk drive for a new one. If you need to try to save data, you might be able to exchange the electronics card assembly of the disk drive. For more details, see the *Installation and Service Guide* for the unit that contains the disk drive.

   To download microcode to one specific disk drive, select **Download Microcode to selected SSA Physical Disk Drives**, and follow the instructions that are displayed. You normally select this option when you do not want the microcode on the selected disk drive to be at the latest available level.

4. If you have a new level of microcode to install, or if you have replaced a disk drive and want to upgrade it to the present level, select **Download Microcode to all SSA Physical Disk Drives**. This option ensures that all disk drives have the latest level of microcode installed. It downloads microcode only to those disk drives whose level of microcode is lower than that in the microcode directory or on the microcode diskette.

   Note: Different types of SSA disk drive might need different versions of the microcode. Microcode download files are provided for each type of disk drive. Where a system contains more than one type of SSA disk drive, this Service Aid selects the correct microcode file for each of those types.

Service Aid Service Request Numbers (SRNs)

If the SSA service aids detect an unrecoverable error, and are unable to continue, one of the following service request numbers (SRNs) might occur:
- SSA01
- SSA02

- SSA03

These SRNs are explained in the main SRN table (see "Service Request Numbers (SRNs)" on page 229).

Using the Service Aids for SSA-Link Problem Determination

If you have a problem with an SSA loop, use the Link Verification service aid (see "Link Verification Service Aid" on page 210). The following examples show various loops and the associated information that is displayed by the Link Verification service aid.

Example 1. Normal Loops

In Figure 30 on page 222, disk drives 1 through 8 are connected to connectors A1 and A2 of the SSA adapter **1** . Disk drives 9 through 12 are connected to connectors B1 and B2 of the same SSA adapter. Disk drives 13 through 16 are connected to connectors A1 and A2 of a different SSA adapter **2** .
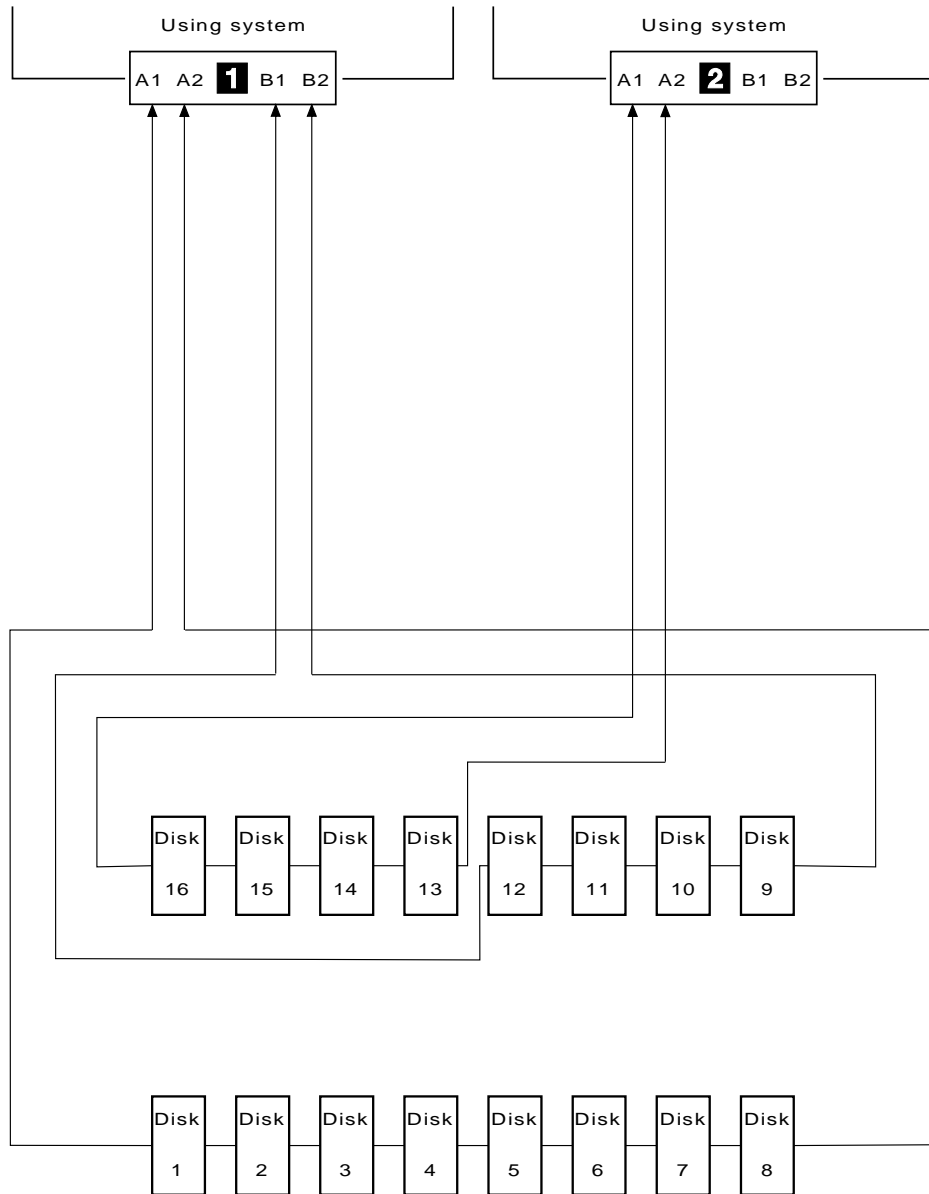
Figure 30. Normal Loop

For this example, the Link Verification service aid displays the following information:

```
┌─────────────────────────────────────────────────────────────────────────────┐
│                                                                             │
│ LINK VERIFICATION                                              802386        │
│                                                                             │
│ SSA Link Verification for:                                                  │
│   systemname:ssa0                      00-04   SSA Enhanced RAID Adapter     │
│                                                                             │
│                                                                             │
│  To Set or Reset Identify, move cursor onto selection, then press <Enter>.  │
│                                                                             │
│   Physical                        Serial#    Adapter Port                   │
│                                              A1 A2  B1 B2      Status        │
│                                                                             │
│  [TOP]                                                                       │
│    systemname:pdisk11             AC50AE43    0   5            Good          │
│    systemname:pdisk8              AC706EA3    1   4            Good          │
│    systemname:pdisk2              AC1DBE11    2   3            Good          │
│    systemname:pdisk3              AC1DBEF4    3   2            Good          │
│    systemname:pdisk7              AC50AE58    4   1            Good          │
│    systemname:pdisk12             AC7C6E51    5   0            Good          │
│    systemname:pdisk0              AC706E9A         0   5       Good          │
│    systemname:pdisk1              AC1DEEE2         1   4       Good          │
│    systemname:pdisk10             AC1DBE32         2   3       Good          │
│  [MORE...4]                                                                  │
│                                                                             │
│                                                                             │
│                                                                             │
│ F3=Cancel       F10=Exit                                                     │
│                                                                             │
└─────────────────────────────────────────────────────────────────────────────┘
```

Note: Scroll the display to see all the connected disk drives.

Example 2. Broken Loop (Cable Removed)

Each disk drive normally communicates with the adapter through one data path.
Because data can pass round the loop in either direction, the adapter automatically
reconfigures the loop to enable communication to continue to each disk drive if the loop
becomes broken.

In Figure 31 on page 224, disk drives 1 through 8 should be connected to connectors
A1 and A2 of the SSA adapter **1**, but the loop is broken because the SSA cable has
been disconnected from connector A2. Disk drives 9 through 12 are connected to
connectors B1 and B2 of the same SSA adapter. Disk drives 13 through 16 are
connected to connectors A1 and A2 of a different SSA adapter **2**.

Although the broken loop is reported as an error, all the disk drives can still
communicate with the using system. Disk drives 1 through 8 can communicate through
connector A1 of the SSA adapter **1**. Disk drives 9 through 12 can communicate
through connectors B1 and B2 of the same SSA adapter (normal loop); disk drives 13
through 16 can communicate through connectors A1 and A2 of the SSA adapter **2**.
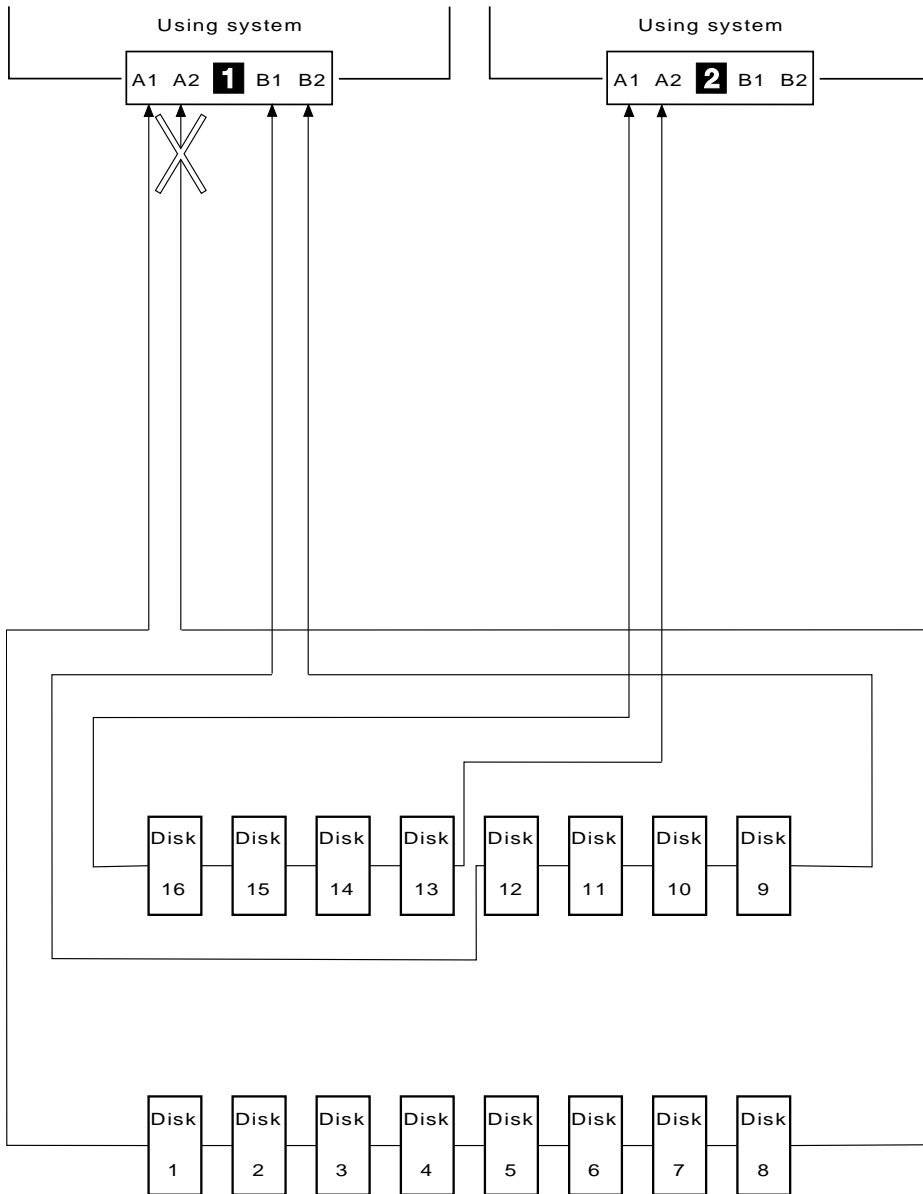
Figure 31. Broken Loop (Cable Removed)

For this example, the Link Verification service aid displays the following information:

```
LINK VERIFICATION                                                        802386

SSA Link Verification for:
  systemname:ssa0                    00-04    SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                       Serial#      Adapter Port
                                              A1  A2  B1  B2        Status

 [TOP]
  systemname:pdisk11             AC50AE43     0                     Good
  systemname:pdisk8              AC706EA3     1                     Good
  systemname:pdisk2              AC1DBE11     2                     Good
  systemname:pdisk3              AC1DBEF4     3                     Good
  systemname:pdisk7              AC50AE58     4                     Good
  systemname:pdisk12             AC7C6E51     5                     Good
  systemname:pdisk0              AC706E9A     6                     Good
  systemname:pdisk1              AC1DEEE2     7                     Good
  systemname:pdisk10             AC1DBE32             0   7         Good
 [MORE...7]



 F3=Cancel        F10=Exit
```

Note that the column for adapter connector A2 shows no connections.

Example 3. Broken Loop (Disk Drive Removed)

In Figure 32 on page 226, disk drives 1 through 8 are connected to connectors A1 and A2 of the SSA adapter **1** , but the loop is broken because disk drive number 3 has been removed. Disk drives 9 through 12 are connected to connectors B1 and B2 of the same SSA adapter. Disk drives 13 through 16 are connected to connectors A1 and A2 of a different SSA adapter **2** .

Although the missing disk drive is reported as an error, all the remaining disk drives can still communicate with the using system. Disk drives 1 and 2 can communicate through connector A1 of the SSA adapter **1** . Disk drives 4 through 8 can communicate through connector A2 of the SSA adapter. Disk drives 9 through 12 can communicate through connectors B1 and B2 of the same SSA adapter (normal loop); disk drives 13 through 16 can communicate through connectors A1 and A2 of the SSA adapter **2** .
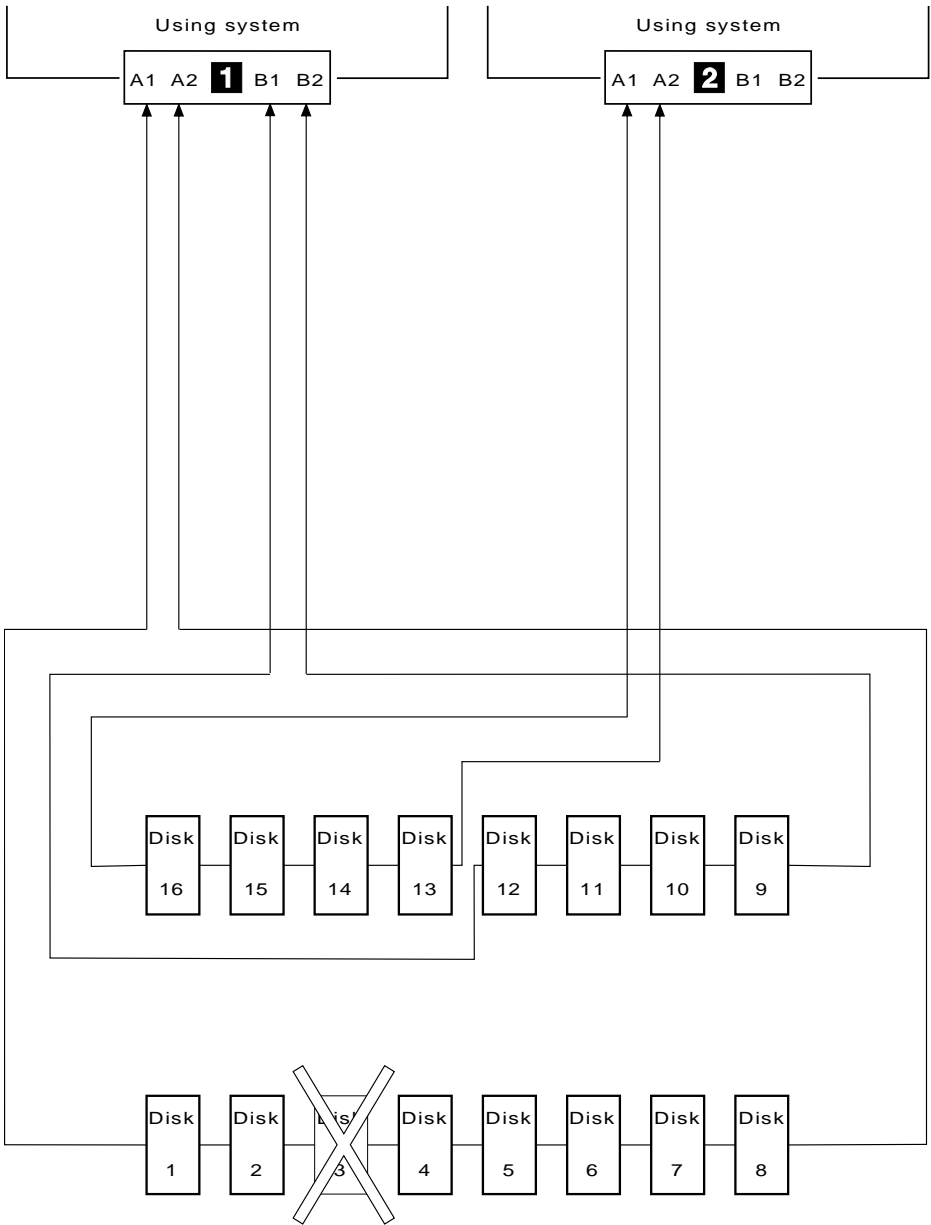
Figure 32. Broken Loop (Disk Drive Removed)

For this example, the Link Verification service aid displays the following information:

```
╭─────────────────────────────────────────────────────────────────────────────╮
│                                                                               │
│  LINK VERIFICATION                                             802386         │
│                                                                               │
│  SSA Link Verification for:                                                   │
│     systemname:ssa0                      00-04    SSA Enhanced RAID Adapter    │
│                                                                               │
│                                                                               │
│   To Set or Reset Identify, move cursor onto selection, then press <Enter>.   │
│                                                                               │
│    Physical                         Serial#      Adapter Port                 │
│                                                   A1  A2  B1  B2      Status   │
│                                                                               │
│   [TOP]                                                                       │
│     systemname:pdisk11              AC50AE43      0                   Good     │
│     systemname:pdisk8               AC706EA3      1                   Good     │
│     ?????                                                                     │
│     systemname:pdisk3               AC1DBEF4          4               Good     │
│     systemname:pdisk7               AC50AE58          3               Good     │
│     systemname:pdisk12              AC7C6E51          2               Good     │
│     systemname:pdisk0               AC706E9A          1               Good     │
│     systemname:pdisk1               AC1DEEE2          0               Good     │
│     systemname:pdisk10              AC1DBE32              0   7       Good     │
│   [MORE...7]                                                                  │
│                                                                               │
│                                                                               │
│                                                                               │
│   F3=Cancel        F10=Exit                                                   │
│                                                                               │
╰─────────────────────────────────────────────────────────────────────────────╯
```

Note that the missing disk drive (pdisk2) is represented by a line of question marks.

Finding the Physical Location of a Device

The physical location of a device (for example, a disk drive or an SSA adapter) cannot be reported directly by the using system because of the way in which the SSA interface works. The address of an SSA device is related to the position of that device on the SSA loop. The address can, therefore, change if the configuration is changed.

Finding the Device When Service Aids Are Available

To help you to find the correct physical disk drive, the SSA service aids include an Identify function. This function, when selected, causes the Check light of the selected disk drive to flash. It also causes the Subsystem Check light (if present) of the unit containing the selected disk drive to flash.

Some devices, (for example, adapters) do not have Check lights. To find such a device, you can either use the Identify function to identify devices that are next to the SSA adapter on the SSA link, or use the procedure described in "Finding the Device When No Service Aids Are Available".

Finding the Device When No Service Aids Are Available

When no service aids are available, you must find the device by using the port (P) and SSA-address (AA) values that are provided by some service request numbers (SRNs). Examples of these SRNs are 43PAA, 44PAA, and 45PAA.

The port (P) values are related to the port connectors of the adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The AA value is the decimal SSA-address value. It indicates the position of the device that you are trying to find (counted *along* the SSA loop).

Use the port value to locate the relevant connector on the SSA adapter, then follow the SSA cable to the first *real* device. Include other adapters as real devices if they are in the same SSA link. Do not include dummy devices or bypass cards.

The first device that you reach represents SSA-address count 0. Continue to follow the SSA links from device to device, increasing the SSA-address count by 1 for each device, until you reach the device that is indicated in the SRN.

Chapter 13. SSA Problem Determination Procedures

SSA problem determination procedures are provided by power-on self-tests (POSTs), service request numbers, and maintenance analysis procedures (MAPs). Some of these procedures use the service aids that are described in "Chapter 12. SSA Service Aids" on page 203.

Installing SSA Extensions to Stand-Alone Diagnostics

Attention: This section is relevant only if the using system has AIX Version 3.2.5 installed. AIX Versions 4.1.3 and above already contain the SSA extensions to stand-alone diagnostics.

Diagnostics and service aids for the SSA subsystem are not included in level 2.4.3 of the stand-alone diagnostic package. These additional diagnostics and service aids (SSA extensions) are supplied on a supplemental diagnostic diskette. To install the SSA extensions:

1. Using the stand-alone diagnostic diskettes or the CD-ROM, start the using-system diagnostics. (See the *Diagnostic Information for Micro Channel Bus Systems* manual for instructions.)

   The Function Selection menu is displayed.

2. Select **Diagnostic Routines**

   The Diagnostic Mode Selection menu is displayed.

3. Select **System Verification**.

   The Diagnostic Selection menu is displayed.

4. Select **Read Another Diagnostic Diskette**.

5. Insert the supplemental diskette into the diskette drive.

6. Press Enter.

   The SSA extensions to the stand-alone diagnostics are installed, and the SSA devices configured.

7. Press the Cancel-function key to go to the Diagnostic Operating Instructions menu.

   Note: The identification of the Cancel-function key is displayed on the screen.

8. Press Enter to go to the Function Selection menu.

9. Select the function that you need (diagnostics or service aids).

Service Request Numbers (SRNs)

Service request numbers (SRNs) are generated by the system error-log analysis, system configuration code, diagnostics, and customer problem-determination procedures. SRNs help you to identify the cause of a problem, the failing field-replaceable units (FRUs), and the service actions that might be needed to solve the problem.

The SRN Table

The table in this section lists the SRNs and describes the actions you should do. The table columns are:

SRN	The service reference number.
FRU list	The FRU or FRUs that might be causing the problem, and how likely it is (by percentage) that the FRU is causing the problem.
Problem	A description of the problem and the action you must take.

Abbreviations used in the table are:

DMA	Direct memory access.
DRAM	Dynamic random-access memory.
FRU	Field-replaceable unit.
IOCC	Input/output channel controller.
PAA	P = Adapter port number
	AA = SSA address (see also "Finding the Device When No Service Aids Are Available" on page 227).
POS	Programmable option select (POS registers).
POST	Power-On Self-Test.

Using the SRN Table

Note: You should have been sent here from either diagnostics or a START MAP. Do not start problem determination from the SRN table; always go to the START MAP for the unit in which the device is installed.

1. Locate the SRN in the table. *If you cannot find the SRN*, refer to the documentation for the subsystem or device. If you still cannot find the SRN, you have a problem with the diagnostics, the microcode, or the documentation. Call your support center for assistance.

2. Read carefully the "Action" you must do for the problem. *Do not exchange FRUs unless you are instructed to do so*.

3. Normally exchange only one FRU at a time. After each FRU is exchanged, go to "MAP 2410: SSA Repair Verification" on page 273 to verify the repair.

4. When exchanging an adapter, always use the instructions that are supplied with the system unit.

SRN	FRU List	Problem
20PAA	**Device (45%)** ("Exchanging Disk Drives" on page 175). **SSA adapter card (45%)** (using-system *Installation and Service Guide*). **External SSA cables (6%)** **Internal SSA connections (4%)** (unit *Installation and Service Guide*).	Description: An open SSA link has been detected. Action: Run the Link Verification service aid to isolate the failure (see "Link Verification Service Aid" on page 210). If the SSA service aids are not available, go to the service information for the unit in which the device is installed

SRN	FRU List	Problem
21PAA to 29PAA	**Device (45%)**("Exchanging Disk Drives" on page 175). **SSA adapter card (45%)** (using-system *Installation and Service Guide*). **External SSA cables (6%)** **Internal SSA connections (4%)** (unit *Installation and Service Guide*).	Description: An SSA 'Threshold exceeded' link error has been detected. Action: Go to "MAP 2323: SSA Intermittent Link Error" on page 258.
2A002	**Device (50%)** ("Exchanging Disk Drives" on page 175). **SSA adapter card (50%)** (using-system *Installation and Service Guide*).	Description: Async code 02 has been received. Probably, a software error has occurred. Action: Go to "Software and Microcode Errors" on page 250 before exchanging any FRUs.
2A003	**Device (50%)** ("Exchanging Disk Drives" on page 175). **SSA adapter card (50%)** (using-system *Installation and Service Guide*).	Description: Async code 03 has been received. Probably, a software error has occurred. Action: Go to "Software and Microcode Errors" on page 250 before exchanging any FRUs.
2A004	**Device (50%)** ("Exchanging Disk Drives" on page 175). **SSA adapter card (50%)** (using-system *Installation and Service Guide*).	Description: Async code 04 has been received. Probably, a software error has occurred. Action: Go to "Software and Microcode Errors" on page 250 before exchanging any FRUs.
2FFFF	**None**	Description: An async code that is not valid has been received. Action: Go to "Software and Microcode Errors" on page 250.
303FF	**Device (100%)** ("Exchanging Disk Drives" on page 175).	Description: An SCSI status that is not valid has been received. Action: Go to "Software and Microcode Errors" on page 250.
40000	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter card has failed. Action: Exchange the FRU for a new FRU.
40004	**4 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 4 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.
40008	**8 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: An 8 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.

SRN	FRU List	Problem
40016	**16 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 16 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.
40032	**32 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 32 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.
40064	**64 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 64 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.
40128	**128 MB DRAM module 0 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 128 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRUs for new FRUs.
41004	**4 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 4 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRUs for new FRUs.
41008	**8 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: An 8 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRUs for new FRUs.
41016	**16 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 16 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRUs for new FRUs.
41032	**32 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 32 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRUs for new FRUs.

SRN	FRU List	Problem
41064	**64 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 64 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRUs for new FRUs.
41128	**128 MB DRAM module 1 (99%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179). **SSA adapter card (1%)** (using-system *Installation and Service Guide*).	Description: A 128 MB DRAM in adapter card module 1 has failed Action: Exchange the FRUs for new FRUs.
42000	**SSA adapter card (50%)** (using system *Installation and Service Guide*). **DRAM modules (50%)** ("Removing a DRAM Module of an SSA RAID Adapter" on page 179).	Description: The SSA adapter has detected that both DRAM modules are failing. Action: 1. Check whether both DRAM modules are correctly installed on the adapter card. Make any necessary corrections. 2. If this problem has occurred immediately after an upgrade to the adapter card, check whether the correct type of DRAM modules have been installed. Make any necessary corrections. 3. If the problem remains, exchange the adapter card FRU for a new one. *Do not exchange any DRAM modules yet*. 4. Install the DRAM modules from the original adapter card onto the new adapter card, then install the new adapter card. 5. If the problem remains, exchange the DRAM modules for new modules. 6. Install the new DRAM modules onto the original adapter card. Reinstall the original adapter card.
42200	**None**	Description: Other adapters on the SSA loop are using levels of microcode that are not compatible. Action: Install the latest level of adapter microcode onto all the other adapters on this SSA loop.
42500	**Fast-Write Cache Option Card (98%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181). **SSA adapter card (2%)** (using system *Installation and Service Guide*).	Description: The Fast-Write Cache Option Card has failed. Action: 1. Exchange the cache card for a new one. 2. Switch on power to the using system. 3. If the original cache card contained data that was not moved to a disk drive, new error codes are produced. Run diagnostics in System Verification mode to the adapter. If an SRN is produced, do the actions for that SRN.

SRN	FRU List	Problem
42510	**None**	Description: Not enough DRAM available to run the fast-write cache operation.
		Action:
		1. Start the using-system service aids.
		2. Select **Display or Change Configuration or Vital Product Data (VPD)**.
		3. Select **Display Vital Product Data**.
		4. Find the VPD for the SSA adapter that is logging the error.
		5. Note the DRAM and cache sizes (Device Specifics Z0 and Z1).
		6. For fast-write operations, you must have a 32 MB DRAM. Check that you have the correct size of DRAM.

SRN	FRU List	Problem

42515	**Fast-write Cache Option Card (90%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181).
	
	 SSA adapter card (10%) (using system *Installation and Service Guide*)
		Description: A fast-write disk is installed, but no Fast-Write Cache Option Card has been detected. This problem can be caused because:
		
		 • The cache card is not installed correctly.
		
		 • The Fast-Write feature is not installed on this machine, but a disk drive that is configured for fast-write operations has been added to the subsystem.
		
		 Action:
		
		 1. If you have not already done so, run diagnostics to the adapter in System Verification mode. If a different SRN is generated, solve that problem first.
		
		 2. Do the following actions as appropriate:
		
		   • If the cache card is not installed correctly, remove it from the adapter, then reinstall it correctly.
		
		   • If the cache card is installed correctly, it might have failed. Exchange, for new FRUs, the FRUs that are shown in the FRU list for this SRN.
		
		   • If the Fast-Write feature is not installed, and you want to delete the fast-write configuration for one or more disk drives that have been added to this subsystem:
		
		     a. Confirm with the customer that the fast-write configuration can be deleted for the disk drives.
		     Attention:
		
		     This action might leave old data on the disk drive.
		     b. Type `smitty devices` and press Enter.
		     c. Select **SSA Disks**.
		     d. Select **SSA Logical Disks**.
		     e. Select **Enable/Disable Fast-Write for Multiple Devices**.
		     f. Select all the pdisks against which the message `Fast-Write is enabled for these devices` appears.
		     g. Press Enter.
		     h. Select **no** in the **Enable Fast-Write** field.
		     i. Select **yes** in the **Force Delete** field.
		     j. Press Enter.

SRN	FRU List	Problem
42520	**Fast-Write Cache Option Card (100%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181).	Description: A Fast-Write Cache Option Card has failed. Data has been written to the cache card, and cannot now be recovered. The location of the lost data is not known. The disk drive is offline. Action: 1. Advise the customer to refer to "Dealing with Fast-Write Problems" on page 97 to determine: • Which disk drives are affected by this error • How much data has been lost • Which data recovery procedures can be done 2. Ask the customer to disable the Fast-Write option for: • Each device for which the Fast-Write option is offline • All other devices that are connected to the failing adapter, and have the Fast-Write option enabled For instructions on how to disable the Fast-Write option, see "Configuring the Fast-Write Cache Feature" on page 93. 3. Exchange the Fast-Write Cache Option Card for a new one. 4. Ask the customer to re-enable the Fast-Write option for the devices that are attached to the new Fast-Write Cache Option Card.

SRN	FRU List	Problem
42521	**Fast-Write Cache Option Card (100%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181).	Description: A Fast-Write Cache Option Card has failed. Data has been written to the cache card, and cannot now be recovered. The disk drives that have lost the data cannot be identified. All unsynchronized fast-write disk drives that are attached to this adapter are offline.

Action:

1. Advise the customer to refer to "Dealing with Fast-Write Problems" on page 97 to determine:

    - Which disk drives are affected by this error

    - How much data has been lost

    - Which data recovery procedures can be done

2. Ask the customer to disable the Fast-Write option for:

    - Each device for which the Fast-Write option is offline

    - All other devices that are connected to the failing adapter, and have the Fast-Write option enabled

    For instructions on how to disable the Fast-Write option, see "Configuring the Fast-Write Cache Feature" on page 93.

3. Exchange the Fast-Write Cache Option Card for a new one.

4. Ask the customer to re-enable the Fast-Write option for the devices that are attached to the new Fast-Write Cache Option Card.

SRN	FRU List	Problem

42522	**Fast-Write Cache Option Card (100%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181).	Description: A Fast-Write Cache Option Card has failed. Data has been written to the cache card, and cannot now be recovered. One or more 4 KB blocks of data for a known disk drive have been lost, and cannot be read.
		
		Action:
		1. Advise the customer to refer to "Dealing with Fast-Write Problems" on page 97 to determine:
		  • Which disk drives are affected by this error
		  • How much data has been lost
		  • Which data recovery procedures can be done
		2. Ask the customer to disable the Fast-Write option for:
		  • Each device for which the Fast-Write option is offline
		  • All other devices that are connected to the failing adapter, and have the Fast-Write option enabled
		
		For instructions on how to disable the Fast-Write option, see "Dealing with Fast-Write Problems" on page 97.
		3. Exchange the Fast-Write Cache Option Card for a new one.
		4. Ask the customer to re-enable the Fast-Write option for the devices that are attached to the new Fast-Write Cache Option Card.

42523	**None**	Description: The Fast-Write Cache Option Card has a bad version number. Action: Install the correct adapter microcode for this cache card.

SRN	FRU List	Problem

42524	**Fast-Write Cache Option Card (100%)** ("Removing the Fast-Write Cache Option Card of an SSA RAID Adapter" on page 181using system).	Description: A fast-write disk drive (or drives) that does not contain synchronized data has been detected. The Fast-Write Cache Option Card, however, cannot be detected. The disk drive (or drives) is offline.
		
		Action:
		• If the Fast-Write Cache Option Card has been removed, replace it, and test the 7133.
		• If the Fast-Write Cache Option card has failed:
		  1. Ask the customer to disable the Fast-Write option for:
		    – Each device for which the Fast-Write option is offline
		    – All other devices that are connected to the failing adapter, and have the Fast-Write option enabled
		
		    For instructions on how to disable the Fast-Write option, see "Dealing with Fast-Write Problems" on page 97.
		  2. Exchange the Fast-Write Cache Option Card for a new one.
		  3. Ask the customer to re-enable the Fast-Write option for the devices that are attached to the new Fast-Write Cache Option Card.

42525	**None**	Description: The wrong Fast-Write Cache Option Card has been detected by a fast-write disk drive that contains unsynchronized data.
		
		Action: The failing disk drive is offline. If the disk drive has just been moved from another adapter, do either of the following actions:
		• Return the disk drive to its original adapter.
		• Move the original Fast-Write Cache Option card to this adapter so that the data can be synchronized.
		
		If you cannot do either action, or the data on the disk drive has no value:
		1. Ask the customer to disable the Fast-Write option for:
		  • Each device for which the Fast-Write option is offline
		  • All other devices that are connected to the failing adapter, and have the Fast-Write option enabled
		
		  For instructions on how to disable the Fast-Write option, see "Dealing with Fast-Write Problems" on page 97.
		2. Ask the customer to re-enable the Fast-Write option for the devices that are attached to the new Fast-Write Cache Option Card.

SRN	FRU List	Problem
42526	**SSA adapter card (100%)** (using system *Installation and Service Guide*).	Description: This adapter card does not provide support for the Fast-Write Cache Option card. Action: Install the correct SSA adapter (if applicable).
42527	**None**	Description: A dormant fast-write cache entry exists. Action: The fast-write cache contains unsynchronized data for a disk drive that is no longer available. If possible, reconnect the disk drive to the adapter to enable the data to be synchronized. If you cannot reconnect the disk drive (for example, because the disk drive has failed), the user should delete the dormant fast-write cache entry (see "Enabling or Disabling Fast-Write for Multiple Devices" on page 95).
42528	**None**	Description: A fast-write disk drive has been detected that was previously unsynchronized, but has since been configured on a different adapter. Action: If this disk drive contains data that should be kept, return the disk drive to the adapter to which it was previously connected. If the disk drive does not contain data that should be kept: 1. Ask the user to delete all offline items (see "Enabling or Disabling Fast-Write for Multiple Devices" on page 95). When the items have been deleted, the disk drive becomes free. 2. Change the use of the disk drive as appropriate (see "Changing or Showing the Use of an SSA Disk Drive" on page 87).
43PAA	**Device (90%)** ("Exchanging Disk Drives" on page 175). **SSA adapter card (10%)** (using-system *Installation and Service Guide*).	Description: An SSA device on the link is preventing the completion of the loop configuration. Action: If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to determine which device is preventing configuration. (That device is the one beyond the last-configured device on an open SSA loop.) If the SSA service aids are not available, note the value of PAA in this SRN, and go to "Finding the Physical Location of a Device" on page 227.

SRN	FRU List	Problem
44PAA	**Device (100%)** ("Exchanging Disk Drives" on page 175).	Description: An SSA device has a 'Failed' status. Action: If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find the failing device. If no device is listed with a status of "Failed", use the PAA part of the SRN to determine which device is failing. Before you exchange the failing device, run diagnostics in System Verification mode to that device to determine the cause of the problem. If the SSA service aids are not available, note the value of PAA in this SRN, and go to "Finding the Physical Location of a Device" on page 227. Exchange the failing FRU for a new FRU.
45PAA	**Device (40%)** ("Exchanging Disk Drives" on page 175). **Adapter (40%)** (unit *Installation and Service Guide*). **External SSA cables, Fibre-Optic Extenders, fiber optic cables, or internal connections in the device enclosure (20%)** (unit *Installation and Service Guide*).	Description: The SSA adapter has detected an open SSA loop. Action: If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to determine which part of the SSA loop is failing. If the SSA service aids are not available, note the value of PAA in this SRN, and go to "Finding the Physical Location of a Device" on page 227. Then go to "SSA Link Errors" on page 275 to solve the problem.
46000	**None**	Description: An array is the Offline state because more than one disk drive is not available. At least one member disk drive of the array is present, but more than one member disk drive is missing. Action: If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find power faults or broken SSA links that might be causing this problem. If the SSA service aids are not available, or the problem remains, go to "MAP 2324: SSA RAID" on page 260 to isolate the problem.
46500	**None**	Description: A member disk drive is missing from an array, or the a remote NVRAM is not available. Action: The array is in the Offline state. Find the missing member disk drive or the other adapter card. If these cannot be found, delete the array, then recreate it.
47000	**None**	Description: An attempt has been made to store in the SSA adapter the details of more than 32 arrays. Action: The system user must delete from the SSA adapter the details of old arrays (see "Deleting an Old RAID Array Recorded in an SSA RAID Manager" on page 78).

SRN	FRU List	Problem
47500	**None**	Description: Part of the array data might have been lost. Action: Go to "MAP 2324: SSA RAID" on page 260.
48000	**None**	Description: The SSA adapter has detected a link configuration that is not valid. Action: See "SSA Loop Configurations that Are Not Valid" on page 251.
48500	**None**	Description: The array filter has detected a link configuration that is not valid. Action: See "Rules for SSA Loops" on page 29, and correct the configuration.
48600	**None**	Description: One member disk drive of an array is not on the SSA loop that contains the other member disk drives of the array. The array is in the Exposed state. Action: All the member disk drives of an array must be on the same SSA loop. Find all the members of the array: 1. Type `smitty devices` and press Enter. 2. Select **SSA RAID Arrays**. 3. Select **List/Identify SSA Physical Disks**. 4. Select **List Disks in an SSA RAID Array**. 5. Select the hdisk that is in the Exposed state, and note all the pdisks. If necessary, use the Identify function to identify the disk drive. 6. Move all the member disk drives to the same SSA loop.
48700	**None**	Description: Multiple member disk drives of an array are not on the SSA loop that contains the other member disk drives of the array. The array is in the Offline state. Action: All the member disk drives of an array must be on the same SSA loop. Find all the members of the array: 1. Type `smitty devices` and press Enter. 2. Select **SSA RAID Arrays**. 3. Select **List/Identify SSA Physical Disks**. 4. Select **List Disks in an SSA RAID Array**. 5. Select the hdisk that is in the Offline state, and note all the pdisks. If necessary, use the Identify function to identify the disk drives. 6. Move all the member disk drives to the same SSA loop.

SRN	FRU List	Problem
48800	**Device (100%)** ("Exchanging Disk Drives" on page 175)	Description: The Invalid-strip-table is full. Because of failures on multiple member disk drives of an array, no access to the data on that array is possible. The failed array is in the Offline state. Action: 1. Type `smitty ssaraid` and press Enter. 2. Select **List Status of All Defined SSA RAID Arrays**. 3. The failed hdisk is listed with `Invalid data strips`. Make a note of the hdisk number. 4. Ask the customer to delete the failed array. 5. When the array has been deleted, run, in System Verification mode, diagnostics and the Certify service aid to each disk drive that was a member of the failed array. 6. If, in the previous step, you found any disk drive failures, correct those failures. 7. Tell the customer that the array can now be recreated.
48900	**None**	Description: An array is not available; multiple devices have failed. Multiple disk drives failed during an array building operation. Action: Run diagnostics and the Certify service aid to all the disk drives that were used to create the array. If problems occur, correct those problems before you attempt to recreate the array.

SRN	FRU List	Problem
48950	**Device (100%)** "Exchanging Disk Drives" on page 175	Description: A disk drive has caused an array building operation to fail. Action: 1. Ask the user to make a backup of the data that is on this array. Some data might not be accessible. 2. Type `smitty ssaraid` and press Enter. 3. Select **List/Identify SSA Physical Disks**. 4. Select **List Disks in an SSA RAID Array**. 5. Note the pdisk numbers of the member disk drives of the failed array. 6. Ask the user to delete the array. 7. Select **Change/Show Use of an SSA Physical Disk**. 8. Run diagnostics in System Verification mode to all disk drives that are listed as rejected (if any are listed). 9. Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to disk drives that are listed as rejected. 10. Run the Certify service aid to all the disk drives that were members of the failed array. 11. If problems occur on any disk drive, exchange that disk drive for a new one. 12. Ask the user to recreate the array.
49000	**None**	Description: An array is in the Degraded state because a disk drive is not available to the array, and a write command has been sent to that array. Action: A disk drive might not be available for one of the following reasons: • The disk drive has failed. • The disk drive has been removed from the subsystem. • An SSA link has failed. • A power failure has occurred. If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find any failed disk drives, failed SSA links, or power failures that might have caused the problem. If you find any faults, go to the Start MAP (or equivalent) in the unit *Installation and Service Guide* to isolate the problem, then go to 35 on page 272 of MAP 2324: SSA RAID to return the array to the Good state. If the SSA service aids are not available, or the Link Verification service aid does not find any faults, go to "MAP 2324: SSA RAID" on page 260 to isolate the problem.

SRN	FRU List	Problem
49100	**None**	Description: An array is in the Exposed state because a disk drive is not available to the array. Action: A disk drive can become not available for several reasons: • The disk drive has failed. • The disk drive has been removed from the subsystem. • An SSA link has failed. • A power failure has occurred. If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find any failed disk drives, failed SSA links, or power failures that might have caused the problem. If you find any faults, go to the Start MAP (or equivalent) in the unit *Installation and Service Guide* to isolate the problem, then go to 35 on page 272 of MAP 2324: SSA RAID to return the array to the Good state. If the SSA service aids are not available, or the Link Verification service aid does not find any faults, go to "MAP 2324: SSA RAID" on page 260 to isolate the problem.
49500	**None**	Description: No hot spare disk drives are available for an array that is configured for hot spare disk drives. Action: If the SSA service aids are available, run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find any failed disk drives, failed SSA links, or power failures that might have caused the problem. If you find any faults, go to the Start MAP (or equivalent) in the unit *Installation and Service Guide* to isolate the problem, then go to 35 on page 272 of MAP 2324: SSA RAID to return the array to the Good state. If the SSA service aids are not available, or the Link Verification service aid does not find any faults, go to "MAP 2324: SSA RAID" on page 260 to isolate the problem.
49700	**None**	Description: The parity for the array is not complete. Action: Go to "MAP 2324: SSA RAID" on page 260.
49800	**None**	Description: A different adapter has been detected on each loop. Action: Go to "Rules for SSA Loops" on page 29 and observe the configuration rules for this adapter. Correct the configuration.

SRN	FRU List	Problem
4A100	**Device (100%)** ("Exchanging Disk Drives" on page 175).	Description: The adapter cannot initialize a disk drive. Action: The failing disk drive might, or might not, be configured on this system. Run diagnostics in System Verification mode to all pdisks. If the diagnostics fail, exchange the pdisk for a new disk drive. If the diagnostics do not detect a failing pdisk, use the Link Verification service aid (see "Link Verification Service Aid" on page 210) to search for disk drives that are not configured. Such disk drives are listed as *****. **Note:** Other adapters in the SSA loop might also be listed as *****. Exchange, for new disk drives, all pdisks that are not configured.
4BPAA	**Device (100%)** ("Exchanging Disk Drives" on page 175).	Description: A disk drive at PAA cannot be configured, because its UID cannot be read. Action: If the SSA service aids are available: 1. Run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find the failing device. The service aid lists the device as *****. 2. Exchange the FRU for a new FRU. If the service aids are not available: 1. Note the value of PAA in this SRN, then go to "Finding the Physical Location of a Device" on page 227. 2. Exchange the FRU for a new FRU.
50000	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter failed to respond to the device driver. Action: Exchange the FRU for a new FRU.
50001	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: A data parity error has occurred. Action: Exchange the FRU for a new FRU.
50002	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: An SSA adapter DMA error has occurred. Action: Exchange the FRU for a new FRU.
50004	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: Channel check. Action: Exchange the FRU for a new FRU.
50005	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: A software error has occurred. Action: Go to "Software and Microcode Errors" on page 250 before exchanging the FRU.

SRN	FRU List	Problem
50006	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: A channel check has occurred. Action: Exchange the FRU for a new FRU.
50007	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The IOCC detected an internal error. Action: Exchange the FRU for a new FRU.
50008	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: Unable to read or write the POS registers or PCI configuration space. Action: Exchange the FRU for a new FRU.
50010	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: An SSA adapter or device drive protocol error has occurred. Action: Go to "Software and Microcode Errors" on page 250 before exchanging the FRU.
50012	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter microcode has hung. Action: Run diagnostics in System Verification mode to the SSA adapter. If the diagnostics fail, exchange the FRU for a new FRU. If the diagnostics do not fail, go to "Software and Microcode Errors" on page 250 before exchanging the FRU.
50013	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter card has failed. Action: Exchange the FRU for a new FRU.
50100	**None**	Description: An attempt was made to log an error against a pdisk that is not available to the using system. Action: This problem has occurred for one of the following reasons: • A user has deleted a pdisk from the system configuration. In such an instance, the hdisk that is related to the pdisk continues to operate normally. If the disk drive tries to log an error, however, this SRN (50100) is produced. Give the **cfgmgr** command to return the pdisk to the system configuration. • A device has tried to log an error during system configuration. To find the failing device, run diagnostics to the devices that are connected to this SSA adapter.
50200	**None**	Description: A duplicate node number has been detected. Action: This problem is a user error. See "SSA Disk Concurrent Mode of Operation Interface" on page 148. You can use the ssavfynn command line utility to determine which node has the duplicate node number.

SRN	FRU List	Problem
50411	**SSA adapter card (40%)** (using-system *Installation and Service Guide*). **External SSA cables (30%)** **Device (30%)** "Exchanging Disk Drives" on page 175.	Description: The SSA adapter has detected an SS_SIC_CLASS1 error. Action: This error can be caused by an adapter hardware failure, or by excessive electrical interference on the SSA loop. Exchange the FRUs for new FRUs in the given sequence.
50425	**None**	Description: The SSA adapter has detected an SS_LINK_CONFIG_FAILED error. SSA devices cannot be configured because one device in the SSA loop is causing link responses that are not valid. Action: Isolate the failing device: 1. If only one SSA loop is connected to the adapter, go to step 2. If two SSA loops are connected to the adapter, disconnect one loop, and run diagnostics in System Verification mode to the adapter, to determine which loop contains the failing device. Then go to step 2. 2. Disconnect the first device on the SSA loop that contains the failing device, and run the diagnostics in System Verification mode to the adapter. 3. If the diagnostics show that the failing device is still in the SSA loop, reconnect the device, and disconnect the next device in sequence. 4. Run the diagnostics again. 5. Repeat steps 3 and 4 until you isolate the failing device.
504XX	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter microcode has hung. Action: Run diagnostics in System Verification mode to the SSA adapter. If the diagnostics fail, exchange the FRU for a new FRU. If the diagnostics do not fail, go to "Software and Microcode Errors" on page 250.
60000	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The SSA adapter is missing from the expected configuration. Action: Verify that the SSA adapter card is installed in the expected slot of the using system. If it is in the expected slot, exchange the FRU for a new FRU. If it is not in the expected slot, give the **diag -a** command, and answer the questions that are displayed.
60240	**None**	Description: A configuration problem has occurred. Action: A device cannot be configured, for some unknown reason. Go to the START MAP for the unit in which the device is installed. If no problem is found, go to "Software and Microcode Errors" on page 250.

SRN	FRU List	Problem
7XXXX	**None**	Description: An SSA device is missing from the expected configuration of the SSA loop. Action: Go to the service information for the unit in which the missing unit should be installed. **Note:** In this SRN, an X represents a digit 0 through F.
D4000	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The diagnostics cannot configure the SSA adapter. Action: Exchange the FRU for a new FRU.
D4100	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The diagnostics cannot open the SSA adapter. Action: Exchange the FRU for a new FRU.
D4300	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The diagnostics have detected an SSA adapter POST failure. Action: Exchange the FRU for a new FRU.
D44XX	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: The diagnostics have detected that the SSA adapter has corrupted the microcode, but cannot download a new version of the microcode. Action: Exchange the FRU for a new FRU. **Note:** In this SRN, an X represents a digit 0 through F.
DFFFF	**SSA adapter card (100%)** (using-system *Installation and Service Guide*).	Description: A command or parameter that has been sent or received is not valid. This problem is caused either by the SSA adapter, or by an error in the microcode. Action: Go to "Software and Microcode Errors" on page 250 before exchanging the FRU.
SSA01	**None**	Description: Not enough using-system memory is available for this service aid to continue. Action: Take one of the actions described here: • This problem might be caused by a failed application program. Ask the user to end any failed application program, then try to run the service aid again. • Run diagnostics in Problem Determination mode to the system unit. If you find any problems, solve them, then try to run the service aid again. • Close down and reboot the using system, then try to run the service aid again. • Run diagnostics from diskette or CD-ROM to isolate the problem. If you do not find a problem, the operating system might have failed.

SRN	FRU List	Problem
SSA02	**None**	Description: An unknown error has occurred. Action: Take one of the actions described here: • Run diagnostics in Problem Determination mode to the system unit. If you find any problems, solve them, then try to run the service aid again. • If diagnostics fail, or if the same problem occurs when you try the service aid again, run diagnostics from diskette or CD-ROM to isolate the problem. If you do not find a problem, the operating system might have failed.
SSA03	**None**	Description: The service aid was unable to open an hdisk. This problem might have occurred because a disk drive has failed or has been removed from the system. Action: Take the actions described here: 1. Use the Configuration Verification service aid (see "Configuration Verification Service Aid" on page 214) to determine the location code of the SSA adapter to which the hdisk is attached. (For example, if the location code of the hdisk is 00-03-L, the location code of the SSA adapter is 00-03.) 2. Run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to the SSA adapter. 3. If a link failure is indicated by the service aid, go to "MAP 2320: SSA Link" on page 253. 4. If no link failures are indicated, run diagnostics in System Verification mode to each pdisk that is attached to the SSA adapter.

Software and Microcode Errors

Some SRNs indicate that a problem might have been caused by a software error or by a microcode error. If you have one of these SRNs, do the following actions:

1. Make a note of the contents of the error log for the device that has the problem.

2. For AIX Versions 4.2 and above, run the **snap -b** command to collect system configuration data, and to dump data.

   For AIX versions below 4.2, go to the using-system service aids and select `Display Vital Product Data` to display the VPD of the failing system. Make a note of the VPD for all the SSA adapters and disk drives.

3. Report the problem to your support center. The center can tell you whether you have a known problem, and can, if necessary, provide you with a correction for the software or microcode.

   If the support center has no known correction for the SRN, exchange, for new FRUs, the FRUs that are listed in the SRN.

SSA Loop Configurations that Are Not Valid

Note: This section is related to SRN 48000.

SRN 48000 shows that the SSA loop contains more devices or adapters than are allowed. The maximum numbers allowed depend on the adapter; "Rules for SSA Loops" on page 29 describes these details for each adapter.

If the SRN occurred when you, or the customer, switched on the using system:

1. Switch off the using system.
2. Review the configuration that you are trying to make, and determine why that configuration is not valid.
3. Correct your configuration by reconfiguring the SSA cables or by removing the excess devices or adapters from the loop.
4. Switch on the using system.

If the SRN occurred because additional devices or adapters were added to a working SSA loop:

1. Remove the additional devices or adapters that are causing the problem, and put the loop back into its original, working configuration.

   Note: *It is important that you do these actions*, because they enable the configuration code to reset itself from the effects of the error.
2. Review the configuration that you are trying to make, and determine why that configuration is not valid.
3. Correct your configuration by reconfiguring the SSA cables or by removing the excess devices or adapters from the loop.

SSA Maintenance Analysis Procedures (MAPs)

The maintenance analysis procedures (MAPs) describe how to analyze a failure that has occurred in an SSA loop.

How to Use the MAPs

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing an SSA loop*. Unit power cables and external SSA cables that connect the devices to the using system can be disconnected while that system is running.

- To isolate the FRUs, do the actions and answer the questions given in the MAPs.
- When instructed to exchange two or more FRUs in sequence:
  1. Exchange the first FRU in the list for a new one.
  2. Verify that the problem is solved. For some problems, verification means running the diagnostic programs (see the using-system service procedures).
  3. If the problem remains:

a. Reinstall the original FRU.

   b. Exchange the next FRU in the list for a new one.

4. Repeat steps 2 and 3 until either the problem is solved, or all the related FRUs have been exchanged.

5. Do the next action indicated by the MAP.

Attention: Disk drives are fragile. Handle them with care, and keep them well away from strong magnetic fields.

MAP 2010: START

This MAP is the entry point to the MAPs for the adapter. If you are not familiar with these MAPs, read "How to Use the MAPs" on page 251 first.

You might have been sent here because:

- The system problem determination procedures sent you here.
- Action from an SRN list sent you here.
- A problem occurred during the installation of a disk subsystem or a disk drive.
- Another MAP sent you here.
- A customer observed a problem that was not detected by the system problem determination procedures.

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing the SSA loop.* Unit power cables and external SSA cables that connect the devices to the using system can be disconnected while that system is running.

1.
   Have you been sent here from the SRN list in this book?

   NO   Go to step 2.

   YES   Go to step 5 on page 253.

2. (from step 1)
   Do you have an SSA subsystem (5-character) SRN?

   NO   Go to step 3.

   YES   Go to "Service Request Numbers (SRNs)" on page 229.

3. (from step 2)
   - If the system diagnostics are available, go to step 4.
   - If the system diagnostics are not available, but the stand-alone diagnostics are available:
     a. Run the stand-alone diagnostics.
     b. Go to 4.
   - If neither the system diagnostics nor the stand-alone diagnostics are available, go to the problem determination procedures for the unit that contains the disk drives.

4. (from step 3)

Run the diagnostics in Problem Determination mode.

Note: Do not run Advanced Diagnostics; otherwise, errors are logged on other using systems that share the same loop.

Did the diagnostics produce an SRN?

NO Go to "MAP 2410: SSA Repair Verification" on page 273.

YES Go to step 5.

5. (from steps 1 and 4)

Do you have SRN 45PAA?

NO Go to step 6.

YES Go to "MAP 2320: SSA Link".

6. (from step 5)

Do you have an SRN in the range 21000 through 29FFF?

NO Go to step 7.

YES Go to "MAP 2323: SSA Intermittent Link Error" on page 258.

7. (from step 6)

Do you have SRN 46000, 47000, 47500, 49000, 49100, 49500, or 49700?

NO You are in the wrong book. Go to the correct service information for your problem.

YES Go to "MAP 2324: SSA RAID" on page 260.

MAP 2320: SSA Link

This MAP helps you to isolate FRUs that are causing an SSA loop problem between a device and the SSA adapter, or between two devices. If you are not familiar with SSA loops, read the section "Chapter 2. Introducing SSA Loops" on page 19 before using this MAP. Chapter 2. Introducing SSA Loops explains SSA links, strings, and loops.

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing the SSA loop.* Unit power cables and external SSA cables that connect the devices to the using system can be disconnected while that system is running.

1.

Are the system service aids available?

NO Go to 2.

YES Go to step 3 on page 254.

2. (from step 1)

Are any Ready (link status) lights flashing on this SSA loop?

NO Go to "Finding the Physical Location of a Device" on page 227.

3. (from step 1)

If the service aid detects pdisks for the adapter you have selected, a list of pdisks is displayed. The diagram shows an example list:

```
LINK VERIFICATION                                                    802386

SSA Link Verification for:
  systemname:ssa0                     00-04   SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                         Serial#      Adapter Port
                                                A1  A2  B1  B2      Status

 [TOP]
  systemname:pdisk11               AC50AE43     0   5               Good
  systemname:pdisk8                AC706EA3     1   4               Good
  systemname:pdisk2                AC1DBE11     2   3               Good
  systemname:pdisk3                AC1DBEF4     3   2               Good
  systemname:pdisk7                AC50AE58     4   1               Good
  systemname:pdisk12               AC7C6E51     5   0               Good
  systemname:pdisk0                AC706E9A             0   5       Good
  systemname:pdisk1                AC1DEEE2             1   4       Good
  systemname:pdisk10               AC1DBE32             2   3       Good
 [MORE...4]



 F3=Cancel       F10=Exit
```

If the service aid cannot detect any pdisks, a message is displayed:

```
LINK VERIFICATION                                                        802385

Move cursor onto selection, then press <Enter>.

 systemname:ssa1                         00-04   SSA Enhanced RAID Adapter
 systemname:ssa1                         00-05   SSA Enhanced RAID Adapter
 systemname:ssa1                         00-07   SSA Enhanced RAID Adapter


          ------------------------------------------------------
         │                                                      │
         │                                                      │
         │ No pdisks are in the 'Available' state.              │
         │                                                      │
         │ If you are running the diagnostics in Concurrent     │
         │ Mode run 'cfgmgr' to ensure that all pdisks are      │
         │ configured before selecting this option.            │
         │                                                      │
         │ If pdisks cannot be configured then go to the        │
         │ START page in the SSA Subsystem Service Guide.       │
         │                                                      │
         │                                                      │
         │                                                      │
         │ F3=Cancel        F10=Exit           Enter            │
 F3=Cancel ------------------------------------------------------
```

Are any pdisks listed for the selected SSA adapter?

NO   One of the following conditions exists. Take the action described.

- No physical disks are connected to this SSA adapter:
    a. Ensure that the external SSA cables are correctly connected to the units in which the devices are installed and to the SSA adapter.
    b. Go to "MAP 2410: SSA Repair Verification" on page 273 to verify the repair.
- All the disk drives are switched off. Go to the START MAP for the unit in which the SSA devices are installed.
- The SSA adapter is failing:
    a. Exchange the SSA adapter for a new one (see the using-system *Installation and Service Guide*).
    b. Go to "MAP 2410: SSA Repair Verification" on page 273 to verify the repair.

YES   Go to step 4.

4. (from step 3)

   Observe the Status column on the screen. If the status of any pdisk is 'Power', that pdisk has detected a loss of redundant power or cooling. In the example shown here, pdisk4 has detected such a loss.

```
LINK VERIFICATION                                                   802386

SSA Link Verification for:
  systemname:ssa0                    00-04   SSA Enhanced RAID Adapter


To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                         Serial#      Adapter Port
                                                A1  A2  B1  B2       Status

[TOP]
  systemname:pdisk11               AC50AE43      0   5               Good
  systemname:pdisk8                AC706EA3      1   4               Good
  systemname:pdisk2                AC1DBE11      2   3               Power
  systemname:pdisk3                AC1DBEF4      3   2               Good
  systemname:pdisk7                AC50AE58      4   1               Good
  systemname:pdisk12               AC7C6E51      5   0               Good
  systemname:pdisk0                AC706E9A              0   5       Good
  systemname:pdisk1                AC1DEEE2              1   4       Good
  systemname:pdisk10               AC1DBE32              2   3       Good
[MORE...4]

 F3=Cancel        F10=Exit
```

Does one of the pdisks have a 'Power' status?

NO   Go to step 5.

YES   Go to the START MAP for the unit in which the SSA device is installed.

5. (from step 4)

   Observe the Status column on the screen. If the status of any pdisk is 'Failed', that
   pdisk is failing. In the example shown here, pdisk4 is failing.

```
LINK VERIFICATION                                                   802386

SSA Link Verification for:
  systemname:ssa0                    00-04   SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                         Serial#      Adapter Port
                                                A1  A2  B1  B2       Status

 [TOP]
  systemname:pdisk11               AC50AE43      0   5               Good
  systemname:pdisk8                AC706EA3      1   4               Good
  systemname:pdisk2                AC1DBE11      2   3               Failed
  systemname:pdisk3                AC1DBEF4      3   2               Good
  systemname:pdisk7                AC50AE58      4   1               Good
  systemname:pdisk12               AC7C6E51      5   0               Good
  systemname:pdisk0                AC706E9A              0   5       Good
  systemname:pdisk1                AC1DEEE2              1   4       Good
  systemname:pdisk10               AC1DBE32              2   3       Good
[MORE...4]

 F3=Cancel        F10=Exit
```

Is one of the pdisks failing?

NO Go to step 6.

YES

    a. Use the Identify function (as instructed on the screen) to find the failing disk. See "Finding the Physical Location of a Device" on page 227 if you need more information about finding the disk drive.

    b. Exchange the disk drive for a new one (see "Exchanging Disk Drives" on page 175).

    c. Go to "MAP 2410: SSA Repair Verification" on page 273 to verify the repair.

6. (from step 5)

Observe the list of pdisks the screen. A row of question marks (?????) shows that a link in one of the loops is broken. If two rows of question marks are displayed, two links are broken, one in each loop. In the example shown here, pdisk2 is missing.

```
LINK VERIFICATION                                             802386

SSA Link Verification for:
  systemname:ssa0                    00-04   SSA Enhanced RAID Adapter


To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                       Serial#      Adapter Port
                                              A1 A2 B1 B2      Status

[TOP]
  systemname:pdisk11             AC50AE43     0                Good
  systemname:pdisk8              AC706EA3     1                Good
?????
  systemname:pdisk3              AC1DBEF4        2             Good
  systemname:pdisk7              AC50AE58        1             Good
  systemname:pdisk12             AC7C6E51        0             Good
  systemname:pdisk0              AC706E9A              0  5     Good
  systemname:pdisk1              AC1DEEE2              1  4     Good
  systemname:pdisk10             AC1DBE32              2  3     Good
[MORE...4]



 F3=Cancel       F10=Exit

```

Is a link broken between two pdisks?

NO No trouble found.

YES

    a. Use the Identify function (as instructed on the screen) to find the pdisks that are on each side of the broken link. See "Finding the Physical Location of a Device" on page 227 if you need more information about finding the disk drive.

    b. Go to "SSA Link Errors" on page 275. The information that is provided there can help you solve the problem. If necessary, refer to the service information for the unit that contains the device.

MAP 2323: SSA Intermittent Link Error

This MAP helps you to isolate FRUs that are causing an intermittent SSA link problem. You are here because you have an SRN from the series 21000 through 29000.

If you are not familiar with the SSA link, read the section "Chapter 2. Introducing SSA Loops" on page 19 before using this MAP. Chapter 2. Introducing SSA Loops explains SSA links, strings, and loops.

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing an SSA loop.* Power cables and external SSA cables can be disconnected while that system is running.

1.
   a. Run the Link Verification service aid to the SSA adapter for which this error has been logged (see "Link Verification Service Aid" on page 210). A list of pdisks, similar to the example given here, is displayed:

```
 LINK VERIFICATION                                                  802386

 SSA Link Verification for:
   systemname:ssa0                    00-04   SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

   Physical                          Serial#     Adapter Port
                                                 A1  A2  B1  B2      Status

   systemname:pdisk1                 AC50AE43    0   3               Good
   systemname:pdisk2                 AC706EA3    1   2               Good
   systemname:pdisk3                 AC1DBE11    2   1               Good
   systemname:pdisk4                 AC1DBEF4    3   0               Good






 F3=Cancel        F10=Exit
```

   Note: On the Link Verification screen, each adapter port is identified by the number of its related connector on the adapter card:
   - Adapter port 0 is identified as A1
   - Adapter port 1 is identified as A2
   - Adapter port 2 is identified as B1
   - Adapter port 3 is identified as B2

   SRNs 21000 through 29000 include the adapter port number (0–3).
   b. Go to step 2.
2. (from step 1)

a. Observe the SRN that sent you to this MAP. It is in the series 21PAA through 29PAA (where P is the number of the SSA adapter port, and AA is the SSA address of the device).

Note the value of PAA in the SRN. For example:
   If the SRN is 24002, PAA = 002.
   If the SRN is 24104, PAA = 104.

b. Observe the Link Verification screen, and identify the physical device that is represented by PAA in the SRN.

Note: If the SSA address (AA) in the SRN is higher than the highest SSA address that is displayed for the adapter port (P), that address is the address of the SSA adapter.

Read through the following examples if you need help in identifying the device, then go to 3. Otherwise, go directly to 3.

Example 1

If the SRN is 24002, the device is connected to adapter port 0 (shown as A1 on the screen), and has an SSA address of 02 (shown as 2 on the screen). In the example screen, that device is pdisk3.

```
LINK VERIFICATION                                            802386

SSA Link Verification for:
  systemname:ssa0                     00-04   SSA Enhanced RAID Adapter


To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                       Serial#     Adapter Port
                                             A1  A2  B1  B2      Status

  systemname:pdisk1              AC50AE43     0   3              Good
  systemname:pdisk2              AC706EA3     1   2              Good
  systemname:pdisk3              AC1DBE11     2   1              Good
  systemname:pdisk4              AC1DBEF4     3   0              Good






  F3=Cancel      F10=Exit
```

Example 2

If the SRN is 24104, the device (in theory) is connected to adapter port 1 (shown as A2 on the screen). The device, however, has an SSA address of 04. That address is higher than the highest address that is displayed for adapter port 1. The device is, therefore, the SSA adapter.

3. (from step 2)

The problem is in the SSA link between the device that you identified in 2 on page 258 and the device that is on the same adapter port (P), but whose SSA address has a value of 1 less than AA (AA − 1).

For example, in 2 on page 258, SRN 24002 identified pdisk3. The SSA address of pdisk3 is 02; the address (AA − 1) of the other device on the link is, therefore, 01. SSA address 01 is the address of pdisk2. SRN 24002 indicates, therefore, that link errors have been detected between pdisk2 and pdisk3.

Similarly, SRN 24104 identified the SSA adapter. The SSA address of the adapter is 04. The address of the other device is, therefore, 03. SSA address 03 is the address of pdisk1. SRN 24104 indicates, therefore, that link errors have been detected between adapter port A2 and pdisk1.

Exchange, in the sequence shown, the following FRUs for new FRUs. Ensure that for *each* FRU exchange, you go to "MAP 2410: SSA Repair Verification" on page 273to verify the repair.

a. One of the two devices that are identified by the SRN (see "Exchanging Disk Drives" on page 175).

b. The other of the two devices.

c. The internal SSA connections of the unit or units in which the devices are installed.

d. The external SSA cable.

MAP 2324: SSA RAID

This MAP helps you to solve problems that have occurred in SSA RAID arrays.

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing an SSA link or a unit in which SSA devices are installed.* Unit power cables and external SSA cables that connect devices to the using system can be disconnected while that system is running.

Before starting this MAP, ensure that all the disk drives are working correctly:

1. Run diagnostics in Problem Determination mode to identify any disk drive problems that have occurred.

2. Run the Link Verification service aid (see "Link Verification Service Aid" on page 210) to find all power problems, SSA link problems, and SSA disk drives that have a Failed status.

3. Correct all those problems before you start this procedure.

Attention: Some of the steps in this MAP need you to change the configuration of the array, or to change the use of an SSA disk drive. Do not do those steps unless you have the user's permission.

1. (from steps 3, 30, and 31)

   You have been sent to this step either from another step in this MAP, or because you have one of the following Service Request Numbers (SRNs):

   46000, 47000, 47500, 49000, 49100, 49500, 49700

Do you have SRN 49500?

NO

    a. Run diagnostics in System Verification mode to the SSA adapters.

    b. Go to step 2.

YES No hot spare disk drives are available.

    Go to step 21 on page 268.

2. (from step 1)

Did the diagnostics produce SRN 46000, 47000, 47500, 49000, 49100, or 49700?

NO Go to step 3.

YES Go to step 4.

3. (from step 2)

Do you have any other SRN?

NO Go to step 28 on page 270.

YES

    a. Solve the problems that caused the SRN.

    b. Return to step 1 on page 260.

4. (from step 2)

Find your SRN in the following table, then do the appropriate actions.

Note: If you still do not have any of these SRNs, you are in the wrong MAP.

SRN	Cause	Action
46000	An array is in the Offline state.	Go to step 5.
47000	You have more than the maximum number of arrays allowed.	Go to step 8 on page 263.
47500	A partial loss of data has occurred.	Go to step 9 on page 263.
49000	An array is in the Degraded state.	Go to step 13 on page 264.
49100	An array is in the Exposed state.	Go to step17 on page 266.
49700	The parity on an array is not complete.	Go to step 22 on page 268.

5. (from step 4)

An array is in the Offline state if at least one member disk drive of the array is present, but more than one member disk drive is missing. Such a condition can occur if at least two disk drives in the array have failed, or are not available to the array at this time.

Are any disk drives missing or without power, or have any disk drives been recabled (not necessarily by you)?

NO Go to step 6 on page 262.

YES Restore the original configuration:

    a. Type `smitty ssaraid` and press Enter.

b. Select **List All SSA RAID Arrays Connected to a RAID Manager**.

   The status of the array changes to Good when the adapter can find all the member disk drives of the array.

c. Go to "MAP 2410: SSA Repair Verification" on page 273 to verify the repair.

6. (from step 5)

   Either more than one disk drive has failed, or an array that is not complete has been connected to the SSA adapter.

   • If one or more disk drives have been added to this system, and those disk drives were previously members of an array on this system or on another system, do the following:

      a. Type `smitty ssaraid` and press Enter.

      b. Select **Delete an SSA RAID Array**.

      c. Select the array that is in the Offline state, and delete it. *All data that is on that RAID array is now lost*.

      d. You must now locate and repair any failed disk drives, and make those disk drives available for the creation of a new array. Go to step 7.

   • If no disk drives have been added to this system, go to step 7.

7. (from step 6)

   a. Type `smitty ssaraid` and press Enter.

   b. Select **Change/Show Use of an SSA Physical Disk**.

   Are any disk drives listed as "SSA physical disks that are rejected"?

   NO   Ask the user to delete and recreate the array that is in the Offline state.

   YES

      a. Run diagnostics in System Verification mode to all the disk drives that are listed as rejected.

      b. Run the Certify service aid (see"Certify Disk Service Aid" on page 217) to all the disk drives that are listed as rejected.

      c. If any problems occur, exchange the failed disk drives for new disk drives (see "Exchanging Disk Drives" on page 175).

      d. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

      Note: A disk drive that is listed as rejected is not necessarily failing. For example, the array might have rejected the disk drive because a power problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

      If you think that a disk drive has been rejected because it is failing, check the error log history for that disk drive. For example, if you suspect pdisk3, type on the command line:

      `ssa_ela -l pdisk3 -h 5`

This command causes the error log for pdisk3 to be analyzed for the previous five days. If a problem is detected, an SRN is generated.

8. (from step 4)

   An attempt has been made to create a new array, but the adapter already has the maximum number of arrays defined.

   a. Type `smitty ssaraid` and press Enter.
   b. Select **List/Delete Old RAID Arrays in an SSA RAID Manager**.
   c. Delete any array names that are no longer used.

9. (from step 4)

   Attention: Part of the data that is on the array has been damaged and cannot be recovered. **Before** any other action is taken, the user must recover all the data that is not damaged, and create a backup of that data.

   a. Type `smitty ssaraid` and press Enter.
   b. Select **List Status Of All Defined SSA RAID Arrays**.

   Are any arrays listed as having an invalid data strip (as shown in the following screen)?

```
                         COMMAND STATUS

Command: OK           stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

                 Unsynced Parity Strips  Unbuilt Data Strips
hdisk3                   0                       0              Invalid data strip
hdisk4                   0                       0









F1=Help              F2=Refresh          F3=Cancel           F6=Command
F8=Image             F9=Shell            F10=Exit            /=Find
n=Find Next
```

   NO   Review the symptoms, then go to "MAP 2320: SSA Link" on page 253, and start the problem determination procedure again.

   YES

   a. Note the hdisk number of the failing array.
   b. Go to step 10.

10. (from step 9)

    a. Type `smitty ssaraid` and press Enter.
    b. Select **List/Identify SSA Physical Disks**.

c. Select **List Disks in an SSA RAID Array**.

d. Select the failing disk drive, and note the pdisk numbers of the disk drives that are members of the array.

e. Ask the user create a backup of all the data from this array. Some data might not be accessible.

f. When the backup has been created, ask the user to delete the array.

g. Run diagnostics in System Verification mode to each of the pdisks that you noted previously.

Do the diagnostics fail when they are run to a particular disk drive?

NO   Go to step 11.

YES

    a. Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 175).

    b. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

11. (from step 10)

Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to each of the pdisks that you noted previously.

Did the Certify service aid fail when it was run to a particular disk drive?

NO

    a. Ask the user to recreate the array.

    b. Go to step 28 on page 270.

YES

    a. Run the Format service aid (see "Format Disk Service Aid" on page 215) to the disk drive.

    b. Run the Certify service aid again to the disk drive.

    c. Go to step 12.

12. (from step 11)

Did the Certify service aid fail again?

NO

    a. Ask the user to recreate the array.

    b. Go to step 28 on page 270.

YES

    a. Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 175).

    b. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

13. (from step 4)

An array is in the Degraded state if one member disk drive of the array is missing, and a write command has been sent to that array. When an array is in the Degraded state, its data is not protected.

a. Type `smitty ssaraid` and press Enter.

b. Select **Change/Show Use of an SSA Physical Disk**.

Are any disk drives listed as "SSA physical disks that are rejected"?

NO   A disk drive has not been detected by the adapter. Go to step 15 on page 266.

YES

a. Run diagnostics in System Verification mode to all the disk drives that are listed as rejected.

b. Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to all the disk drives that are listed as rejected.

c. If problems occur on any disk drive, go to step 14. Otherwise, continue with this procedure.

d. Type `smitty ssaraid` and press Enter.

e. Select **Change/Show Use of an SSA Physical Disk** and, for all disks that you have tested or exchanged, change the **Current Use** to **Array Candidate Disk**.

f. Select **Change Member Disks in an SSA RAID Array**.

g. Select **Add a Disk to an SSA RAID Array**.

h. Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Degraded state. The array changes its state to the Good state, and parity is rebuilt.

> **Note:** The array can be used during the rebuilding operation. Inform the user, however, that while the rebuilding operation is running, the data is not protected against another disk drive failure. The rebuilding operation runs more slowly if the array is being used.

> When the rebuilding operation is complete, ask the user to run diagnostics in System Verification mode to the SSA adapters, to ensure that the rebuilding operation has not found any more problems.

14. (from step 13)

a. Exchange the disk drive for a new drive (see "Exchanging Disk Drives" on page 175).

b. Go to step 35 on page 272 to add the disk drives to the group of disk drives that are available for use by the RAID manager.

> **Note:** A disk drive that is listed as rejected is not necessarily failing. For example, the array might have rejected the disk drive because a power

problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

If you think that a disk drive has been rejected because it is failing, check the error log history for that disk drive. For example, if you suspect pdisk3, type on the command line:

```
ssa_ela -l pdisk3 -h 5
```

This command causes the error log for pdisk3 to be analyzed for the previous five days. If a problem is detected, an SRN is generated.

15. (from step 13)

   Does the Link Verification service aid indicate an open loop?

   NO   Go to step 16.

   YES   Go to "MAP 2320: SSA Link" on page 253.

16. (from step 15)

   Does any SSA disk drive have its Check light on?

   NO   The disk drive might have been removed from the subsystem.

   a. Reinstall the removed drive, or select a new disk drive for addition to the array.

   b. Type `smitty ssaraid` and press Enter.

   c. Select **Change Member Disks in an SSA RAID Array**.

   d. Select **Add a Disk to an SSA RAID Array**.

   e. Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Degraded state. The array changes its state to the Good state, and parity is rebuilt.

   YES

   a. Exchange the failed disk drive for a new one (see "Exchanging Disk Drives" on page 175).

   b. Go to step 35 on page 272.

17. (from step 4)

   An array is in the Exposed state when one member disk drive of the array is not available. If data is written to an array that is in the Exposed state, that data is not protected (see "Array States" on page 37 for more information). Command line parameters are available that allow you to prevent such write operations.

   a. Type `smitty ssaraid` and press Enter.

   b. Select **Change/Show Use of an SSA Physical Disk**.

   The status of the disk drives that are connected to the using system is displayed.

   Are any disk drives listed as "SSA physical disks that are rejected"?

| **NO** A disk drive has not been detected by the adapter. Go to step 19.

| **YES**

a. Run diagnostics in System Verification mode to all the disk drives that are listed as rejected.

b. Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to all the disk drives that are listed as rejected.

c. If problems occur on any disk drive, go to step 18. Otherwise, continue with this procedure.

d. Type `smitty ssaraid`.

e. Select **Change Member Disks in an SSA RAID Array**.

f. Select **Add a Disk to an SSA RAID Array**.

g. Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Exposed state. The array changes its state from the Exposed state, and parity is rebuilt.

18. (from step 17)

a. Exchange the disk drive for a new drive (see "Exchanging Disk Drives" on page 175).

b. Go to step 35 on page 272 to add the disk drives to the group of disk drives that are available for use by the RAID manager.

> **Note:** A disk drive that is listed as rejected is not necessarily defective. For example, the array might have rejected the disk drive because a power problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.
>
> If you think that a disk drive has been rejected because it is failing, check the error log history for that disk drive. For example, if you suspect pdisk3, type on the command line:
>
> `ssa_ela -l pdisk3 -h 5`
>
> This command causes the error log for pdisk3 to be analyzed for the previous five days. If a problem is detected, an SRN is generated.

19. (from step 17)

Does the Link Verification service aid indicate an open loop?

NO Go to step 20.

YES Go to "MAP 2320: SSA Link" on page 253.

20. (from step 19)

Does any SSA Disk drive have its Check light on?

NO The disk drive might have been removed from the subsystem.

a. Reinstall the removed drive, or select a new disk drive for addition to the array.

b. Type `smitty ssaraid` and press Enter.

c. Select **Change Member Disks in an SSA RAID Array**.

d. Select **Add a Disk to an SSA RAID Array**.

e. Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Exposed state. The array changes its state from the Exposed state, and parity is rebuilt.

YES

a. Exchange the failed disk drive for a new one (see "Exchanging Disk Drives" on page 175).

b. Go to step 35 on page 272.

21. (from step 1

No spare disk drives are available for an array that is configured for hot spare disk drives.

a. If the subsystem contains disk drives that have failed, repair those disk drives, or exchange them for new disk drives (see "Exchanging Disk Drives" on page 175).

b. Type `smitty ssaraid`and press Enter.

c. Select **Change/Show Use of an SSA Physical Disk**.

Are any disks listed as "SSA Physical disks that are hot spares"?

NO Review with the user the requirement for hot spare disk drives. If the customer wants hot spare disk drives, one or more disk drives must have their use changed to **Hot Spare Disk**.

If the customer does not want hot spare disk drives:

a. Return to the SSA RAID Arrays menu.

b. Select **Change/Show Attributes of an SSA RAID Array**.

c. Change the **Enable Use of Hot Spares** attribute to **No**.

YES You have solved the problem.

Note: Because this problem has occurred, an error log is generated when the system runs the health check program. To verify that the availability of hot spare disk drives has solved the problem:

a. Give the following command:

`/usr/lpp/diagnostics/bin/run_ssa_healthcheck`

b. Verify that error code 049500 is **not** logged.

You **cannot** detect this problem by running diagnostics in System Verification mode to the adapter.

22. (from step 4)

The RAID Manager has detected an array that does not have complete parity. All read and write operations can complete normally, but the failure of one disk drive can cause the loss of some data.

The problem might be caused by a rebuilding operation that is running on an array. You must first check whether a rebuilding operation is running. If a rebuilding operation is not the cause, the user must delete the array, then recreate it.

a. Type `smitty ssaraid` and press Enter.

b. Select **List All SSA RAID Arrays Connected to a RAID Manager**.

c. Select the adapter that you are testing. A list of hdisks is displayed.

d. Check whether a rebuilding operation is running on any array.

Is a rebuilding operation running on any RAID array?

NO　　Go to step 24.

YES

a. Wait for the rebuilding operation to complete.

b. Rerun diagnostics in System Verification mode to the adapter.

c. Go to step 23.

23. (from step 22)

Is the problem solved?

NO　　Go to step 24.

YES　　No further action is needed.

24. (from steps 22 and 23)

a. Type `smitty ssaraid` and press Enter.

b. Select **List Status Of All Defined SSA RAID Arrays**.

Do any arrays have a number other than zero listed under "Unsynced Parity Strips" or "Unbuilt Data Strips"?

NO　　The error might have occurred because a hot spare drive was being started and rebuilt. Check whether any failed disk drives are present in the array.

YES

a. Note the hdisk number of the failing array.

b. Go to step 25.

25. (from step 24)

a. Type `smitty ssaraid` and press Enter.

b. Select **List/Identify SSA Physical Disks**.

c. Select **List Disks in an SSA RAID Array**.

d. Select the failing disk drive.

e. Note all the pdisk numbers that are in the array.

f. Ask the user to create a backup of all the data that is contained in this array. (All the data should be accessible without error.)

g. Ask the user to delete the array.

      h. Run diagnostics in System Verification mode to each of the pdisks that you noted previously.

Do the diagnostics fail when run to any particular disk drive?

NO   Go to step 26.

YES

      a. Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 175).

      b. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

26. (from step 25)

    Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to the pdisks that you noted previously.

Did the Certify service aid fail when run to any particular disk drive?

NO

      a. Ask the user to recreate the array.

      b. Go to step 28.

YES

      a. Run the Format service aid (see "Format Disk Service Aid" on page 215) to the disk drive.

      b. Run the Certify service aid to the disk drive again.

      c. Go to step 27.

27. (from step 26)

Did the Certify service aid fail again?

NO

      a. Ask the user to recreate the array.

      b. Go to step 28.

YES

      a. Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 175).

      b. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

28. (from step 2 in MAP 2410: SSA Repair Verification, and from steps 3, 11, 12, 26, and 27 in this MAP)

RAID Checkout

You are now starting the RAID checkout procedure

---

    a. Type `smitty ssaraid` and press Enter.

    b. Select **Change/Show Use of an SSA Physical Disk** from the SSA RAID Arrays menu.

Are any disks listed as "SSA physical disks that are rejected"?

NO   Go to step 30.

YES

    a. Run diagnostics in System Verification mode to all the disk drives that are listed as rejected.

    b. Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to all the rejected disk drives.

    c. Go to step 29.

29. (from step 25)

Is any disk drive failing?

NO   Go to step 30.

YES

    a. Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 175).

    b. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

30. (from steps 28 and 29)

    a. Type `smitty ssaraid` and press Enter.

    b. Select **List All SSA RAID Arrays Connected to a RAID Manager**.

    c. List the arrays that are connected to each SSA Adapter.

Are any arrays listed with a status other than Good or Rebuilding?

NO   Go to step 31.

YES   Go to step 1 on page 260.

31. (from step 30)

    a. Type `smitty ssaraid` and press Enter.

    b. Select **List Status Of All Defined SSA RAID Arrays**.

Do any listed arrays have Unsynced Parity Strips, Unbuilt Data Strips, or Invalid Data Strips?

NO   Go to step 32.

YES   Go to step 1 on page 260.

32. (from step 31)

Have disk drives been going into the rejected state with no other failure indications?

NO   Go to step 33 on page 272.

YES   This problem can occur if an array is accessed before all the member disk drives are available.

            Ensure that the power system switches on power to all the disk drives before, or when, it switches on the power to the using system.

33. (from step 33)

   Was SRN 46000 logged, but no error found, when diagnostics were run in System Verification mode?

   NO   Go to step 34.

   YES   An array was in the Offline state, but is now available.

           Ensure that the power system switches on power to all the disk drives before, or when, it switches on the power to the using system.

34. (from step 33)

   Was SRN 49100 logged, but no error found, when diagnostics were run in System Verification mode?

   NO   You have solved all the array problems.

           If you have previously created a data backup, reload that data now.

   YES   An array was in the Exposed state, but is now in the Good state.

           This problem might have occurred because a disk drive was temporarily removed from the system.

           Ensure that the power system switches on power to all the disk drives before, or when, it switches on the power to the using system.

35. (from steps 7, 10, 12, 14, 16, 18, 20, 25, 27, and 29)

   Has a failed disk drive been exchanged for a new disk drive?

   NO   If you have repaired a power or cabling fault that caused the disk drive to be missing from the system, the drive might now be in a rejected state. You must change that disk drive into a usable disk drive:

           a. Type `smitty ssaraid` and press Enter.

           b. Select **Change/Show Use of an SSA Physical Disk**.

              The disk drive that has been restored to the system is listed under **SSA Physical Disks that are rejected**.

           c. Select the disk drive that has been restored to the system.

           d. Change the Current Use parameter to **Hot Spare Disk** or to **Array Candidate Disk**.

              Note: It is the user who should make the choice of Current Use parameter. That choice should be:

                   • **Hot Spare Disk** if the use of hot spares is enabled for the arrays on the subsystem

                   • **Array Candidate Disk** if the use of hot spares is disabled for the arrays on the subsystem

   YES   If you exchanged the disk drive by using the procedure that is described in "Exchanging Disk Drives" on page 175, the new disk drive is configured as an AIX disk.

           a. Type `smitty ssaraid` and press Enter.

           b. Select **Change/Show Use of an SSA Physical Disk**.

The pdisk that has been exchanged is listed under **SSA Physical Disks that are system disks**.

c. Select the pdisk from the list.

d. Change the Current Use parameter to **Hot Spare Disk** or to **Array Candidate Disk**

Note: It is the user who should make the choice of Current Use parameter. That choice should be:

- **Hot Spare Disk** if the use of hot spares is enabled for the arrays on the subsystem
- **Array Candidate Disk** if the use of hot spares is disabled for the arrays on the subsystem

MAP 2410: SSA Repair Verification

This MAP helps you to verify a repair after a FRU has been exchanged for a new one.

Attention: Unless the using system needs to be switched off for some other reason, *do not switch off the using system when servicing an SSA link or a unit in which SSA devices are installed.* Unit power cables and external SSA cables that connect devices to the using system can be disconnected while that system is running.

1. (from step 4 in MAP 2010: START; steps 3 and 5 in MAP 2320: SSA Link; step 3 in MAP 2323: SSA Intermittent Link Error; step 5 in MAP 2324: SSA RAID)

   Before you arrived at this MAP, you exchanged one or more FRUs for new FRUs. Some of those FRUs have Power lights (for example, disk drives and fan-and-power-supply assemblies). Check whether all those Power lights are on.

   Do all the FRUs that you have exchanged have their Power lights on (where applicable)?

   NO

   a. Exchange, for a new one, the FRU whose Power light is off.

   b. Go to step 2.

   YES Go to step 2.

2. (from step 1)

   Are all Check lights off?

   NO Go to the START MAP for the unit in which the device that has its Check light on is installed.

   YES

   a. Run diagnostics, in System Verification mode, to the device that reported the problem.

      Notes:

      1) Do not run Advanced Diagnostics; otherwise, errors are logged on other using systems that share the same loop.

2) If you have just exchanged a disk drive or an SSA adapter, you
might need to run `cfgmgr` to restore the device to the system
configuration.

If the original problem was not reported by a device, run diagnostics to
each SSA adapter in the using system.

b. Go to step 3.

3. (from step 2)

Do you still have the same SRN, although you have exchanged all the FRUs that were originally reported by that SRN?

NO Go to step 4.

YES

a. Run diagnostics, in System Verification mode, to all the adapters that are in this SSA loop.

b. Run diagnostics, in System Verification mode, to all the disk drives that are in this SSA loop.

c. Run the Certify service aid (see "Certify Disk Service Aid" on page 217) to all the disk drives that are in this SSA loop.

d. Correct all errors that are reported by the diagnostics.

e. Run the Product Topology service aid (a non-SSA system service aid).

Note: If you do not run this service aid, the diagnostics might create an SRN for a problem that has already been solved.

f. If your subsystem contains RAID arrays, go to the **RAID Checkout** at 28 on page 270 of MAP 2324: SSA RAID.

4. (from step 3)

a. Type `smitty ssaraid` and press Enter.

b. Select **Change/Show Use of an SSA Physical Disk**.

Are any disk drives listed as "SSA physical disks that are rejected"?

NO Go to step 5 on page 275.

YES

a. Run diagnostics in System Verification mode to all the disk drives that are listed as rejected.

b. Run the Certify service aid (see"Certify Disk Service Aid" on page 217) to all the disk drives that are listed as rejected.

c. If any problems occur, exchange the failed disk drives for new disk drives (see "Exchanging Disk Drives" on page 175).

d. Go to step 35 on page 272 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

Note: A disk drive that is listed as rejected is not necessarily failing. For example, the array might have rejected the disk drive

because a power problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

If you think that a disk drive has been rejected because it is failing, check the error log history for that disk drive. For example, if you suspect pdisk3, type on the command line:

```
ssa_ela -l pdisk3 -h 5
```

This command causes the error log for pdisk3 to be analyzed for the previous five days. If a problem is detected, an SRN is generated.

5. (from step 3)

   a. Run the Product Topology service aid (a non-SSA system service aid).

      Note: If you do not run this service aid, the diagnostics might create an SRN for a problem that has already been solved.

   b. If your subsystem contains RAID arrays, go to the **RAID Checkout** at 28 on page 270 of MAP 2324: SSA RAID.

SSA Link Errors

SSA link errors can be caused if:

- Power is removed from an SSA device.
- An SSA device is failing.
- An SSA device is removed.
- A cable is disconnected.

Such errors might be indicated by:

- SRN 45PAA
- A flashing link status (Ready) light on the SSA device at each end of the failing link
- The indication of an open link by the Link Verification service aid

SSA Link Error Problem Determination

Instead of using the normal MAPs to solve a link error problem, you can refer directly to the link status lights to isolate the failing FRU. The descriptions given here show you how to do this.

In an SSA loop, SSA devices are connected through two or more SSA links to an SSA adapter. Each SSA link is the connection between two SSA nodes (devices or adapters); for example, disk drive to disk drive, adapter to disk drive, or adapter to adapter.

An SSA link can contain several parts. When doing problem determination, think of the link and all its parts as one complete item.

Here are some examples of SSA links. Each link contains more than one part.

Example 1

In Figure 33, the link is between two disk drives that are in the same subsystem. It has three parts.
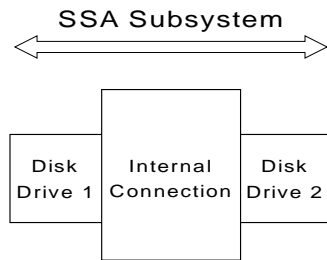
Figure 33. Three-Part Link in One Subsystem

Example 2

In Figure 34, the link is between two disk drives that are in the same subsystem. It has five parts.
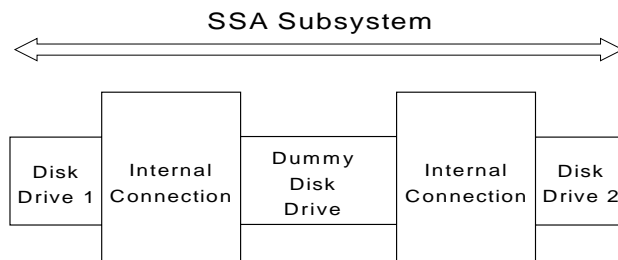
Figure 34. Five-Part Link in One Subsystem

Example 3

In Figure 35 on page 277, the link is between two disk drives that are not in the same subsystem. It has seven parts.
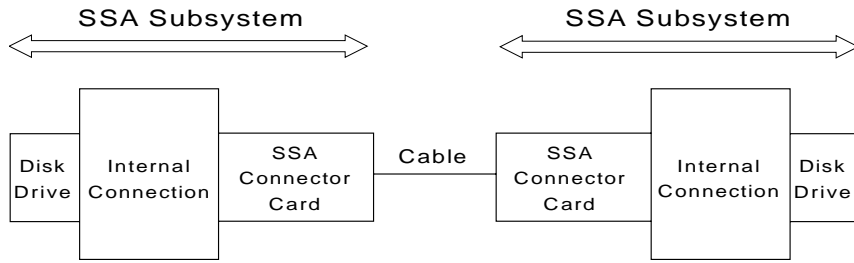
Figure 35. Seven-Part Link in Two Subsystems

Example 4

Figure 36, the link is between a disk drive and an SSA adapter. It has five parts.
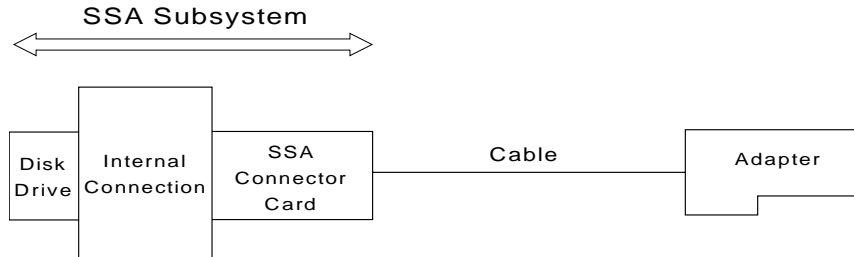
Figure 36. Five-Part Link between Disk Drive and Adapter

Example 5

In Figure 37, the link is between two SSA adapters. It has five parts. Note that it has fiber optic cables and optical connectors instead of normal SSA cables.
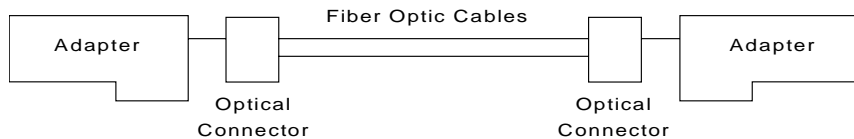
Figure 37. Five-Part Link between Two Adapters

Link Status (Ready) Lights

If a fault occurs that prevents the operation of a particular link, the link status lights of the various parts of the complete link show that the error has occurred.

You can find the failing link by looking for the flashing green status light at each end of the affected link. Some configurations might have other indicators along the link (for example, SSA connector cards) to help with FRU isolation.

The meanings of the disk drive and adapter lights are summarized here:

Status of Light	Meaning
Off	Both SSA links are inactive.
Permanently on	Both SSA links are active.
Slow flash (two seconds on, two seconds off)	Only one SSA link is active.

If your subsystem has other link status lights, see the subsystem service information for the subsystem for more details.

Service Aid

If service aids are available, you can use the Link Verification service aid to show that the SSA loop is broken.

```
LINK VERIFICATION                                              802386

SSA Link Verification for:
 systemname:ssa0                       00-04    SSA Enhanced RAID Adapter


 To Set or Reset Identify, move cursor onto selection, then press <Enter>.

  Physical                       Serial#     Adapter Port
                                             A1  A2  B1  B2       Status

  [TOP]
    systemname:pdisk11           AC50AE43    0   5                Good
    systemname:pdisk8            AC706EA3    1   4                Good
    systemname:pdisk2            AC1DBE11    2   3                Failed
    systemname:pdisk3            AC1DBEF4    3   2                Good
    systemname:pdisk7            AC50AE58    4   1                Good
    systemname:pdisk12           AC7C6E51    5   0                Good
    systemname:pdisk0            AC706E9A            0            Good
    ?????                                                        Good
    systemname:pdisk10           AC1DBE32                3        Good
  [MORE...4]




F3=Cancel          F10=Exit
```

This example screen shows a break in the SSA loop between the pdisk3 and pdisk1. In the condition shown by the display, the Ready lights on the pdisk3 and pdisk1 are both flashing.

To help locate these disk drives, select the pdisk, and press Enter. The Check light on the selected disk drive flashes. This action does not affect the customer's operations.

For more information about the service aids, see "Chapter 12. SSA Service Aids" on page 203.

Part 3. Appendixes

Appendix. Communications Statements

The following statements apply to this product. The statements for other products intended for use with this product appear in their accompanying manuals.

Federal Communications Commission (FCC) Statement

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 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. Neither the provider nor the manufacturer is responsible for any radio or television interference caused 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 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.

電波障害自主規制　届出装置の記述

この装置は，第一種情報装置（商工業地域において使用されるべき情報装置）で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会（VCCI）基準に適合しております。

従って，住宅地域またはその隣接した地域で使用すると，ラジオ，テレビジョン受信機等に受信障害を与えることがあります。

取扱説明書に従って正しい取り扱いをしてください。

VCCI Statement

The following is a summary of the VCCI Japanese statement.

This equipment is Type 1 Data Processing Equipment and is intended for use in commercial and industrial areas. When used in a residential area, or areas of proximity, radio and TV reception may be subject to radio interference. VCCI-1.

International Electrotechnical Commission (IEC) Statement

This product has been designed and built to comply with (IEC) Standard 950.

Avis de conformité aux normes de l'Industrie Canada

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Industry Canada Compliance Statement

This Class A digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

United Kingdom Telecommunications Requirements

This apparatus is manufactured to the International Safety Standard EN60950 and as such is approved in the U.K. under approval number NS/G/1234/J/100003 for indirect connection to public telecommunications systems in the United Kingdom.

European Union (EU) 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. Neither the provider or the manufacturer can accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of option cards not supplied by the manufacturer. Consult your dealer or sales representative for details for your specific hardware.

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 communications devices.

Attention: This is a Class A product. In a domestic environment, this product might cause radio interference. In such an instance, the user might be required to take adequate measures.

Radio Protection for Germany

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov. das EG–Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM Germany.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese Klasse von Geräten gilt folgende Bestimmung nach dem EMVG:

Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.

(Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

Hinweis:

Dieses Genehmigungsverfahren ist von der Deutschen Bundespost noch nicht veröffeentlicht worden.

Glossary

This glossary explains terms and abbreviations that are used in the manual. The glossary contains terms and definitions from the *IBM Dictionary of Computing*, ZC20-1699.

If you do not find the term or abbreviation for which you are looking, try the index or refer to the *IBM Dictionary of Computing*.

A

AIX. Advanced Interactive Executive.

AIX system disk. A disk that is owned by AIX; that is, it does not belong to an array, and it is not a hot spare disk.

array. See *disk array*.

attribute. A named property of an entity; for example, the attributes of a RAID array include state, current use, and size of array.

B

boot. To prepare a computer system for operation by loading an operating system.

buffer. A routine or storage that is used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to the other.

C

candidate disk. Disk drives that are available for use in an array.

D

daemon. In the AIX operating system, a program that runs unattended to perform a standard service. Some daemons are triggered automatically to perform their task; others operate periodically. Synonymous with demon.

Degraded state. The state that a RAID array enters if, while in the Exposed state, it receives a write command. See also *Exposed state*.

descriptor. In the AIX object data manager (ODM), a named and typed variable that defines one characteristic of an object.

device driver. (1) A file that contains the code needed to use an attached device. (2) A program that enables a computer to communicate with a specific peripheral device. (3) A collection of subroutines that control the interface between I/O device adapters and the processor.

DMA. Direct memory access.

DRAM. Dynamic random-access memory.

E

EEPROM. Electrically erasable read-only memory.

Exposed state. The state that a RAID array enters if a member disk drive becomes missing (logically or physically) from that array.

F

Failed status. The disk drive is not working.

fencing. SSA disk fencing is a facility that is provided in the SSA subsystem. It allows multiple using systems to control access to a common set of disk drives.

flag. A character that shows that a particular condition exists.

FRU. Field-replaceable unit.

G

GB. Gigabyte.

gigabyte (GB). 1000000000 bytes.

Good state. The state of a RAID array when all its member disk drives are present.

H

hdisk. A logical unit that can consist of one or more physical disk drives (pdisks). An hdisk in an SSA subsystem might, therefore, consist or one pdisk or several pdisks. An hdisk is also known as a LUN.

hot spare disk drive. A spare disk drive that is automatically added to a RAID array to logically replace a member disk drive that has failed.

I

interface. Hardware, software, or both, that links systems, programs, or devices.

IOCC. Input/output channel controller.

IPN. Independent Packet Network.

ISAL. Independent Network Storage Access Language.

K

KB. Kilobyte.

kernel. The part of the AIX operating system for RS/6000 containing functions that are needed frequently.

kernel mode. In the AIX operating system, the state in which a process runs in kernel mode. Contrast with *user mode*.

kilobyte (KB). 1000 bytes.

L

logical disk. An hdisk. See *hdisk*.

LUN. Logical unit. See also *hdisk*.

M

maintenance analysis procedure (MAP). A service procedure for isolating a problem.

MAP. See *maintenance analysis procedure*.

MB. Megabyte.

megabyte (MB). 1000000 bytes.

Member disk. A disk drive that is part of a RAID array.

microcode. One or more microinstructions used in a product as an alternative to hard-wired circuitry to implement functions of a processor or other system component.

N

node. In a network, a point at which one or more functional units connect channels or data circuits. For example, in an SSA subsystem, a disk drive or an adapter.

O

object data manager (ODM). In the AIX operating system, a data manager intended for the storage of system data.

ODM. Object data manager (ODM)

Offline state. The state that a RAID array enters when two or more member disk drives become missing.

P

page split. The separation of amounts of data in preparation for data transfer. AIX splits data on page boundaries, where a page is 4 KB.

parameter. A variable that is given a constant value for a specified application.

PCI. Peripheral Component Interconnect.

pdisk. Physical disk.

physical disk. The actual hardware disk drive.

POST. Power-on self-test.

power-on self-test (POST). A series of diagnostic tests that are run automatically by a device when the power is switched on.

R

RAID. Redundant array of independent disks.

RAID array. In RAID systems, a group of disks that is handled as one large disk by the operating system.

RAID manager. The software that manages the logical units of an array system.

Rebuilding state. The state that a RAID array enters after a missing member disk drive has been returned to the array or exchanged for a replacement disk drive. While the array is in this state, the data and parity are rebuilt on the returned or replacement disk drive.

Rejected disk. A failing disk drive that the array management software has removed from a RAID array.

Reserved status. The disk drive is used by another using system also.

router. A computer that determines the path of network traffic flow.

S

Serial Storage Architecture. An industry-standard interface that provides high-performance fault-tolerant attachment of I/O storage devices.

service request number. A number that helps you to identify the cause of a problem, the failing field-replaceable units (FRUs), and the service actions that might be needed to solve the problem. Service request numbers are generated by the system error-log analysis, system configuration code, and customer problem determination procedures.

SCSI. Small computer system interface.

SMIT. System management interface tool.

SRN. Service request number.

SSA. Serial Storage Architecture.

SSA unique ID. The specific identifier for a particular SSA device. Each SSA device has a specific identifier that is not used by any other SSA device in the whole world.

U

unrecoverable error. An error for which recovery is impossible without the use of recovery methods that are outside the normal computer programs.

user mode. In the AIX operating system, a mode in which a process is run in the user's program rather than in the kernel.

V

vary off. To make a device, control unit, or line not available for its normal intended use.

vary on. To make a device, control unit, or line available for its normal intended use.

vital product data (VPD). In the AIX operating system, information that uniquely defines system, hardware, software, and microcode elements of a processing system.

VPD. Vital product data.

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