

COMPAQ

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NetWare SFT III v3.11

Concepts and Installation

Compaq TechNote

Includes information on:

- Product architecture and theory of operation
- Planning and installation
- Troubleshooting and performance tuning

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COMPAQ TECHNOTE FOR NETWARE

NETWARE SFT III v3.11 CONCEPTS AND INSTALLATION

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CONTENTS

Chapter 1

INTRODUCTION

About This Compaq TechNote	1-1
NetWare SFT III Overview	1-2
Hardware Requirements	1-4
NetWare SFT III Features	1-5
Packet Burst	1-6
Dual Processing	1-6
Independent Routing	1-6
Split Seeks	1-7
New Console Commands and Utilities	1-8
Modified Console Commands and Utilities	1-9
SET Parameters	1-10
New Client Shells	1-11
Unsupported Products and Features	1-11
Unsupported Compaq Products and Features	1-12
Unsupported NetWare Products and Features	1-12
Other Unsupported Products	1-13

Chapter 2
NETWARE SFT III OPERATION

NetWare SFT III Architecture	2-1
NetWare SFT III Engine Naming Scheme	2-3
NetWare SFT III Addressing Scheme	2-3
Dual Processing	2-4
Server Synchronization Process	2-6
The Workstation's View	2-6
Server Failure Recovery	2-8
Primary Server Failure Recovery	2-8
Secondary Server Failure Recovery	2-8
Examples of Failure Recovery	2-9
Recovery Parameters	2-15

Chapter 3
PLANNING AND INSTALLATION

Planning	3-1
Planning Alternate Routing Paths	3-1
Using Redundant MSL Boards	3-2
Using Disk Fault Tolerance Technology With NetWare SFT III	3-3
Using a Print Server With NetWare SFT III	3-4



PLANNING AND INSTALLATION *(Continued)*

Installation	3-5
Preliminary Setup Checklist	3-5
Installing MSL Boards and Cables	3-6
.NCF Files	3-7
Implementing Dual Processing	3-8
Upgrading to NetWare SFT III	3-8
Installing Client Workstations	3-11
Test Mode Parameters	3-12
Adding Hardware to a NetWare SFT III Server	3-12
Adding System Memory	3-13
Adding a Hard Drive Subsystem Component	3-14

Chapter 4

TROUBLESHOOTING AND PERFORMANCE TUNING

Troubleshooting NetWare SFT III	4-2
Troubleshooting the Installation	4-5
Troubleshooting MSL Boards	4-6
Troubleshooting the LAN	4-10
Troubleshooting the Hard Drive Subsystem	4-13
Other Troubleshooting Tips	4-15

TROUBLESHOOTING AND PERFORMANCE TUNING (Continued)

Using the System Audit Parameters	4-16
Updating the NetWare SFT III Operating System	4-19
Performance Tuning NetWare SFT III	4-20

Appendix A

**MIRRORED SERVER LINK (MSL)
BOARD MANUFACTURERS**

Eagle NMSL -- Novell Mirrored Server Link	A-1
Microdyne NMSL -- Novell Mirrored Server Link	A-1
Thomas-Conrad 100-MB/s Solution for Novell NetWare SFT III Mirrored Server Link	A-2
PlainTree Systems, Inc. -- WaveBus MSL	A-2

Appendix B

EXAMPLES OF SYSTEM MESSAGE LOG FILES

<i>IO\$LOG.ERR</i>	B-1
<i>SYSS\$LOG.ERR</i>	B-3
<i>MSSTATUS.DMP</i>	B-4

Appendix C

EXAMPLE .NCF FILES

Example <i>IOSTART.NCF</i> File	C-1
Example <i>IOAUTO.NCF</i> File	C-2
Example <i>MSSTART.NCF</i> File	C-2
Example <i>MSAUTO.NCF</i> File	C-3



FIGURES

1-1. NetWare SFT III System	1-3
1-2. NetWare SFT III Independent Routing	1-7
2-1. NetWare SFT III Architecture	2-2
2-2. NetWare SFT III Addressing Scheme	2-4
2-3. NetWare SFT III Dual Processing	2-5
2-4. Primary Server Failure	2-7
2-5. Complete Failure of the Primary Server	2-10
2-6. Failure of the Primary Server Hard Drive Subsystem	2-11
2-7. Failure of the Primary Server NIC	2-12
2-8. Failure of the MSL	2-14
3-1. Alternate Routing Paths	3-2

TABLES

1-1. New Console Commands and Utilities	1-8
1-2. Modified Console Commands and Utilities	1-9
1-3. SET Parameters	1-10
3-1. .NCF Files	3-7
4-1. Troubleshooting Messages	4-3
4-2. Troubleshooting Error Conditions	4-4
A-1. MSL Board Manufacturers' Specifications	A-3



Chapter 1

INTRODUCTION

Today, network administrators are faced with increasing demands from network users to provide a system that has stable functionality and support. With this ever-increasing demand comes the challenge to provide increased server availability.

NetWare System Fault Tolerance (SFT) III v3.11 is a software solution that provides mirrored server fault tolerance. It allows increased server availability by mirroring the state of one network server to a second network server. It preserves existing hardware investments by using existing technology and supporting current disk and LAN drivers, as well as high-performance servers.

NetWare SFT III allows network administrators to maintain and upgrade mission-critical servers without interrupting application processing or client services. With the appropriate hardware and tape backup, it can provide around-the-clock operation and protection from any single server hardware failure, such as system processor, hard drive controller subsystem, system memory, or power failure.

ABOUT THIS COMPAQ TECHNOTE

This Compaq TechNote for NetWare is for systems integrators and network administrators with a knowledge of Compaq Server products and NetWare v3.11. It is a supplement to the Compaq product manual and the *NetWare SFT III* manual. It provides guidelines for installing and configuring a NetWare SFT III system.

The following topics are included:

- NetWare SFT III operation
- Planning and installation
- Troubleshooting and performance tuning



NETWARE SFT III OVERVIEW

NetWare SFT III v3.11 provides mirrored server fault tolerance, which allows for increased server availability. NetWare SFT III also provides for disaster recovery, such as recovery from building blackout or fire when the servers are located at different sites. It allows you to maintain and upgrade mission-critical servers without bringing down the system resources.

NetWare SFT III is the first version of NetWare to support more than one processor. Dual-processor support is provided by the operating system and a Compaq dual-processor device driver.



IMPORTANT: Dual processing is not a requirement for NetWare SFT III.

In a NetWare SFT III system, one network server is designated as the primary server, and the other network server is designated as the secondary server. The primary server processes requests and interacts with clients. The secondary server duplicates the processing, but does not interact with clients. The system memory and hard drives of both servers are synchronized so that the secondary server can immediately assume the role of the primary server in the event of a primary server failure.

The two servers are connected by a Mirrored Server Link (MSL) that provides a high-speed, off-the-network link. All network and server requests are transmitted across this link from the primary server to the secondary server. The servers are also connected to the LAN and should reside on the same internet.

Figure 1-1 illustrates a typical NetWare SFT III system.

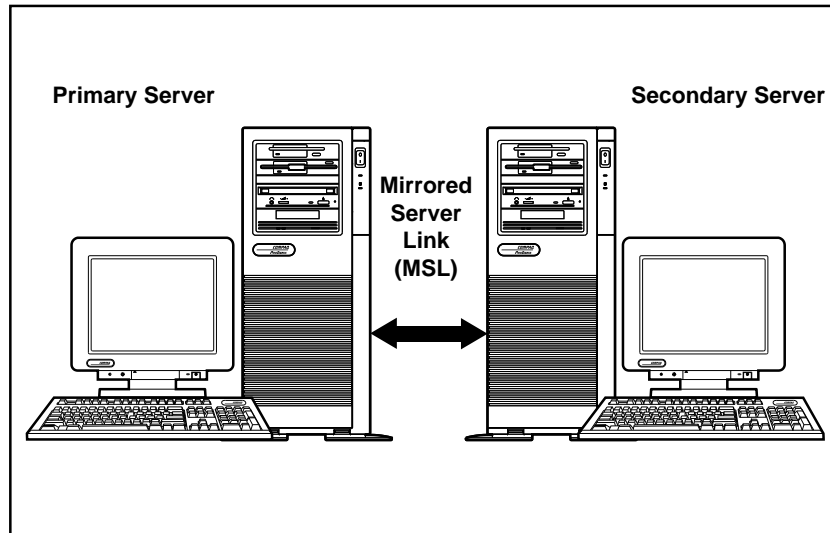


Figure 1-1. NetWare SFT III System

The MSL board is a dedicated, bi-directional link that connects the primary server to the secondary server and maintains the mirrored state of the NetWare SFT III system.

Several vendors currently provide MSL boards, such as Eagle Technology, Thomas-Conrad Corporation, PlainTree Systems, and Microdyne Corporation. These solutions are relatively close in specification, pricing, and speed. They have speed ratings at or slightly above 100 MB/s, but supported cable distances for each MSL board are different and should be investigated.

NOTE: Refer to Appendix A for detailed MSL specifications and information on MSLs.



HARDWARE REQUIREMENTS

NetWare SFT III hardware requirements include:

- Two servers with Intel 80386 (or greater) system processors. Ideally, these servers should be the same model and contain the same processor type, system memory, and disk storage capacity, as well as similar monitors (both monochrome or both color).
- Adequate system memory for a standard NetWare v3.11 installation plus an additional 2 megabytes of system memory for each server to handle the added requirements of NetWare SFT III mirroring.
- An MSL board for each server with the correct device drivers and cabling.
NOTE: MSL boards are discussed earlier in this chapter. Refer to Appendix A for more details.
- NIC for each server with the correct device drivers.
- Same brand and version of DOS (v3.1 or higher) on each server.

Use the following formula to estimate the *minimum system memory* requirements for your NetWare SFT III v3.11 servers based on total NetWare volume space.

For NetWare v3.11:

$$\frac{(0.023 * \text{total MB of volume})}{\text{volume block size in KB}} = \text{system memory} + 4 \text{ MB} = \text{Total}$$

For NetWare SFT III v3.11:

$$\left[\frac{(0.023 * \text{total MB of volume})}{\text{volume block size in KB}} = \text{system memory} + 4 \text{ MB} \right] + 2 \text{ MB} = \text{Total}$$

NOTE: Use 0.023 as the constant when configuring DOS volumes. Use 0.032 as the constant when configuring volumes for Name Space support. Refer to Chapter 3 of the *NetWare v3.11 Installation* manual for details.



For example, the minimum amount of system memory required for a NetWare SFT III system with 3.06 gigabytes of hard disk space is calculated as follows. This NetWare SFT III system includes 2.04 gigabytes of disk space for DOS volumes and 1.02 gigabytes of disk space for Name Space volumes.

For DOS Volumes:

$$\left[\frac{(0.023 * 2040)}{8 \text{ KB}} \right] = 5.865 \text{ MB}$$

For Name Space Volumes:

$$\left[\frac{(0.032 * 1020)}{8 \text{ KB}} \right] = 4.08 \text{ MB}$$

Total System Memory: 5.865 + 4.08 + 4 MB + 2 MB = 15.945 or 16 MB

NETWARE SFT III FEATURES

NetWare SFT III provides features that increase both server and network availability and minimize costly maintenance downtime. These features include:

- Packet burst
- Dual processing
- Independent routing
- Split seeks

NetWare SFT III also includes new console commands, NetWare v3.11 console commands that have been modified for NetWare SFT III, new SET parameters, and new client shells for workstations. These enhancements and modifications are also discussed in the following sections.

Packet Burst

NetWare SFT III includes packet burst functionality within the operating system. To take advantage of packet burst, the workstations must use the correct workstation support files.

NOTE: Refer to Chapter 3 of this Compaq TechNote for more details.

Dual Processing

NetWare SFT III is the first version of NetWare to support more than one processor. Dual processing is implemented by loading the dual-processor driver (*CPQMP.NLM*). All Compaq Servers that support multiple processors support NetWare SFT III v3.11 dual processing with *CPQMP.NLM*. It is available on NetWare Programs from Compaq (NPFC) version (v) 2.20 or later and in The Compaq Connection Forum on CompuServe.

Independent Routing

NetWare SFT III provides independent routing for each server. Each IOEngine acts as a protocol router or bridge, so that remote users can access network resources. For example, instead of installing another section of cabling between each server, you can install another NIC in one of the NetWare SFT III servers. Remote users can then use this NIC to access resources located on the internet connected to the other NetWare SFT III server. This implementation is recommended for users who would not lose productivity if the primary or secondary server fails.

Figure 1-2 illustrates independent routing. Workstation 2 (WS2) is connected to servers implementing Token Ring. WS2 can access resources on the Ethernet network, because the IOEngine of the secondary server has both Token Ring and Ethernet NICs installed. Workstation 1 (WS1) can communicate with the resources on the Ethernet network, because the primary server IOEngine has an ARCnet NIC installed.

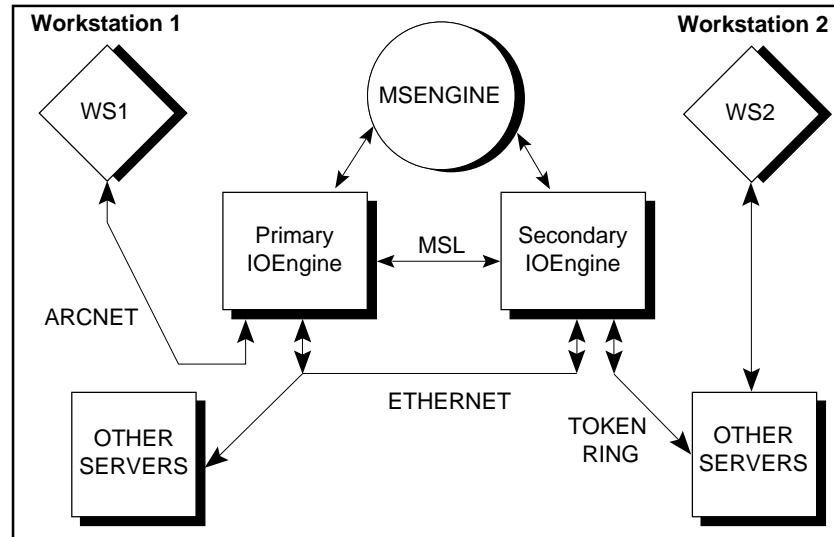


Figure 1-2. NetWare SFT III Independent Routing

Split Seeks

NetWare SFT III implements split seeks to service read requests efficiently. Read requests are sent to the primary server and across the MSL to the secondary server. If the primary server disk channel can process the read request, it services the request and cancels the response from the secondary server. Otherwise, the secondary server response is sent to the client.

New Console Commands and Utilities

Table 1-1 summarizes the new console commands for NetWare SFT III.

Table 1-1
New Console Commands and Utilities

Command/Utility	Function
ACTIVATE SERVER	Loads the MEngine, synchronizes the memory of both servers, and starts the disk remirroring process. Enter ACTIVATE SERVER at the IOEngine console on the server designed to be primary.
HALT	Stops the IOEngine on one NetWare SFT III server. Used when bringing a server down for maintenance. Enter HALT at the IOEngine console.
RESTART	Reloads the IOEngine on one NetWare SFT III server. Used to switch the roles of the servers. Enter RESTART at the IOEngine console.
MEMORY MAP	Displays the amount of system memory allocated to DOS, IOEngine, and MEngine. Used for troubleshooting memory size problems. Enter MEMORY MAP at the IOEngine or MEngine console.
MIRROR STATUS	Displays the status of the mirrored disk partitions. Used to determine how much of the partition mirroring process is complete. Enter MIRROR STATUS at the MEngine console.
<i>PROTO.NLM</i>	Displays LAN information. Similar to the LAN Information screen in the <i>MONITOR.NLM</i> under NetWare v3.11. Load <i>CLIB.NLM</i> , and then load <i>PROTO.NLM</i> in the IOEngine.
<i>DEVMON.NLM</i>	Displays more detailed LAN information than <i>PROTO.NLM</i> . Load <i>DEVMON.NLM</i> in the IOEngine.
<i>SET.NLM</i>	Menu driven utility for viewing and changing SET parameters. Load <i>SET.NLM</i> in the IOEngine.

NOTE: *SET.NLM* and *DEVMON.NLM* are part of the *SFTUTL.ZIP* file in the NOVLIB Forum on Compuserve.

Modified Console Commands and Utilities

Table 1-2 summarizes the modified console commands and utilities for NetWare SFT III.

Table 1-2
Modified Console Commands and Utilities

Command/Utility	Function
<i>INSTALL.NLM</i>	NetWare SFT III installation supports new <i>.NCF</i> files. It also supports copying System and Public files from any source location. These files are located in the SYS volume. Load <i>INSTALL.NLM</i> at the MEngine.
<i>MONITOR.NLM</i>	Some features in <i>MONITOR.NLM</i> do not support NetWare SFT III. The LAN Information and Processor Utilization screens are not available. Since <i>MONITOR.NLM</i> is loaded in the MEngine, the information provided on these screens is not available. Load <i>MONITOR.NLM</i> at the MEngine.
CONFIG	The CONFIG command provides detailed information about network addressing and engine naming in the NetWare SFT III configuration. Enter CONFIG at the MEngine or IOEngine.
MEMORY	Displays information on the amount of system memory used by each engine. It also lists the amount of system memory borrowed by each engine. Enter MEMORY at the MEngine or IOEngine.

SET Parameters

NetWare SFT III includes 8 new SET parameters for the MEngine and 39 for the IOEngine. The following table describes SET parameters discussed in this Compaq TechNote. Refer to Chapter 3 of the *NetWare SFT III* manual for a complete description of all NetWare SFT III parameters.

**Table 1-3
SET Parameters**

Command/Utility	Description
SET MEMORY PARITY ERROR RECOVERY OPTION PARAMETER	Defines the recovery behavior of the server when a memory parity error is detected.
SET COMM DEADLOCK DETECT WAIT TIME	Defines how long the server waits before it determines a "Comm Deadlock" condition.
SET COMM DRIVER STUCK RECOVERY OPTION	Determines the recovery behavior of the primary or secondary server if there are packets in the MSL queues that are not being transmitted.
SET CONCURRENT REMIRROR REQUESTS	Reduces the time needed to remirror the disks.
SET IPX INTERNET DOWN WAIT TIME	Defines how long the IOEngine waits before determining that the IPX connection is down.
SET NEW START ADDRESS FOR UNCLAIMED MEMORY BLOCK	Allocates additional system memory to the IOEngine.
SET COMPREHENSIVE MSENGINE SYNCHRONIZATION CHECK	Enables and disables the comparison between the primary server and secondary server MEngine output.
SET ENABLE IPX CHECKSUMS	Ensures that the packets transmitted by the workstation are the same packets received by the server.
SET CHECK SERVER TO SERVER COMM	Ensures the integrity of a communication link. It enables CRC checking of all MSL packet traffic.
SET ENABLE DISK READ AFTER WRITE VERIFY	Verifies each IOEngine disk write operation, while the MEngine performs other tasks.

NOTE: Refer to Chapter 4 of this Compaq TechNote for further explanation of parameters used in a NetWare SFT III configuration.



New Client Shells

Workstation support files are shipped with NetWare SFT III; however, these files are not the latest files available. To implement full DOS client workstation support for NetWare SFT III, you must use the Virtual Loadable Module (VLM) client software in the NetWare Client Kit for DOS/Windows (version 1.02 or later).

Earlier versions of the workstation support files, such as the DOS ODI Workstation Services files that ship with NetWare SFT III, will also work, but they do not provide full support for the features of the operating system. Client workstations running earlier versions of the workstation support files (before version 3.31) may experience a time-out when a server switchover occurs. The support files in the NetWare DOS/Windows Client Kit allow the workstation to wait for a switchover to occur in the event of a primary server failure.

NOTE: You can order the NetWare DOS/Windows Client Kit by calling 1-800-UPDATE1. You can also download the DOS/Windows Client Kit from CompuServe.

UNSUPPORTED PRODUCTS AND FEATURES

NetWare SFT III is based on NetWare v3.11; however, due to changes made in the operating system to incorporate NetWare SFT III functionality, some features and products supported under NetWare v3.11 are not supported under NetWare SFT III v3.11. These unsupported features and products should be available with future releases of NetWare SFT III.

Unsupported Compaq Products and Features

Due to the architectural changes made to NetWare v3.1x to provide NetWare SFT III v3.11 functionality, NetWare SFT III does not support all current NetWare v3.1x NLMs written by Compaq, including Compaq Server Manager/R support software, Compaq Insight Management Agent NLMs, *CPQDAOPT.NLM*, and SBACKUP with Compaq Fast-SCSI-2 Controllers.

The NetWare SFT III design is incompatible with the technology used in Compaq server management products. Novell and Compaq are working closely together to provide a Compaq Insight Manager solution for NetWare SFT III with a resolution anticipated for NetWare SFT III 4.0.

Unsupported NetWare Products and Features

The following NetWare products and features are not supported in a NetWare SFT III v3.11 environment:

- NetWare NFS
- NetWare for SAA
- NetWare FTAM
- NetWare for Macintosh
- NetWare Name Service
- NetWare Management Services
- *PATCHMAN.NLM* for NetWare v3.11

NOTE: All other NetWare v3.11 patches have been included in the NetWare SFT III operating system.

- Packet burst for extended system memory and expanded memory shells
- IPX checksums for 802.3 Ethernet frame types
- LAN Information and Processor Utilization screens in *MONITOR.NLM*
- Edit System *AUTOEXEC.NCF* File option in the SYSCON utility



NOTE: *MONITOR.NLM* does not provide LAN information, because *MONITOR.NLM* is loaded in the MSEngine. You can obtain LAN information by viewing the information monitored by *PROTO.NLM* or *DEVMON.NLM*. Refer to Table 1-1 in this Compaq TechNote for information on *PROTO.NLM* and *DEVMON.NLM*.

Other Unsupported Products

NetWare SFT III does not support the following third-party products:

- OS/2 versions earlier than 2.0
- TCP/IP and AppleTalk protocols
- Folio infobase for on-line help



Chapter 2

NETWARE SFT III OPERATION

To install and troubleshoot your NetWare SFT III system, you must thoroughly understand the product architecture and theory of operation. This chapter provides detailed architecture and operations information, including a description of NetWare SFT III software engines and their operations, the server synchronization process, a series of failure and recovery scenarios, and a discussion of recovery parameters.

NETWARE SFT III ARCHITECTURE

The NetWare SFT III operating system, shown in Figure 2-1, is divided into two engines. These engines are the Input/Output Engine (IOEngine) and the Mirrored Server Engine (MSEngine). Each server has an MSEngine and IOEngine. The MSEngine provides network and file services to attached clients.

The MSEngines are mirrored and maintain the mirrored state of the NetWare SFT III system. This mirroring is represented in Figure 2-1 by the horizontal box enclosing each MSEngine. For example, if you load *MONITOR.NLM* on the primary server, the MSEngine automatically loads *MONITOR.NLM* on the secondary server. You can see this mirroring by viewing keystrokes on the secondary server monitor as you type them on the primary server keyboard.

The MSEngine also controls and responds to events that are not hardware-related. For example, all memory caching, file caching, volume information, name spaces, application NLMs, and user connections are controlled and maintained by the MSEngine. The arrows in Figure 2-1 represent "event" and "request" queues. These queues allow the MSEngine and the IOEngine of each server to communicate.

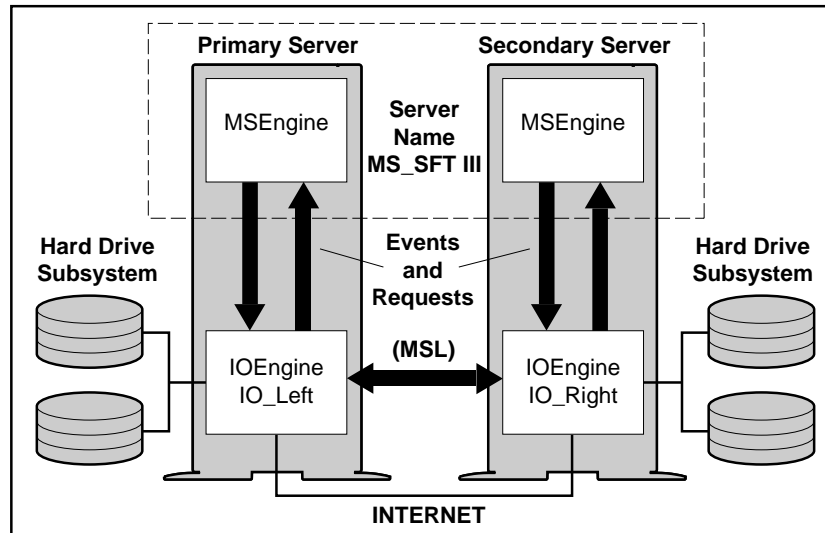


Figure 2-1. NetWare SFT III Architecture

In Figure 2-1, the name of the NetWare SFT III system is MS_SFT III. Each IOEngine has a unique name (for example, IO_LEFT and IO_RIGHT). The IOEngines are connected by the MSL and the LAN or internet.

The IOEngines contain all hardware device drivers and are not mirrored for two reasons:

- Each server can have dissimilar hardware; therefore, the software controlling this hardware cannot be mirrored.
- The IOEngines must be independent, so that if the IOEngine fails on the primary server, the secondary IOEngine can assume control.

The IOEngine controls and responds to hardware events. For example, the IOEngine controls all hard drives, NICs, and tape drives.



NetWare SFT III Engine Naming Scheme

The MEngine and each IOEngine must have unique names. The MEngine name corresponds to the server name as seen by the user. The IOEngine names distinguish the two IOEngines and aid in configuring and troubleshooting the NetWare SFT III system.

The MEngine name should follow your existing server naming scheme or define the two mirrored servers as a NetWare SFT III system. The IOEngine names should be unique and distinguishable by their location. For example, if the servers are next to each other, IO_LEFT and IO_RIGHT may be appropriate. If the servers are separated by buildings or rooms, an IOEngine name with the building and room number B1R110 would be adequate to distinguish the server's location.



IMPORTANT: The name used for the MEngine and for each IOEngine must be unique. Choose names that are short, easy to understand, and correspond to existing server naming conventions.

NetWare SFT III Addressing Scheme

The following comparison of NetWare SFT III and NetWare v3.11 emphasizes the flexible addressing scheme used by NetWare SFT III. This flexible scheme supports dynamic routing.

In NetWare v3.11, there is one internal IPX network number. The client workstation connects to the server using the internal IPX network number, because this number advertises the best route for the client workstation to access the server.

NetWare SFT III has three internal IPX network numbers: one number for the MEngine and one number for each IOEngine. During NetWare SFT III operation, workstations communicate with the MEngine via the primary server IOEngine address. The workstations use this address to find the best path to the MEngine.

Figure 2-2 shows the IPX network numbers for the MSEngines and the two IOEngines.

The internal IPX network number for the MEngine and the two IOEngines must be unique. The IOEngines have a unique address, because there is a constant communication between the two IOEngines over the LAN. This communication is performed via "I'm alive" packets. As illustrated in Figure 2-2, each IOEngine broadcasts packets to the other IOEngine to signal continuous functionality.

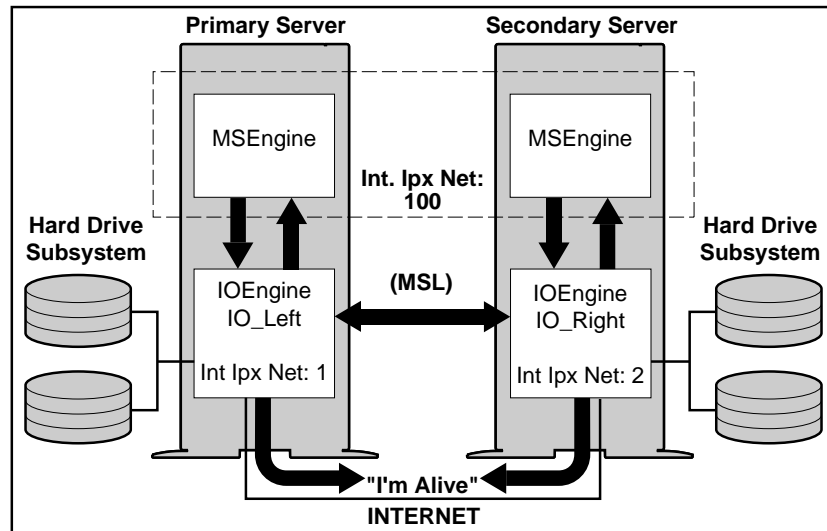


Figure 2-2. NetWare SFT III Addressing Scheme

Dual Processing

In NetWare SFT III, each engine (MSEngine and IOEngine) executes program code on one processor until you load the dual-processor driver. The communication between the first processor (P1) and second processor (P2) is reserved for the operating system. Once you have loaded the driver, the IOEngine is loaded onto P1, and the MEngine is loaded onto P2.

For dual-processing support, you must load the NetWare SFT III driver *CPQMP.NLM* in each IOEngine. When the driver is loaded, MEngine processing is transferred to P2. IOEngine processing remains on P1. When the driver is unloaded, MEngine processes are transferred back to P1. Figure 2-3 illustrates this process.



IMPORTANT: *CPQMP.NLM* must be loaded before any other drivers or commands in the *IOSTART.NCF* file. See Appendix C of this Compaq TechNote for an example *IOSTART.NCF* file.

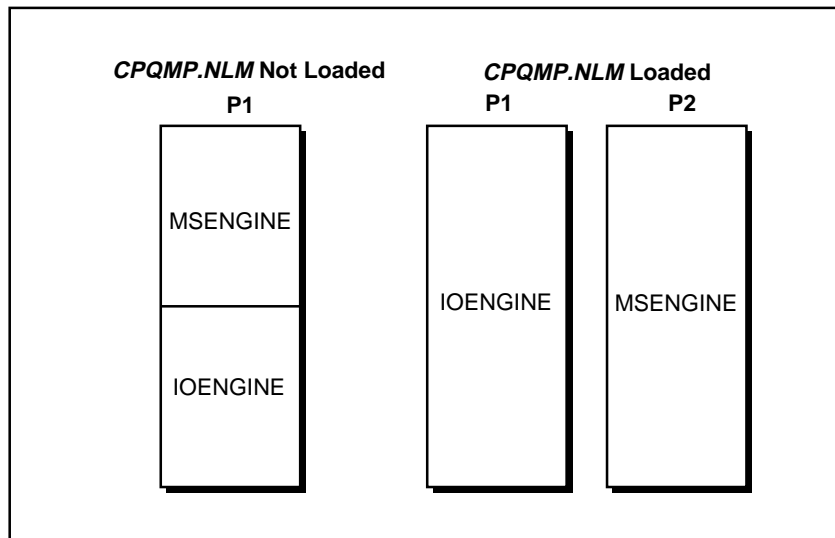


Figure 2-3. NetWare SFT III Dual Processing

NOTE: *CPQMP.NLM* is available on NetWare Programs from Compaq v2.20 or later and in The Compaq Connection Forum on CompuServe.

SERVER SYNCHRONIZATION PROCESS

To create a mirrored server state, NetWare SFT III mirrors the system memory and then the hard drive subsystem. Resynchronization occurs when you initially configure the NetWare SFT III servers, shut down a server for preventive maintenance then restart it, or after a server failure when you restart the failed server. For example, server A is the primary server, and server B is the secondary server. If server A fails, server B assumes control as the primary server. Once server A is repaired or the failure is corrected, server A resumes operation as the secondary server. Server A assumes its role as secondary server, when the system memory contents of server B are copied across the MSL to server A.

While the system memory copying takes place, all other NLM and workstation activity is suspended. This is called *blocking*. During blocking, maintaining the mirrored state of the NetWare SFT III system is the highest priority of the operating system. Workstations experience some delay in response time during blocking, but they will not lose the connection to the NetWare SFT III system.

After the system memory contents are copied from the primary to the secondary server, the disk partitions are mirrored. Concepts of controller duplexing with NetWare v3.11 can be applied to controller duplexing with NetWare SFT III. NetWare SFT III mirrors the disks across the MSL as a background task.

When one NetWare SFT III server halts for any reason, the other server begins a Disk Change Map. This map records changes that occur while the server is down. Once the server is operational, only the disk changes are remirrored.

THE WORKSTATION'S VIEW

During NetWare SFT III operation, workstations communicate with the MSEngine via the primary server IOEngine (PIO) address. Figure 2-4 describes the workstation's view during a failure of the primary server. In Figure 2-4, the PIO address is A. The workstation uses this address to find the best path to the MSEngine.

As shown in Figure 2-4, when the primary server IOEngine is inaccessible, the workstation no longer receives acknowledgments from the primary server IOEngine (PIO) address A. The secondary server IOEngine (SIO) address B notices that the PIO is inaccessible and alerts the workstation to change its path address from A to B. The workstation recognizes address B as the best path to the MSEngine. In some cases, the workstation loses packets during a primary server failure, but the lost packets are recovered via the LAN communication protocol once the failure recovery takes place.

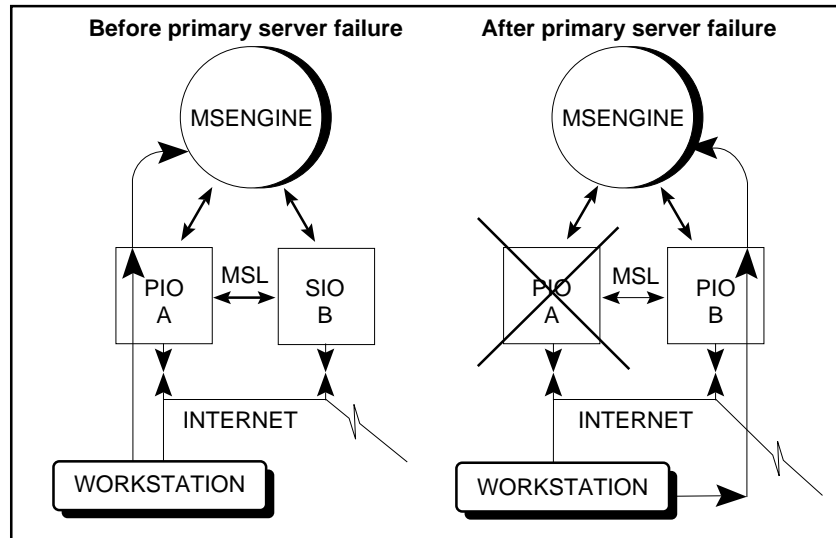


Figure 2-4. Primary Server Failure

SERVER FAILURE RECOVERY

This section describes the step-by-step process of the primary and secondary server recovery operation, including four examples of failure recovery.

Primary Server Failure Recovery

When the primary server fails, the following occurs:

1. The secondary server examines acknowledgments across the MSL and checks the internet for "I'm alive" packets.
2. The secondary server receives no acknowledgments across the MSL and no "I'm alive" packets across the internet.
3. The secondary server declares itself as primary server, because there is no communication from the primary server IOEngine.
4. The new primary server IOEngine signals workstations to change their route to the MEngine. One Router Information Packet (RIP) is broadcast to accomplish this change.
5. The workstations access the MEngine via the new route.
6. Lost packets are resent by the LAN communication protocol.
7. System message log files are updated.

NOTE: Refer to Appendix B for examples of system message log files.

8. The new primary server's Disk Change Map is updated.

Secondary Server Failure Recovery

When the secondary server fails, the following process occurs:

1. The primary server examines acknowledgments across the MSL and checks the internet for "I'm alive" packets.
2. The primary server receives no acknowledgments across the MSL and no "I'm alive" packets across the internet.



3. System message log files are updated.

NOTE: Refer to Appendix B for examples of system message log files.

4. Since the secondary IOEngine has failed, independent routing is lost.
5. The primary server's Disk Change Map is updated.

Examples of Failure Recovery

This section examines component failures of a NetWare SFT III system. Examining these scenarios can help you understand how NetWare SFT III responds to these failures. This information is valuable when installing, configuring, or troubleshooting a NetWare SFT III system. The example component failures are:

- Complete power loss.
- Primary server hard drive failure.
- Primary server NIC failure.
- MSL failure.

COMPLETE POWER LOSS

Figure 2-5 represents a complete failure of the primary server due to power loss. This example assumes that no UPS is used when the failure occurs and each server has a different power source. In this scenario, the secondary server receives no acknowledgments across the MSL and no "I'm alive" packets across the LAN or internet. The secondary server assumes full control, because the secondary server has determined that the primary server has failed.

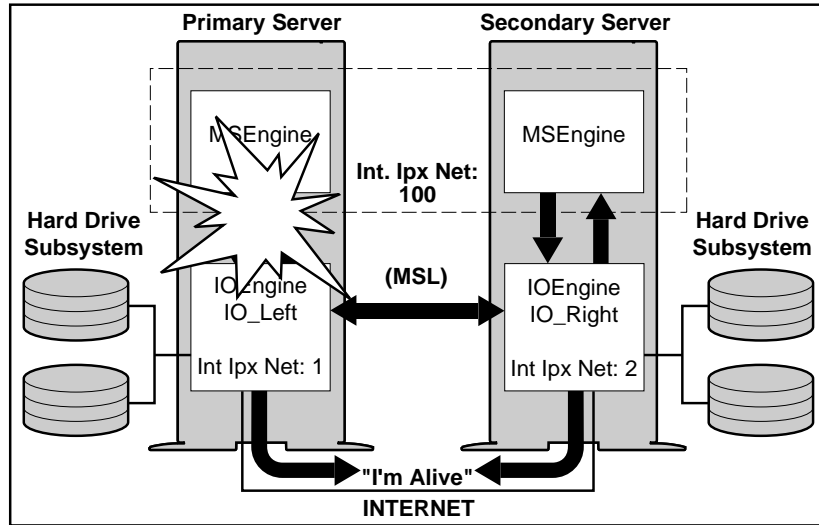


Figure 2-5. Complete Failure of the Primary Server

PRIMARY SERVER HARD DRIVE FAILURE

Figure 2-6 illustrates a failure of the primary server hard drive subsystem. A client workstation initiates a disk request by communicating with the primary server IOEngine. Since the primary server hard drive has failed, the request is then sent across the MSL to the secondary server IOEngine for servicing. The response, if needed, is sent back across the MSL to the IOEngine of the primary server, and the primary server IOEngine services the client workstation request.

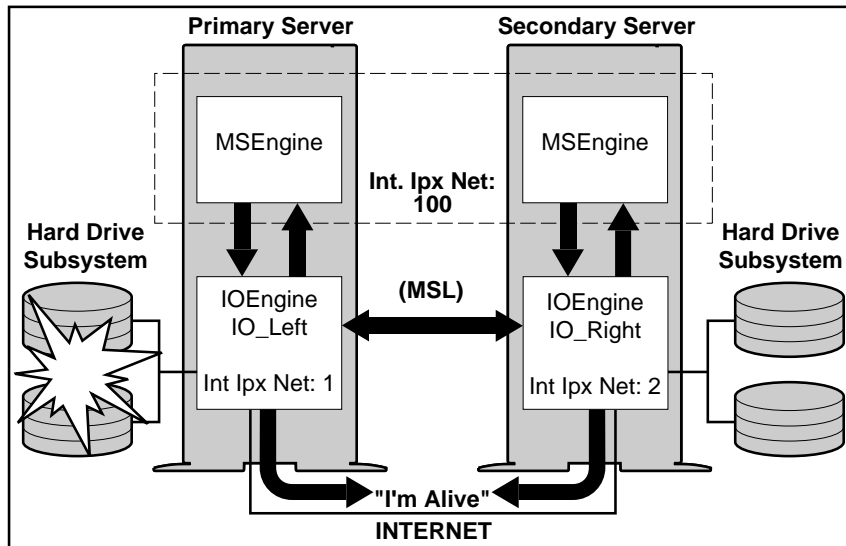


Figure 2-6. Failure of the Primary Server Hard Drive Subsystem



IMPORTANT: The primary server is still active if a primary hard drive failure occurs. In this case, additional overhead is required, because the client workstations are communicating with the primary server and using the secondary server hard drive subsystem. Perform a forced switchover by entering **RESTART** at the primary server IOEngine console to increase performance and to correct any hard drive problems on the primary server.

PRIMARY SERVER LAN COMMUNICATION FAILURE

Figure 2-7 represents a LAN communication failure in the primary server. A communication failure can occur as a result of one of the following:

- The Network Interface Controller (NIC) in the primary server fails.
- The NIC in the secondary server fails.
- The cabling between the two IOEngines fails.
- The LAN device driver is unstable, and the network communication degrades.

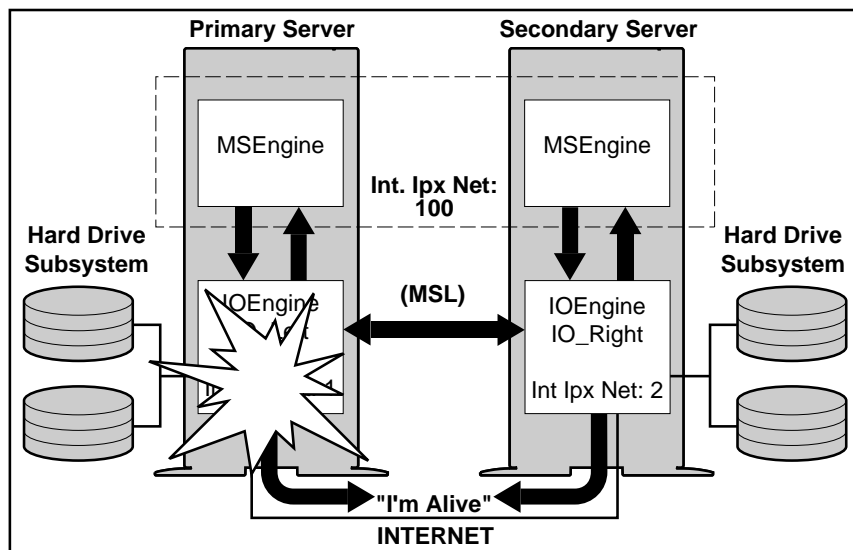


Figure 2-7. Failure of the Primary Server NIC



The two IOEngines constantly communicate to determine which IOEngine is properly functioning. The ability of each server to transmit and receive packets is monitored by each IOEngine. If one of the primary server NICs stops transmitting or receiving packets, the secondary server assumes the role of the primary server as long as the secondary server NICs are more functional than the primary server NICs, the servers are synchronized, and the hard drives are mirrored.

If a secondary server NIC fails, the primary server receives a message of the failure, and operations continue. Since the client workstations are communicating with the primary server, no role-swapping occurs. If neither IOEngine can transmit or receive packets from the NICs, then the primary server resumes its role.



CAUTION: During any hardware failure on either server, the NetWare SFT III system becomes vulnerable. Should a hardware failure occur on one server while the other server requires maintenance, the network must halt operation until at least one server is repaired.

MSL FAILURE

Figure 2-8 represents a failure of the MSL. There are three potential points of failure in the MSL:

- MSL cable
- MSL board in the primary server
- MSL board in the secondary server

If there is a failure of any of these points, the secondary server restarts, and no switchover occurs. The secondary server does not synchronize with the primary server until the MSL error is corrected. The restart occurs because the secondary server IOEngine continues communicating with the primary server through the internet though it cannot communicate through the MSL.

Since the highest priority of the NetWare SFT III system is to maintain a mirrored state, and a failure of the MSL violates this state, the secondary server must assume that the primary server is still active. As long as the two servers can still communicate over the MSL, operation continues without a switchover.

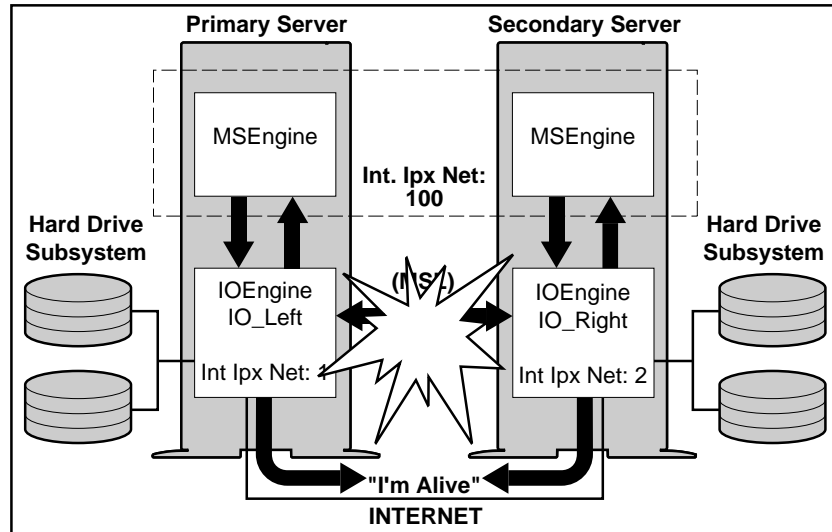


Figure 2-8. Failure of the MSL

NOTE: Refer to Chapter 3 for additional information on MSL board failure.



IMPORTANT: To begin server synchronization after an MSL error is corrected, you must unload, then reload, the MSL driver in one of the IOEngines. Refer to "Troubleshooting MSL Boards" in Chapter 4 of this Compaq TechNote for more details.



Recovery Parameters

NetWare SFT III can automatically recover from a server ABEND in the IOEngine. If an ABEND occurs in the IOEngine of the primary server, the secondary server assumes control, and the primary server restarts.

The behavior of a failed server can be customized using the 14 recovery SET parameters provided in NetWare SFT III. For example, a server experiencing a memory parity error will automatically restart. To stop the server and identify the error, you can set the SET MEMORY PARITY ERROR RECOVERY OPTION PARAMETER to 0. It is not always necessary to power down the server to recover from this type of error. This setting stops the server from restarting and displays the ABEND message.

NOTE: Refer to Table 3-3 of the *NetWare SFT III* manual for detailed information on SET parameters.



Chapter 3

PLANNING AND INSTALLATION

This chapter provides planning and installation guidelines for a NetWare SFT III system. These guidelines are not comprehensive; they are supplemental to the instructions in the *NetWare SFT III* manual.



IMPORTANT: Before proceeding with installation, refer to Chapter 2 of this Compaq TechNote for a detailed explanation of NetWare SFT III architecture.

PLANNING

Planning your NetWare SFT III system is essential to your system's reliability. Redundant hardware and multiple communication paths are vital to ensuring that loss of data and user productivity is minimal in the event of a hardware component or server failure. This section includes:

- Planning alternate routing paths.
- Using redundant MSL boards.
- Using disk fault tolerance technology with mirrored server technology.
- Using a print server with NetWare SFT III.

Planning Alternate Routing Paths

Alternate routing paths are essential for successful implementation of NetWare SFT III. When the primary and secondary servers are located across a large internet, the many bridges and routers between the two servers represent possible points of failure.

Figure 3-1 illustrates an example of alternate routing paths. The IOEngines communicate over the internet. If there is only one path for this communication, one hardware failure in the cabling can compromise the fault tolerance of the NetWare SFT III system. Providing additional paths ensures that the two IOEngines continue to communicate even if the primary communication path fails. In the example shown in Figure 3-1, if bridge/router B1 fails or is removed from the network, the primary and secondary servers can communicate through bridge/router B2.

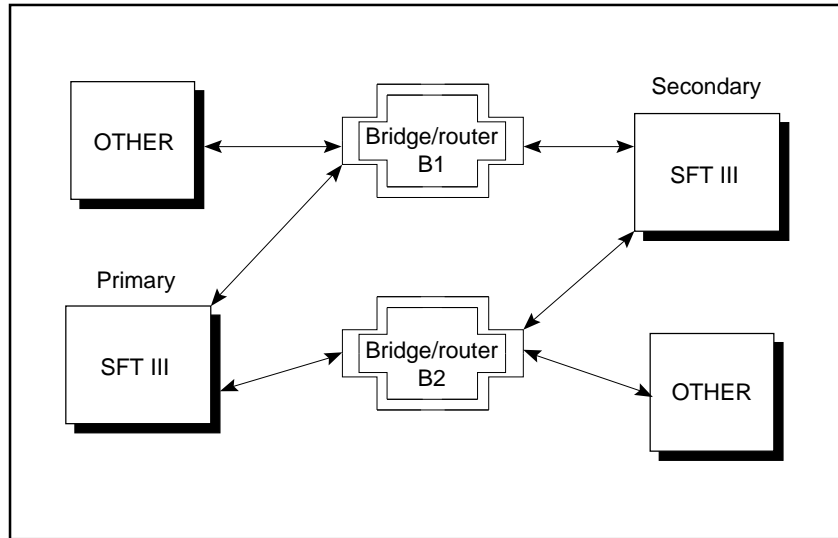


Figure 3-1. Alternate Routing Paths

Using Redundant MSL Boards

NetWare SFT III v3.11 has one unrecoverable point of failure. If the MSL board fails in the primary server, then this server must be brought down for repair. This action compromises the fault tolerance of NetWare SFT III.



To eliminate this problem, install redundant MSL boards. If the MSL board fails in the primary server, the driver for the redundant MSL board is loaded in the IOEngine of each server, and the NetWare SFT III system can return to a mirrored state. You can use any of the MSL boards discussed in Appendix A, or you can use NICs with MSL drivers.

Using Disk Fault Tolerance Technology With NetWare SFT III

Implementing disk fault tolerance technology in addition to mirrored server technology has advantages and disadvantages. The primary advantage to implementing disk fault tolerance technology with NetWare SFT III is the security of a second level of fault tolerance. If a hard drive fails on the primary server, the disk fault tolerance implementation recovers without switching to the secondary server.

There are several disadvantages to using disk fault tolerance technology:

- When a hard drive fails in the primary server, the disk fault tolerance implementation recovers from the failure. However, you are informed of the failure only on the console, unless you are using a network or server management application.
- Disk fault tolerance technology requires extra disk storage, which increases the hardware cost of the NetWare SFT III system. In a NetWare SFT III system, the servers include identical storage systems that provide fault tolerance.
- Disk fault tolerance technology can provide additional system overhead, thus slowing down the NetWare SFT III system.



Using a Print Server With NetWare SFT III

Using a NetWare v3.1x server as a print server is a common solution for many printing needs; however, installing a print server on a NetWare SFT III mirrored server is more complex. What happens if the primary server fails while servicing a print job in a queue that contains multiple print jobs?



IMPORTANT: The optimal solution is to *avoid* loading any print server on your NetWare SFT III system.

Although it is not the optimal solution, you can implement print services on a NetWare SFT III system. The print server is loaded in the IOEngine of each NetWare SFT III server, creating two independent print servers. When you implement a print server on the NetWare SFT III system, printing fault tolerance is not available. When a server fails, the print server halts, and the other print server does not assume control.



CAUTION: If you choose to use the primary server as a print server and the primary server fails, the print jobs are lost.

The optimal solution in a NetWare SFT III environment is to implement a print server using a separate server or workstation with third-party products and system utilities, or using a network printer that functions as a print server, such as the Compaq PageMarq.



INSTALLATION

Chapter 2 of the *NetWare SFT III* manual provides installation instructions. The following sections are supplemental to the *NetWare SFT III* manual. Use the following checklist to ensure successful implementation of your NetWare SFT III system.

Preliminary Setup Checklist

- Install Compaq hardware. _____
- Install MSL boards. _____
- Configure the hardware using the Compaq EISA Configuration Utility.
Select NetWare as the primary operating system. _____
- Create and format the DOS partitions. _____
- Copy needed system files to the DOS partitions. _____
- Copy Compaq drivers from NPFC v2.20B or later to the DOS partitions. _____
- Create *IOSTART.NCF* files. _____
- Execute *MSERVER.EXE*. _____
- Load the hard disk device driver(s). _____
- Load the NIC driver(s). _____
- Enter ACTIVATE SERVER at the primary server IOEngine. _____
- Create the NetWare partitions. _____
- Mirror the NetWare partitions. _____
- Create the NetWare volumes. _____
- Copy the System and Public files. _____
- Create the remaining *.NCF* files. _____
- Restart both servers. _____
- Begin NetWare SFT III operation. _____

NOTE: See Appendix C of this Compaq TechNote for an example *IOSTART.NCF* file.

The Compaq device drivers for NetWare SFT III are the same as those used for NetWare v3.11. They are available on NPFC v2.20B or later. Copy the System and Public files while the systems are mirrored to ensure that the partitions are fully mirrored after the installation.

Installing MSL Boards and Cables

Most MSL boards discussed in Appendix A of this Compaq TechNote have installation manuals that accompany them. The Eagle Technology, Microdyne, and PlainTree solutions include documentation specifically for their MSL solutions. The Thomas-Conrad MSL solution refers to the *TCNS Adapter User Guide* for installation instructions.

If your implementation includes fiber optic cabling for your MSL, the communication must be bi-directional. To accomplish this bi-directional communication, use two cables to connect the transmit port of one MSL board to the receive port of the other MSL board. For example, if you connect a cable to the top port of the primary server MSL board, then connect the same cable to the bottom port of the secondary server MSL board. This concept also applies to the coaxial version of the Eagle Technology MSL product and the Microdyne product. The Thomas-Conrad coaxial versions use one cable to connect the two MSL boards.

To ensure that there are no I/O address, memory address, or interrupt conflicts, run the Compaq EISA Configuration Utility after installing the MSL boards.



IMPORTANT: Different MSL boards require between 16 and 32 Kbytes of base memory, so there may be conflicts between memory-mapped NICs like the IBM 16/4 Token-Ring Adapter and MSL boards.

You can improve MSL board performance by placing the board at a higher priority interrupt (IRQ9, IRQ10, or IRQ11).

.NCF Files

NetWare SFT III has seven .NCF files in one of three different locations. The following table describes each file, its location, and its purpose.

NOTE: See Appendix C of this Compaq TechNote for examples of these files.

Table 3-1
.NCF Files

File Name	# of Files	Location	Purpose
<i>IOSTART.NCF</i>	2	DOS partition of each server	These files name and assign an address to the IOEngine. The disk, LAN, and MSL drivers are loaded from these files. SET parameters are also defined.
<i>IOAUTO.NCF</i>	2	DOS partition of each server	These files contain load commands for I/O-related NLMs that need to access the MSEngine or the SYS volume, such as a server-based backup application. No SET parameters are defined in these files.
<i>MSSTART.NCF</i>	2	DOS partition of each server	These files define SET parameters for server startup. They must be identical. For example, the SET MINIMUM PACKET RECEIVE BUFFERS parameter resides in these files.
<i>MSAUTO.NCF</i>	1	SYS volume in the \SYSTEM subdirectory	One <i>MSAUTO.NCF</i> file exists on the SYS volume in the \SYSTEM subdirectory. This file names and assigns an address to the server. All load commands for application NLMs are defined in this file. For example, <i>MONITOR.NLM</i> and application NLMs are loaded from this file.

NOTE: The *IOAUTO.NCF* file is not executed automatically when the NetWare SFT III system is first activated. You must enter the following at each IOEngine to initiate the commands defined in the *IOAUTO.NCF* file:

IOAUTO

Once the system is activated, subsequent server restarts will automatically execute the *IOAUTO.NCF* file.

Implementing Dual Processing

NetWare SFT III implements asymmetric dual processing in the operating system by loading a dual-processor device driver in the IOEngine of a server with two processors. *CPQMP.NLM*, the dual-processor device driver for Compaq Servers, can be loaded or unloaded at any time. When the driver is loaded, all MEngine processes are moved to the second processor. All IOEngine processes remain on the first processor. Figure 2-3 of this Compaq TechNote illustrates this concept.

NOTE: *CPQMP.NLM* is available on NetWare Programs from Compaq v2.20B or later and in The Compaq Connection Forum on CompuServe.



IMPORTANT: *CPQMP.NLM* must be loaded before any other drivers or commands in the *IOSTART.NCF* file. See Appendix C of this Compaq TechNote for an example *IOSTART.NCF* file.

Upgrading to NetWare SFT III

If you are upgrading from a NetWare v2.x server to a NetWare SFT III server, you must upgrade the server to NetWare v3.11 first. Refer to Chapter 2 of the *Novell NetWare Version 3.11 Installation* manual for detailed information on this topic.

If you are upgrading from a NetWare v3.11 environment, use the following procedure. The upgrade process includes converting an existing NetWare v3.11 server to a NetWare SFT III server and then installing the secondary server as a mirrored partner to the primary server.



IMPORTANT: Review the entire upgrade procedure before beginning the upgrade process.

1. Before shutting down the server, back up the server to be upgraded.
2. Load *INSTALL.NLM* and edit the *AUTOEXEC.NCF* file as follows:
 - a. Replace "file server name" with "msengine name."
 - b. Replace "IPX internal net" with "msengine IPX internal net."
 - c. Delete all other commands in the file.
3. Log into the server and copy the *AUTOEXEC.NCF* file from the \SYSTEM subdirectory of the SYS volume to *MSAUTO.NCF* file.
4. Shut down the server.



IMPORTANT: Steps 5 through 9 must be performed on both servers.

5. Install the MSL boards and run the Compaq EISA Configuration Utility.
6. Create a subdirectory on the DOS partition for the NetWare SFT III System files.

7. Copy the following System files into the DOS subdirectory:

All Disk, LAN, and MSL drivers
VREPAIR.NLM
MONITOR.NLM
MSERVER.EXE
PROTO.NLM
CLIB.NLM
STREAMS.NLM
INSTALL.NLM

8. Create the *IOSTART.NCF* file.

NOTE: Refer to Appendix C, "Upgrading from NetWare v3.11," in the *NetWare SFT III* manual for details and an example.

9. Start NetWare SFT III by entering the following at each server:

MSERVER

10. Initiate the MEngine of the primary server by entering the following at the IOEngine prompt:

ACTIVATE SERVER

11. Load *INSTALL.NLM* by entering the following at the MEngine prompt:

LOAD C: INSTALL

NOTE: *INSTALL.NLM* must be loaded from the DOS partition, because the *SYS:\SYSTEM* subdirectory contains the NetWare v3.11 *INSTALL.NLM* that does not work with NetWare SFT III.

12. Copy the System and Public files to the SYS volume.

13. Create the following *.NCF* files:

- *IOAUTO.NCF*
- *MSAUTO.NCF*
- *MSSTART.NCF*



NOTE: Any SET parameters defined in your NetWare v3.11 configuration can also be used with NetWare SFT III. Make sure that the parameters are defined in the appropriate *.NCF* files. See Appendix C of this Compaq TechNote for example *.NCF* files.

Installing Client Workstations

The workstation support files that are shipped with NetWare SFT III are not the latest files available. You must use the NetWare Client for DOS/Windows Kit v1.02 or later. Client workstations running earlier versions of the workstation support files (before version 3.31) may experience a time-out when a server switchover occurs. The support files in the NetWare DOS/Windows Client Kit allow the workstation to wait for a switchover to occur in the event of a primary server failure.

You can order the NetWare Client Kit for DOS/Windows by calling 1-800-UPDATE1. You can also download the DOS/Windows Client Kit from CompuServe by performing the following:

1. Connect to CompuServe, and enter the following:
GO NOVFILES
2. Select *Client Kits DOS/Windows Client Kit (VLM)*.
3. Select *VLMUP#.EXE* (where # is the latest update).

If you are implementing the packet burst feature, configure the client workstations to support the packet burst protocol as follows:

1. Replace the *NETX* file with the latest client kit files.
2. Modify the workstation *NET.CFG* file by placing the following parameter in the file:

PB BUFFERS = X

Where "X" depends on the speed of the workstation.

3. Vary "X" from 1 to 10 until you find a value that gives optimal performance. **The default setting is 3.**

NOTE: NetWare SFT III supports OS/2 v2.0 clients using the OS/2 Requester v2.0 or later.

Test Mode Parameters

Before migrating your current implementation to NetWare SFT III, you should implement NetWare SFT III in a test environment by using one of the four test modes. These four test modes allow you to test the recovery features of the NetWare SFT III system. For example, Test Mode 1 simulates primary server failures, so that you can monitor the secondary server behavior. These test modes are set in each IOEngine using specific Test Mode SET parameters. To implement the test modes, each IOEngine must have the same test mode set, and each *IOSTART.NCF* file must have the Test Mode SET parameter defined.

NOTE: There are six SET parameters related to the test modes. Refer to Table 3-3 of the *NetWare SFT III* manual for a list of the SET parameters and a description of each.

ADDING HARDWARE TO A NETWARE SFT III SERVER

One of the benefits of NetWare SFT III is that hardware upgrade or maintenance of the servers can be performed without interrupting services to the users. The following sections describe adding server system memory and adding a hard drive subsystem component to your NetWare SFT III system.



Adding System Memory

To add system memory to both servers, perform the following:

1. Enter the following at the secondary IOEngine prompt:

HALT

2. Turn off the secondary server.
3. Install the system memory modules in the secondary server.
4. Turn on the secondary server.
5. Run the EISA Configuration Utility to configure the new system memory.
6. Enter the following at the secondary server DOS prompt:

MSERVER

The MSERVER command begins the server system memory and hard disk synchronization process.

7. After the resynchronization is complete, force a server switchover by entering the following at the primary server IOEngine prompt:

HALT

The secondary server is now the primary server.

8. Turn off the halted server.
9. Install the system memory modules in the halted server.
10. Turn on the halted server.
11. Run the EISA Configuration Utility to configure the new system memory.
12. Enter the following at the secondary server DOS prompt:

MSERVER

The MSERVER command begins the server system memory and hard disk synchronization process.

During the system memory resynchronization, NetWare SFT III recognizes the additional amount of system memory and adds the system memory to the MSEngine memory pool. This functionality eliminates the need for scheduling maintenance and upgrades during off-peak hours.

Adding a Hard Drive Subsystem Component

To add a hard drive subsystem component to each server, perform the following:

1. Enter the following at the secondary IOEngine prompt:
 HALT
2. Turn off the secondary server.
3. Install the hard drives or hard drive subsystem in the secondary server.
4. Turn on the secondary server.
5. Run the EISA Configuration Utility to configure the new hardware.
6. Enter the following at the secondary server DOS prompt:

 MSERVER

The MSERVER command begins the server system memory and hard disk synchronization process.

7. After the resynchronization is complete, force a server switchover by entering the following at the primary server IOEngine prompt:

 HALT

The secondary server is now the primary server.

8. Turn off the halted server.
9. Install the hard drives or hard drive subsystem in the halted server.
10. Turn on the halted server.
11. Run the EISA Configuration Utility to configure the new hardware drive.



12. Enter the following at the secondary server DOS prompt:

MSERVER

The **MSERVER** command begins the server system memory and hard disk synchronization process.

13. Create NetWare partitions on the newly installed hard drives.
14. Mirror the new partitions to create mirrored partition pairs.
15. Add partitions to an existing volume or to the new volume.

Hard drive subsystem modification is complete, and both of your servers should be operating.



Chapter 4

TROUBLESHOOTING AND PERFORMANCE TUNING

With two servers acting as one virtual server, troubleshooting NetWare SFT III is slightly different from troubleshooting NetWare v3.11. The two servers, combined with the split architecture and communication requirements, make NetWare SFT III more complex to troubleshoot.

This chapter addresses possible NetWare SFT III problems you may experience. It also includes possible solutions and troubleshooting tips to help you resolve these problems and improve your network's performance.

Troubleshooting NetWare SFT III is easier if you understand the architecture and acquire the following skills:

- Consider the dual-server NetWare SFT III system as one system.
- Learn how to predict the behavior of the system if a specific component fails.

NOTE: Chapter 2 of this Compaq TechNote provides detailed information on the NetWare SFT III architecture.

The following sections describe tips for troubleshooting the MSL board, the LAN, and the hard drive subsystems of the NetWare SFT III system. These tips assume you understand the NetWare SFT III architecture, as well as basic NetWare v3.11 concepts. These tips supplement those found in Chapter 3 in the "Troubleshooting Tips" section of the *NetWare SFT III* manual.

TROUBLESHOOTING NETWARE SFT III

There are some rules of thumb used when troubleshooting NetWare SFT III, based on the fact that the MSEngines on both servers are mirrored and the IOEngines are not mirrored. These rules apply to most situations, but you should use them as guidelines only.

- If the whole NetWare SFT III system ABENDs or fails (that is, if both servers cease to function), the failure is probably related to software running in the MSEngine.
- If one server fails and the remaining server assumes the role of the primary server, then the failure is probably hardware-related. Switchovers are usually due to a failure of a driver or device in the IOEngine.
- If the secondary server fails, then the failure is probably related to the hardware in the secondary server or to a software or hardware failure in the IOEngine of the primary server.

When a failure occurs, NetWare SFT III updates three system error log files with important information. These log files are in the \SYSTEM subdirectory of the SYS volume. Use these files to troubleshoot or determine the status of the NetWare SFT III system.

- *IO\$LOG.ERR* file contains historical information about IOEngine activity.
- *SYS\$LOG.ERR* file contains historical information about MSEngine activity.
- *MSSTATUS.DMP* file contains detailed information about the condition of the NetWare SFT III system before and after a server switchover.

NOTE: Refer to Appendix B in this Compaq TechNote for examples of these log files. These log files contain a history of system activity and can be used to track the events that occurred prior to the failure.

Table 4-1 lists the error messages discussed in this Compaq TechNote and provides the probable causes of these messages. Table 4-2 lists error conditions and provides the probable causes for these conditions.



**Table 4-1
Troubleshooting Messages**

Error Message	Probable Cause(s)
Auto Synchronize	Displays when each IOEngine receives a console verification message after the MSL driver in that IOEngine is loaded and the MSL is communicating.
Invalid Server Initialization	Displays when the secondary server IOEngine is unable to establish communication with the primary server IOEngine during system initialization.
IPX Internet is Up	Displays once communication is resumed between servers.
IPX Internet is Down	Displays if an IOEngine determines that a LAN connection is faulty, and the "I'm alive" packets cannot be transmitted over the LAN to the other IOEngine. A faulty LAN connection may indicate a problem with the cabling or with the communication across the LAN.
This Server Does Not Know How To Route IPX	Displays when one IOEngine cannot find the other IOEngine.
IPX Network (Address) Is No Longer Returning Status Check Packets	Displays on the IOEngine console of the server experiencing a LAN connection problem. When the NIC cannot find a router to communicate with, a message informs you of the LAN connection problem. It also indicates that the LAN connection is degrading due to cabling, router or bridge, or IOEngine problems.
Error Transferring IOEngine Error Log	Displays when the NetWare SFT III operating system cannot update the system log files located in the \SYSTEM subdirectory of the SYS volume.
MSEngine Different Outputs	Displays when one IOEngine receives different output from the MSEngine than the other IOEngine.
Other Server Requested This Server To Restart	Displays at the console of the restarted IOEngine.

Table 4-2
Troubleshooting Error Conditions

Error Condition	Probable Cause(s)
MSL Comm Deadlock	Occurs when neither MSL can transmit data due to "holdoffs." A holdoff occurs when the IOEngine receives a packet but cannot process the packet, or when an MSL sends a packet and does not receive an acknowledgment. The IOEngine stops processing until an acknowledgment is received.
Secondary Server ABENDs When MSL Driver Is Unloaded	Occurs if the MSL driver is unloaded from the IOEngine of either server. Once the driver is unloaded, the mirrored state of the system is compromised; therefore, the secondary server halts.
Other Server Requested This Server to Restart Due to COMM Failure	Occurs on the secondary server. The primary server requests the secondary server to restart if there are errors associated with the MSL.
Failure of Primary Server Hard Drive Subsystem	Occurs when the primary server hard drive subsystem fails, and the secondary server subsystem services all read and write requests.
Orphaned Partition	Occurs during an abnormal shutdown. NetWare SFT III cannot perform housekeeping, which results in a partition being damaged.
Servers Restart For No Reason	Occurs when configuring or troubleshooting a NetWare SFT III system. One of the servers may restart continually.
Mirrored Server to Server COMM Received Message with Checksum	Occurs when a checksum fails. The MSL performs checksums on all packets.
Server ABENDs When Loading <i>CPQMP.NLM</i>	Occurs if the IOEngine is short of memory when you manually load the <i>CPQMP.NLM</i> at the IOEngine console. It also occurs if the <i>CPQMP.NLM</i> is loaded last in the <i>IOSTART.NCF</i> file and the server is short of memory.



Troubleshooting the Installation

The following checklist can help you verify a successful installation.

Is all hardware installed correctly? _____

Is the MSL cabling installed correctly? If the cabling is installed correctly and the MSL driver is loaded, the following message displays on both I/O Engine console screens: "Neither server has an active MSEngine...will autosynchronize when one is activated." _____

Do both servers have the same monitor type? For example, both servers should be using VGA monochrome, VGA color, or EGA. _____

Do both servers have a functioning connection to the LAN? _____

Do both servers have the same amount of system memory, or is the server with more system memory aligned to match the server with less system memory? (Refer to Chapter 3 of the *NetWare SFT III* manual for information on server memory alignment.) _____

Does the memory type indicate "Compaq Linear" when you run the Compaq EISA Configuration Utility? If the memory type of both servers is not linear, the servers will not synchronize without modifying certain NetWare SFT III SET parameters. _____

Do the servers use the same version of DOS and the same *AUTOEXEC.BAT* and *CONFIG.SYS* files? This ensures that the IOEngines start with the same amount of system memory. _____

Are the latest NetWare SFT III System and Public files being used, including *MSERVER.EXE* and the client workstation files? _____

Does each mirrored logical partition contain a disk partition from the primary server and the secondary server? _____

Troubleshooting MSL Boards

When troubleshooting any MSL problems, check and recheck all cabling and MSL boards to verify that they were properly installed. Each board should be seated in the bus correctly, and the cables should be securely fastened to each board. Configure the MSL board using the EISA Configuration Utility. If the hardware installation is correct, run the diagnostics software provided by the MSL board manufacturer. The diagnostics software ensures that the boards are functioning properly. If the MSL board passes the diagnostics software, the troubleshooting tips in Chapter 3 of the *NetWare SFT III* manual or the following tips should help resolve any problems.

NOTE: If you have two NICs that can provide MSL support, such as two NE2000 NICs, you can replace the MSLs with the NE2000 NICs to verify that the problem is actually the MSL. However, using NICs as MSL boards may not yield the same performance as using MSL boards.

"AUTO SYNCHRONIZE" MESSAGE

Each IOEngine receives the following console verification message after you load and start the MSL driver in that IOEngine:

```
"Neither server has an active MSEngine...will auto synchronize when  
one is activated"
```



IMPORTANT: Do not type **ACTIVATE SERVER** unless the message shown above is displayed. **This message signals that the MSL is functioning properly.**



After the MSL drivers load, the "Auto Synchronize" message should be displayed. If this message does not appear, the MSLs may not be functioning. Follow these steps:

1. Run MSL diagnostics software.
2. Verify that the boards are properly seated and the cables are connected correctly.

MSL COMM DEADLOCK CONDITION

NetWare SFT III servers with very busy system processors and/or MSL links of long distances may experience a "Comm Deadlock" condition. "Comm Deadlock" is a condition when neither MSL can transmit data due to "holdoffs." A holdoff occurs when the IOEngine receives a packet but cannot process the packet, or when an MSL sends a packet and does not receive an acknowledgment. The IOEngine stops processing until an acknowledgment is received. When a Comm Deadlock occurs, increase the time-out value by changing the SET COMM DEADLOCK DETECT WAIT TIME parameter value. If the servers are very busy, increase this parameter in 1-second increments until the error disappears. Increasing the time-out value gives the IOEngine more time to process a packet or send an acknowledgment packet.

Changing this value can affect two other SET parameters: the SET IPX INTERNET DOWN WAIT TIME and SET COMM DRIVER STUCK RECOVERY OPTION parameter.

The SET IPX INTERNET DOWN WAIT TIME parameter defines how long the IOEngine waits before determining that the IPX connection is down. The value of the SET IPX INTERNET DOWN WAIT TIME should be at least one second less than the value of the COMM DEADLOCK DETECT WAIT TIME parameter.

NOTE: Refer to "Troubleshooting the LAN" in this chapter for more details regarding this parameter.

The SET COMM DRIVER STUCK RECOVERY OPTION parameter determines the recovery behavior of the primary or secondary server if there are packets in the MSL queues that are not being transmitted. This recovery parameter takes action at four times the setting of the SET COMM DEADLOCK DETECT WAIT TIME parameter. For example, if the value of the SET COMM DEADLOCK DETECT WAIT TIME parameter is 5 seconds, the SET COMM DRIVER STUCK RECOVERY OPTION parameter halts or restarts an IOEngine after 20 seconds.

"INVALID SERVER INITIALIZATION" MESSAGE

An "Invalid Server Initialization" message occurs when the secondary server IOEngine is unable to establish communication with the primary server IOEngine during system initialization. The secondary server IOEngine attempts to inform the primary server IOEngine to begin system memory and hard disk synchronization, but the initialization messages or packets are corrupted. This corruption can occur at different levels. An MSL board may be malfunctioning, the cabling may be faulty, or the MSL driver may be in error.

When you receive an "Invalid Server Initialization" message, perform the following steps:

1. Turn off both servers, and restart both servers.
2. Reload all drivers including the MSL drivers.
3. Verify that each MSL board and the cables are functional by running the diagnostics software provided by the MSL board manufacturer.
4. If problems persist, replace the failing MSL boards and the cabling.

SECONDARY SERVER ABENDS WHEN MSL DRIVER IS UNLOADED

If the MSL driver is unloaded from the IOEngine of either server, the secondary server ABENDs. Once the driver is unloaded, the mirrored state of the system is compromised; therefore, the secondary server halts.



If the secondary server ABENDs when the MSL driver is unloaded:

1. Turn off the secondary server.
2. Restart the secondary server.
3. Ensure that the MSL driver loads properly.

OTHER SERVER REQUESTED THIS SERVER TO RESTART DUE TO COMM FAILURE

When there are errors associated with the MSL, the primary server requests the secondary server to restart. The error could be associated with any component of the MSL (cable, boards, or MSL drivers).

The "Other Server Requested This Server to Restart Due To Comm Failure" message displays at the console of the restarted IOEngine. For example, when the primary server requests the secondary server to restart, the message displays on the IOEngine console of the secondary server.

The primary server usually requests that the secondary server restart due to problems with the MSL; however, this message may indicate a problem with the IOEngine or MEngine of the secondary server. For example, if the primary server attempts to maintain a mirrored state, but the secondary server fails to respond, the primary server then requests, across the LAN, that the secondary server restart.

If this occurs:

1. Run MSL diagnostics software on the secondary server.
2. If the MSL passes diagnostics, then replace the MSL cabling. When coaxial cabling is used, ensure that the cables are not coiled on the floor. Coiled cables may cause electromagnetic interference.
3. If replacing the cabling does not correct the error, then the MSL board in the primary server may be suspect. Schedule server maintenance to replace the board.
4. If the MSL fails diagnostics in the primary or secondary server, replace the failed MSL board.

MIRRORED SERVER TO SERVER COMM RECEIVED MESSAGE WITH CHECKSUM

The MSL performs checksums on all packets that are sent and received. If a checksum fails, the message "Mirrored Server to Server COMM Received Message With Checksum" displays.

If this occurs:

1. Run MSL diagnostics software.
2. Verify that the cable is functioning correctly.
3. If you are using coaxial cable, ensure that the cables are not coiled on the floor. Coiled cables may cause electromagnetic interference.
4. Replace MSL boards if necessary.

Troubleshooting the LAN

The IOEngines of the primary and secondary server constantly monitor each other to ensure that they are transmitting and receiving packets. Once a NIC device driver is loaded and the protocol is bound, the IOEngines attempt to communicate with other routers on the internet. Once a router is found, a periodic "ping" or broadcast occurs to establish a constant communication. If this communication fails during either transmission or reception, the IOEngine searches for another router.

"IPX INTERNET IS DOWN/UP" MESSAGE

If an IOEngine determines that a LAN connection is faulty, the "I'm alive" packets cannot be transmitted over the LAN to the other IOEngine. A faulty LAN connection may indicate a problem with the cabling or with the communication across the LAN. The "IPX Internet is Down" message displays at the IOEngine of each server to indicate that communication is halted. Once communication is resumed, the "IPX Internet is Up" message displays.



When you receive an "IPX Internet is Down" message, perform the following steps:

1. Check the network cabling attached to each server.
2. If there is distance between the primary and secondary servers, check the internet. There may be faulty cabling or a faulty router or bridge.
3. Load the *PROTO.NLM* or the *DEVMON.NLM* in each IOEngine to determine the packet transmit and receive status and to view possible errors.

NOTE: Refer to Table 1-1 in this Compaq TechNote for more information on *PROTO.NLM* and *DEVMON.NLM*.

"THIS SERVER DOES NOT KNOW HOW TO ROUTE IPX" MESSAGE

This message displays when one IOEngine cannot find the other IOEngine. It only occurs when the other IOEngine has not been activated or when the appropriate LAN drivers are not loaded in the other IOEngine. Once both IOEngines start communicating, the "IPX Internet is Down/Up" message displays when communication errors occur between each IOEngine. The message "This Server Does Not Know How to Route IPX" does not display after the IOEngines begin communicating, because the IOEngines have determined the best route for communication. Although the IOEngines have learned how to route, the route might have disappeared due to a communication failure.

When you receive a "This Server Does Not Know How to Route IPX" message, perform the following steps:

1. Ensure that both IOEngines are active and functioning properly.
2. Ensure that the LAN drivers are loaded.
3. Check for a faulty LAN connection.

"IPX NETWORK IS NO LONGER RETURNING STATUS" MESSAGE

The message "IPX Network Is No Longer Returning Status " displays on the IOEngine console of the server experiencing a LAN connection problem. If the primary IOEngine concludes that its LAN connection is faulty, then it signals the secondary IOEngine via the MSL and causes a switchover. For example, a NetWare SFT III system includes a primary and secondary server with four Ethernet NICs in each server. If one NIC in the primary server stops transmitting or receiving packets, then a switchover occurs.

At this point, the secondary server assumes the role of primary server. If the LAN connection fails in the secondary server, the primary server is notified with an "IPX Network Is No Longer Returning Status" message. This message does not affect NetWare SFT III performance. At this point, however, the NetWare SFT III system is vulnerable.

When you receive an "IPX Network Is No Longer Returning Status" message, the LAN connection is degraded due to one of the following:

- Cabling problems
- Router or bridge problems
- Problems with the IOEngine

CHANGING PACKET SIZES

There are some occasions when you should change the IOEngine packet size. For example, if a Token Ring LAN must coexist with an Ethernet LAN, then you may need to increase the packet size. Change the packet size by changing the SET MAXIMUM PHYSICAL RECEIVE PACKET SIZE parameter in each IOEngine or the *IOSTART.NCF* file of each server.



IMPORTANT: To change the packet size, you must shut down the NetWare SFT III system. Schedule a time during off-peak hours to perform this task.



Troubleshooting the Hard Drive Subsystem

This section describes several considerations when you troubleshoot hard drive subsystems. Before you begin troubleshooting, verify that you are using the latest versions of hard disk device drivers, controller firmware, system firmware, drive firmware, and EISA Configuration Utility. Keeping up-to-date drivers, software, and firmware reduces the risk of having hard drive subsystem problems.

USING *CPQDA386.DSK*

The device driver for Compaq drive arrays (*CPQDA386.DSK*) fully supports NetWare SFT III. To ensure optimal compatibility, make sure that your configuration includes *CPQDA386.DSK* v2.20 or later.

NOTE: *CPQDA386.DSK* is located on NetWare Programs from Compaq v2.20 or later.

LOADING THE COMPAQ FAST-SCSI-2 DEVICE DRIVER

The device driver for the Compaq Fast-SCSI-2 Controller is fully compatible with NetWare SFT III. When loading the driver, the IOEngine may experience a shortage of system memory. Before loading the driver, increase the amount of system memory allocated to the IOEngine. The default amount allocated is 2,097,152 bytes. Increase this amount to 3,500,000 bytes. To increase the amount of system memory allocated to each (or both) IOEngine(s), place the following SET command in the *IOSTART.NCF* file of each IOEngine:

```
SET NEW START ADDRESS FOR UNCLAIMED MEMORY BLOCK=3500000
```

This command allocates 3.5 megabytes of system memory to the IOEngine.

"ERROR TRANSFERRING IOENGINE ERROR LOG" MESSAGE

This message displays when the NetWare SFT III operating system cannot update the system log files located in the \SYSTEM subdirectory of the SYS volume. This may mean that the files are flagged as read-only or the SYS volume is not mounted. Check the file attributes of the *IO\$LOG.ERR* file, and make sure that the SYS volume is mounted.

NOTE: When this error occurs, the *IO\$LOG.ERR* file is created on the DOS partition.

FAILURE OF PRIMARY SERVER HARD DRIVE SUBSYSTEM

When the primary server hard drive subsystem fails, the secondary server subsystem services all read and write requests. The primary server still services all other client requests. This means that all disk activity is being serviced across the MSL.

While this scenario works, it is not optimal. Once the primary server hard drive subsystem fails, initiate a manual switchover by entering **HALT** or **RESTART** at the IOEngine console of the primary server. This action ensures optimal performance of the NetWare SFT III system and provides an opportunity to service the hard drive subsystem.

ORPHANED PARTITION

During a "clean shutdown," NetWare SFT III performs housekeeping to ensure that all partitions and mirrored files are paired correctly. During an abnormal shutdown, NetWare SFT III cannot perform this housekeeping, which results in a partition being damaged. When NetWare SFT III does not know what to do with the damaged partition, it describes that partition as "orphaned." Since all partitions were once mirrored, a full recovery is required.

NOTE: Refer to Chapter 3 of the *NetWare SFT III* manual for detailed information on how to recover an orphaned partition.



Other Troubleshooting Tips

"MSENGINE DIFFERENT OUTPUTS" ABEND MESSAGE

There are two independent MEngines in a NetWare SFT III system. The IOEngines communicate with the MEngines. If the IOEngines give the same input to each MEngine, the IOEngines should receive the same output. If one IOEngine receives different output, an "MEngine Different Outputs" ABEND occurs. This ABEND usually points to a problem with the NetWare SFT III software or with applications running in the IOEngines or MEngines.

When you receive an "MEngine Different Outputs" ABEND message, *both* servers have failed. To identify the offending software, perform the following:

1. Unload all third-party NLMs.
2. Run diagnostics software on all server hardware components, and replace any component that fails.
3. If the hardware passes all diagnostic tests, restart NetWare SFT III.
4. Load NLMs one at a time, and observe the system's behavior.

If the system ABENDs after you restart NetWare SFT III and before you load the NLMs, contact your Authorized Service Provider. If the system ABENDs while you are loading NLMs, identify the last NLM you loaded on the system and contact the developer or your Authorized Service Provider.

SERVERS RESTART FOR NO REASON

When configuring or troubleshooting a NetWare SFT III system, one of the servers may restart continually. To determine the cause of the restart, set all recovery parameters to a value of 0. Setting recovery parameters to 0 will stop the server from restarting and display an ABEND message on the console. To make the SET parameter changes easier, create an *.NCF* file with these recovery SET parameters defined.

NOTE: Refer to Table 3-3 of the *NetWare SFT III* manual for a detailed explanation of recovery parameters.

Using the System Audit Parameters

A new feature of NetWare SFT III is the implementation of system audit parameters. System audit parameters represent cyclic redundancy checks (CRCs) between two entities and provide system components an extra margin of verification. These parameters are enabled and disabled using SET parameters. These four parameters are described in the following sections.

SET COMPREHENSIVE MENGINE SYNCHRONIZATION CHECK = ON

For the NetWare SFT III system to maintain a mirrored state, the output of the two MEngines must be the same. These MEngines are mirrored and represented by a logical engine. For example, the IOEngine of each server generates a request to be serviced by each MEngine. If the same input is supplied to both MEngines, then the same output should be expected from the MEngine. If the output is different, then the secondary server ABENDs. The SET COMPREHENSIVE MENGINE SYNCHRONIZATION CHECK parameter enables and disables the MEngine output CRC check.

This SET parameter exists in both IOEngines. From the SET menu, select *Mirrored Servers* and enable it by changing the setting to ON. The default setting is OFF. Enabling this parameter ensures data integrity, but it also creates overhead that may degrade server performance.

SET ENABLE IPX CHECKSUMS = 0, 1, OR 2

This SET parameter ensures that the packets transmitted by the workstation are the same packets received by the server. Use this parameter to troubleshoot corrupt data packet problems. Client workstations can request that IPX checksums be used.



This parameter has three settings.

- No checksums (0)
- Checksums only if the client requests them (1)
- Require all clients to use checksums (2)

This SET parameter exists in the MSEngine. From the SET menu, select *Communications*. The default setting is 1 (checksums only if the client requests them). Setting this parameter to 0 can increase the performance of your network and server, because checksums are not required.

NOTE: If your network uses only Ethernet 802.3 frame types, set this parameter to 0.

SET CHECK SERVER TO SERVER COMM = ON

This SET parameter ensures the integrity of a communication link. It enables CRC checking of all MSL packet traffic. Enabling this parameter ensures data integrity; however, it also creates overhead that may degrade performance.

This parameter is set in each IOEngine. From the SET menu, select *Mirrored Servers*. The default setting is ON.

SET ENABLE DISK READ AFTER WRITE VERIFY

The NetWare SET ENABLE DISK READ AFTER WRITE VERIFY parameter ensures the integrity of data written to a target device. In the NetWare environment, the device driver for the hard drive controller implements NetWare Read After Write Verify operations.

After NetWare writes data from system memory to the storage device, such as a hard drive, the data is read back from the hard drive and compared to the original data to ensure that it was correctly written. The NetWare SET ENABLE READ AFTER WRITE VERIFY parameter checks data integrity only when the data is written. It does not provide protection against future media failures that could lead to data corruption.

Most available hard drive subsystems, including Compaq drive arrays and Fast-SCSI-2 subsystems, have "built-in" intelligence to determine if a write operation completes successfully. If the operation does not complete successfully, the device driver and NetWare flag the sector on the disk as faulty and remap it. Since these hard drive subsystems include this "built-in" intelligence, and since NetWare provides the Hot Fix Redirection feature, the read-after-write verification process becomes unnecessary.

When you configure a Compaq drive array controller for a *hardware* method of fault tolerance (such as Compaq drive mirroring or distributed data guarding), the system automatically enables Dynamic Sector Repairing, a Compaq hardware feature, as a background task. While the controller waits for I/O requests, it performs read and write operations to disk sectors and remaps the faulty sectors. Dynamic Sector Repairing works much like the NetWare Hot Fix Redirection feature, but it is transparent to NetWare. Although the Hot Fix Redirection feature is still enabled under NetWare, it is used only when the hard drive runs out of spare sectors for Dynamic Sector Repairing.

When you configure the drive array controller for a *software* method of fault tolerance (such as NetWare drive mirroring or controller duplexing), the controller *does not enable* Dynamic Sector Repairing. However, the hard drive subsystem and the Hot Fix Redirection feature provide sector remapping.

In the Fast-SCSI-2 subsystem, read-after-write verification is supported at the hardware level only. The Compaq Fast-SCSI-2 device driver disregards the NetWare SET ENABLE DISK READ AFTER WRITE VERIFY parameter in favor of performing this task at the hard drive subsystem level. The default setting for read-after-write verification is *disabled*. The performance impact of read-after-write verification is significant. Enabling read-after-write verification yields about a 50 percent decrease in throughput.

The *hardware* read-after-write verification capability is included in the Fast-SCSI-2 subsystem to support NetWare compatibility. You can enable read-after-write verification by using either of the following methods.

- Using the `-V` parameter when you load the `CPQSDISK.DSK`
- Using `MONITOR.NLM`



! **IMPORTANT:** Both of these methods enable *hardware* read-after-write verification via the hard disk device driver. They do not enable the NetWare SET ENABLE DISK READ AFTER WRITE VERIFY parameter.

Considering the detection and correction capabilities of each hard drive in the intelligent drive array, the levels of fault tolerance, the negative performance impact, and the increased system memory required, the NetWare SET ENABLE READ AFTER WRITE VERIFY parameter is not implemented in Compaq drive array and Compaq Fast-SCSI-2 device drivers.

! **IMPORTANT:** Read-after-write verification, whether it is implemented in the hardware or the software, is independent of the Hot Fix Redirection feature of NetWare. If read-after-write verification is disabled, the NetWare Hot Fix feature remains enabled.

Updating the NetWare SFT III Operating System

The NetWare SFT III operating system software cannot be updated online. To update NetWare SFT III, you must shut down both NetWare SFT III servers. The *MSERVER.EXE* files cannot be updated independently without compromising the integrity of the mirrored servers. Schedule time to bring the NetWare SFT III system down for the operating system update.

NOTE: Ensure that the NetWare SFT III version you are implementing is dated 01-08-93 or later.

PERFORMANCE TUNING NETWARE SFT III

Although a measurable performance difference is dependent on the hardware configuration of your NetWare SFT III system, there are several tasks you can do to optimize performance. Individually, these actions may not show performance improvement, but collectively they may result in a measurable performance difference.

The Compaq TechNote for NetWare *Performance Management in a NetWare v3.1x Environment* provides recommendations for optimizing the performance of a NetWare v3.1x server. These concepts also apply to NetWare SFT III optimization. For example, matching the volume block size and the cache buffer size can increase performance.

Adjusting some SET parameters can also affect performance. Disabling all system audit parameters may increase performance, but the fault tolerance features are compromised.

Drive mirroring occurs in the background during NetWare SFT III operation, but it generates extra overhead on the servers. Adjusting the value of the SET `CONCURRENT REMIRROR REQUESTS` parameter can reduce the time needed to remirror the disks. By timing the remirroring activity when the parameter is set at different values, you can determine the value best suited for your NetWare SFT III server. A general recommendation cannot be given, because each hard drive subsystem has different characteristics and each environment yields different workloads.

To minimize the system memory synchronization time, use the smallest amount of system memory possible that supports your network server needs. It takes 60 seconds to synchronize 256 megabytes of system memory. During these 60 seconds, all NLM and client workstation activities are halted.

NOTE: Depending on the applications running on your server, too little system memory can also negatively affect your server performance.



The same concept can be applied to hard disk space. The disk mirroring resynchronization can be reduced if the NetWare SFT III system stores only mission-critical data. Other data or applications should be moved to other NetWare servers.

Use packet burst protocol and dual processing to increase the performance of your NetWare SFT III system. Using the packet burst protocol can substantially increase network performance. Packet burst protocol is enabled by client workstations with the packet burst support. For more information concerning packet burst protocol, refer to *NetWare Application Notes* (March 1992) "An Introduction to Novell's Burst Mode Protocol."

NetWare SFT III includes embedded dual-processing support in the operating system. The performance benefits of dual processing are most apparent in operating environments that require more system processor and system memory activity and less I/O activity and in environments where the workload is evenly distributed between the MEngine and the IOEngine.

Typical NetWare servers perform 80 percent I/O and 20 percent CPU/memory tasks. To benefit from the second system processor, the I/O-to-CPU activity ratio must be closer than this ratio. CPU-intensive environments, such as databases, provide a more balanced I/O-to-CPU activity ratio and can benefit from a dual-processing solution. In most resource-sharing environments, a network server that supports at least 100 users can also benefit from a second system processor.

NOTE: Refer to Chapter 2 of this Compaq TechNote for information on dual processing.



Appendix A

MIRRORED SERVER LINK (MSL) BOARD MANUFACTURERS

The following paragraphs contain background information and specifications for MSLs that can be used in the NetWare SFT III environment.

EAGLE NMSL — NOVELL MIRRORED SERVER LINK (1-800-733-2453)

The Eagle NMSL board was jointly developed with Novell and Compaq specifically to support NetWare SFT III. The Eagle NMSL is an EISA-only solution supporting both coaxial and fiber optic cabling. When you order the NMSL package from Eagle Technology, you receive one NMSL board, one manual, a diskette containing the EISA configuration file, a diagnostic utility for the NMSL, and the NMSL driver for NetWare SFT III (*NMSL.MSL*).

The coaxial version includes a 20-foot coaxial cable. The fiber optic version does not include a cable. You can order a fiber optic cable from Eagle Technology or from another cable provider.

MICRODYNE NMSL — NOVELL MIRRORED SERVER LINK (1-800-255-3967)

The Microdyne NMSL is an EISA-only solution that supports both coaxial and fiber optic cabling. When you order the NMSL board from Microdyne Corporation, you receive an NMSL board, a user's manual, as well as a diskette that includes configuration files, a diagnostic utility for the NMSL, and the NMSL driver for NetWare SFT III (*NMSL.MSL*).

The coaxial version of the Microdyne NMSL includes a cable, but the fiber optic version does not include cable. For information on ordering fiber optic cable, call Microdyne Corporation.

**THOMAS-CONRAD 100-MB/S SOLUTION
FOR NOVELL NETWARE SFT III
MIRRORED SERVER LINK
(1-800-654-3822)**

Thomas-Conrad Networking System (TCNS) has created an MSL driver that functions with current TCNS NIC products. The TCNS NIC product line includes industry-standard, MicroChannel, and EISA versions. Several cable types are supported, but Thomas-Conrad does not provide cables. You can order cables from a cable provider.

Every TCNS NIC product comes with the correct MSL driver and documentation. Refer to Chapter 11 of the *TCNS Users Guide* for further instructions on installing the TC3047 TCNS Adapter/EISA as an MSL board.

**PLAINTREE SYSTEMS, INC. —
WAVEBUS MSL (1-800-461-0062)**

PlainTree Systems, Inc., Ontario, Canada, offers a complete MSL package including industry-standard, MicroChannel, and EISA versions with fiber optic cable. When you order the MSL package from PlainTree, you receive two MSL boards, 10 feet of dual fiber optic cable, one manual, the MSL driver (*WBMSL.MSL*), an EISA configuration file, and the diagnostic utility.

NOTE: Table A-1 includes the manufacturers' specifications for these products.



Table A-1
MSL Board Manufacturers' Specifications

Manufacturer/Model	Bus Type	Connection Type	Maximum Cable Distance	Rated Speed
Eagle Technology				
NMSL/C	EISA	BNC - coaxial	100 ft (130 m)	128 MB/s
NMSL/F	EISA	ST - fiber optic	13,123 ft (4 km)	128 MB/s
Microdyne				
NMSL/C	EISA	BNC-coaxial	100 ft (130 m)	128 MB/s
NMSL/F	EISA	ST-fiber optic	13,123 ft (4 km)	128 MB/s
Thomas-Conrad				
TC3045-CX	ISA	BNC - coaxial	328 ft (100 m)	100 MB/s
TC3045-STP	ISA	DB-9 - shielded twisted pair	492 ft (150 m)	100 MB/s
TC3045-ST	ISA	ST - fiber optic	2,950 ft (900 m)	100 MB/s
TC3046-CX	MCA	BNC - coaxial	328 ft (100 m)	100 MB/s
TC3046-STP	MCA	DB-9 - shielded twisted pair	492 ft (150 m)	100 MB/s
TC3046-ST	MCA	ST - fiber optic	2,950 ft (900 m)	100 MB/s
TC3047-CX	EISA	BNC - coaxial	328 ft (100 m)	100 MB/s
TC3047-STP	EISA	DB-9 - shielded twisted pair	492 ft (150 m)	100 MB/s
TC3047-ST	EISA	ST - fiber optic	2,950 ft (900 m)	100 MB/s
PlainTree Systems				
WaveBus MSL	ISA, EISA, MCA	ST - fiber optic	1,640 ft (500 m)	100 MB/s



NOTE: The rated speed reflects the maximum speed. In most environments, the measured speed is reduced, because each server must wait for a response from the other server. Even with a reduced speed, the MSL is not a bottleneck in a NetWare SFT III environment.

Appendix B

EXAMPLES OF SYSTEM MESSAGE LOG FILES

When a failure occurs, NetWare SFT III updates three system error log files with important information. These log files are in the \SYSTEM subdirectory of the SYS volume. These files are used to troubleshoot or determine the status of the NetWare SFT III system. They also contain a history of system activity and can be used to track the events that occurred prior to the failure. This appendix contains the following examples:

- *IO\$LOG.ERR* file
- *SYS\$LOG.ERR* file
- *MSSTATUS.DMP* file

IO\$LOG.ERR

5/6/93 4:12:41 pm Begin Error Log For IO_RIGHT.

5/6/93 4:12:26 pm Severity = 0.

0.0.0 Mirrored server to server comm link activated.

5/6/93 4:12:27 pm Severity = 2.

0.0.0 Neither server has an active MEngine...will auto synchronize when one is activated.

5/6/93 4:12:35 pm Severity = 0.

0.0.0 MEngine activated...will synchronize with other server if it's there.

5/6/93 4:12:35 pm Severity = 0.

0.0.0 Mirrored server to server comm link connection established with other server...beginning synchronization.

5/6/93 4:12:37 pm Severity = 0.

0.0.0 Mirrored servers now synchronized (this is the primary server).

5/6/93 4:12:41 pm End Error Log For IO_RIGHT.

5/6/93 4:12:42 pm Begin Error Log For IO_LEFT.

5/6/93 4:12:12 pm Severity = 2.
0.0.0 Primary server failed due to Mirrored server to server comm link time out hearing from other server...this server is becoming the primary but the server has been downed.

5/6/93 4:12:22 pm Severity = 0.
0.0.0 Mirrored server to server comm link activated.

5/6/93 4:12:22 pm Severity = 2.
0.0.0 Neither server has an active MSEngine...will auto synchronize when one is activated.

5/6/93 4:12:30 pm Severity = 0.
0.0.0 Mirrored server synchronization beginning (this will be the secondary server).

5/6/93 4:12:30 pm Severity = 0.
0.0.0 Mirrored servers now synchronized (this is the secondary server).

5/6/93 4:12:42 pm End Error Log For IO_LEFT.

5/6/93 4:13:05 pm Severity = 2 Name = IO_LEFT.
0.0.0 Mirrored server to server comm link hardware failure...checking if the primary server is alive over the IPX internet.

5/6/93 4:13:06 pm Severity = 2 Name = IO_LEFT.
0.0.0 Primary server failed due to Mirrored server to server comm link hardware failure... this server is becoming the primary server.

5/6/93 4:14:50 pm Severity = 0 Name = IO_LEFT.
0.0.0 Mirrored server to server comm link connection established with other server... beginning synchronization.

5/6/93 4:14:52 pm Begin Error Log For IO_RIGHT.

5/6/93 4:14:50 pm Severity = 0.
0.0.0 Mirrored server to server comm link activated.

5/6/93 4:14:50 pm Severity = 0.
0.0.0 Mirrored server synchronization beginning (this will be the secondary server).

5/6/93 4:14:52 pm End Error Log For IO_RIGHT.

5/6/93 4:14:52 pm Severity = 0 Name = IO_LEFT.
0.0.0 Mirrored servers now synchronized (this is the primary server).

5/6/93 4:14:51 pm Severity = 0 Name = IO_RIGHT.
0.0.0 Mirrored servers now synchronized (this is the secondary server).



5/6/93 4:14:52 pm Severity = 0 Name = IO_RIGHT.
0.0.0 This server does not know how to route via IPX to the primary server.

5/6/93 4:14:52 pm Severity = 0 Name = IO_RIGHT.
0.0.0 IPX route to the other server has been discovered.

SYSS\$LOG.ERR

5/6/93 4:12:05 pm Severity = 0.
1.1.62 Bindery close requested by the SERVER.

5/6/93 4:12:05 pm Severity = 4.
1.1.72 SFT3_SERVER TTS shut down
because backout volume SYS was dismounted.

5/6/93 4:12:45 pm Severity = 0.
1.1.60 Bindery open requested by the SERVER.

5/6/93 4:13:04 pm Severity = 4.
1.1.10 [1] IO_RIGHT\COMPAQ IDA v2.30 (47000000) deactivated due to server failure.

5/6/93 4:13:04 pm Severity = 4.
1.1.85 Volume SYS still operational despite drive deactivation.

5/6/93 4:13:04 pm Severity = 0.
1.1.24 Not fully mirrored partition #1.

5/6/93 4:13:04 pm Severity = 4.
1.1.101 The mirrored partitions on this system are not all fully mirrored.

5/6/93 4:14:53 pm Severity = 4.
1.1.99 Remirroring partition #1.

5/6/93 4:14:53 pm Severity = 4.
1.1.99 From the partition on [0] IO_LEFT\COMPAQ IDA v2.30 (47000000).

5/6/93 4:14:53 pm Severity = 4.
1.1.99 ..To the partition on [1] IO_RIGHT\COMPAQ IDA v2.30 (47000000).

5/6/93 4:14:54 pm Severity = 0.
1.1.92 Fully mirrored partition #1.

5/6/93 4:14:54 pm Severity = 4.
1.1.100 All mirrored partitions on this system are fully mirrored.

MSSTATUS.DMP

START MIRRORED SERVERS STATUS DUMP

This IOEngine Name: IO_LEFT Other IOEngine Name: IO_RIGHT

MSEngine Name:SFT3_SERVER

Status Dump Taken At 5/6/93 4:12:12 pm

Status Dump Reason:

Mirrored server to server comm link time out hearing from other server

*** Begin Dumping IOEngine Synchronization And Communications State ***

IOEngine state: Secondary Server Mirrored With Primary

Server Number: 1; Failure Detected In MSEngine

Maximum server to server comm message size = 4096

No messages currently being sent to the primary server

Previous 10 event(s) processed by the MSEngine:

EAdd = 0x2BAA3C; EType = Timer Tick; ECon = Single;

EData = 0x0; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA4C; EType = Key Was Hit; ECon = Single;

EData = 0x5; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA5C; EType = Key Was Hit; ECon = Single;

EData = 0x4; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA6C; EType = Timer Tick; ECon = Single;

EData = 0x0; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA7C; EType = Key Was Hit; ECon = Single;

EData = 0x6; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA8C; EType = Timer Tick; ECon = Single;

EData = 0x0; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAA9C; EType = Timer Tick; ECon = Single;

EData = 0x0; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAAAC; EType = Key Was Hit; ECon = Single;

EData = 0x6; EPointer = 0x2F1C1C; ELen = 0x0

EAdd = 0x2BAABC; EType = Timer Tick; ECon = Single;

EData = 0x0; EPointer = 0x2F1C1C; ELen = 0x0



EAdd = 0x2BAACC; EType = Key Was Hit; ECon = Single;
EData = 0x6; EPointer = 0x2F1C1C; ELen = 0x0

No events available for the MEngine

Previous 10 requests already processed by the IOEngine

RAdd = 0x2F1B7C; RType = LSL Give Receive Buffer; RData = 0x7EC8EC;

RCheck = 7EC8EC83FE18; Gen Event:

EAdd = 0x2BA77C; EType = IPX Receive Packet; ECon = Single;

EData = 0x7EC8EC; EPointer = 0x7EC8FA; ELen = 0x0

RAdd = 0x2F1B8C; RType = LSL Give Receive Buffer; RData = 0x7D2DEC;

RCheck = 7D2DEC83FE18; Gen Event:

EAdd = 0x2BA78C; EType = IPX Receive Packet; ECon = Single;

EData = 0x7D2DEC; EPointer = 0x7D2DFA; ELen = 0x0

RAdd = 0x2F1B9C; RType = LSL Give Receive Buffer; RData = 0x7CBA54;

RCheck = 7CBA5483FE18; Gen Event:

EAdd = 0x2BA79C; EType = IPX Receive Packet; ECon = Single;

EData = 0x7CBA54; EPointer = 0x7CBA62; ELen = 0x0

RAdd = 0x2F1BAC; RType = LSL Give Receive Buffer; RData = 0x7EB5A8;

RCheck = 7EB5A883FE18; Gen Event:

EAdd = 0x2BA7AC; EType = IPX Receive Packet; ECon = Single;

EData = 0x7EB5A8; EPointer = 0x7EB5B6; ELen = 0x0

RAdd = 0x2F1BBC; RType = LSL Give Receive Buffer; RData = 0x7E88B4;

RCheck = 7E88B483FE18; Gen Event:

EAdd = 0x2BA7BC; EType = IPX Receive Packet; ECon = Single;

EData = 0x7E88B4; EPointer = 0x7E88C2; ELen = 0x0

RAdd = 0x2F1BCC; RType = LSL Give Receive Buffer; RData = 0x7E4210;

RCheck = 7E421083FE18; Gen Event:

EAdd = 0x2BA7CC; EType = IPX Receive Packet; ECon = Single;

EData = 0x7E4210; EPointer = 0x7E421E; ELen = 0x0

RAdd = 0x2F1BDC; RType = LSL Give Receive Buffer; RData = 0x7ED5C4;

RCheck = 7ED5C483FE18; Gen Event:

EAdd = 0x2BA7DC; EType = IPX Receive Packet; ECon = Single;

EData = 0x7ED5C4; EPointer = 0x7ED5D2; ELen = 0x0

RAdd = 0x2F1BEC; RType = LSL Give Receive Buffer; RData = 0x7D00F8;

RCheck = 7D00F883FE18; Gen Event:

EAdd = 0x2BA7EC; EType = IPX Receive Packet; ECon = Single;

EData = 0x7D00F8; EPointer = 0x7D0106; ELen = 0x0

RAdd = 0x2F1BFC; RType = LSL Give Receive Buffer; RData = 0x7F9998;
RCheck = 7F999883FE18; Gen Event:
EAdd = 0x2BA7FC; EType = IPX Receive Packet; ECon = Single;
EData = 0x7F9998; EPointer = 0x7F99A6; ELen = 0x0

RAdd = 0x2F1C0C; RType = Screen Buffer Released; RData = 0x29E5C1;
RCheck = 083FE18; Gen Event:
EAdd = 0x2BA80C; EType = Deactivate Screen; ECon = Single;
EData = 0x29E5CC; EPointer = 0x1; ELen = 0x0

No requests available for the IOEngine

914 IOEngine hold offs occurred

4095 messages enqueued for the primary server:

(only the first 10 and last 10 messages will be dumped)

MAdd = 0x16FE0C; MType = Primary Check Registration;MCon = Single;
MData = 0x1; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE20; MType = Ask About Raw Hook INT7;MCon = Single;
MData = 0x1; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE34; MType = Add Screen To List;MCon = Single;
MData = 0x151E20; MPointer = 0x1428A8; MLen = 0xB

MAdd = 0x16FE48; MType = Add Screen To List;MCon = Single;
MData = 0x152012; MPointer = 0x1428B4; MLen = 0xF

MAdd = 0x16FE5C; MType = Ask For Server Screen List PRequest;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE70; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE84; MType = Update IO Screen State;MCon = Single;
MData = 0x151E20; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE98; MType = Poller Primary Time Check;MCon = Single;
MData = 0x0; MPointer = 0x1FE058; MLen = 0x0

MAdd = 0x16FEAC; MType = Poller Primary Time Check;MCon = Single;
MData = 0x0; MPointer = 0x1FE058; MLen = 0x0

MAdd = 0x16FEC0; MType = Ask For IO Screen State;MCon = Single;
MData = 0x151E20; MPointer = 0x0; MLen = 0x0



Now skipping 4075 messages; next is the final 10 messages

MAdd = 0x183D30; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D44; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D58; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D6C; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D80; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D94; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DA8; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DBC; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DD0; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DE4; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

*** End Dump Of IOEngine Synchronization And Communications State ***

*** Begin Dumping Miscellaneous MEngine Support Lists ***

##MEngineThreadReschedules = 0

##MEngineMemoryFrees = 0

*** End Dump Of Miscellaneous MEngine Support Lists ***

*** Start Dump Of IOEngine To MEngine IO Requests ***

```
##SecondaryOutstandingAllocCount = 0
##SecondaryOutstandingDoReqCount = 0
##SecondaryOutstandingDoneReqCount = 0
##SecondaryOutstandingPrimaryDoReqCount = 0
##SecondaryOutstandingPrimaryDoneReqCount = 0

*** End Dump Of IOEngine To MEngine IO Requests ***

*** Start Dump Of MEngine DOS IO Outstanding Requests ***

##OtherEngineRequestListCount = 0
##DoneRequestListCount = 0

*** End Dump Of MEngine DOS IO Outstanding Requests ***

*** Start Dump Of Memory Borrowed From MEngine By IOEngine ***

##AmountMemoryBorrowedFromMEngine = 0
##AmountUsedOfMemoryBorrowedFromMEngine = 0
##NumberOfMemoryBlocksBorrowedFromMEngine = 0
##OutstandingSecondaryBorrowRequestAmount = 0

*** End Dump Of Memory Borrowed From MEngine By IOEngine ***

*** Start Dump Of Secondary Timer Calibrate Messages ***

##OutstandingSecondaryCalibrateRequests = 0
##OutstandingCalibrateRequestToPrimaryServer = 0

*** End Dump Of Secondary Timer Calibrate Messages ***

*** Start Dump Of LSL State ***

ReceiveBuffersCount = 100; ReceiveBuffersSize = 1574

##OutstandingMEngineSends = 0
##GetInfoRequest = 0
##SecondaryAlreadyKnowsAboutIt = 0
##SecondaryHoldOff = 0
##SecondaryFragmentedMessage = 0
##SecondaryGotTheData = 288

*** End Dump Of LSL State ***

*** Start Dump Of IPX Protocol Stack State ***
```



```
This IOEngine IPX Internal Net Number = 0x30
Other IOEngine IPX Internal Net Number = 0x20
MSEngine IPX Internal Net Number = 0x25

*** Start Dump Of IPX Protocol Stack State ***

*** Start Dump Of IOEngine To MSEngine Comm State ***

##RegisteredIOTtoMComm = 0
##CurrentlyRegisteringIOTtoMComm = 0
##SecondaryTrackingMSEngineCommRegistration = 0
##SecondaryIOTtoMCommRegistrationState = 0

*** End Dump Of IOEngine To MSEngine Comm State ***

*** Begin Dumping Adapter IOCTL Queue Information ***

Adapter
CPQDA386.DSKA
( 1010047) IOCTL information

*** Begin Dumping Device Queue Information ***

Device COMPAQ IDA v2.30 (47000000) queue information
Device COMPAQ IDA v2.30 (47000000) dequeue information
Device COMPAQ IDA v2.30 (47000000) indevice information

*** Begin Dumping Generic Event Information ***

Pending generic events count = 0

*** Begin Dumping Generic Request Information ***

END MIRRORED SERVERS STATUS DUMP
IOEngine Name: IO_LEFT Other IOEngine Name: MSEngine Name:
SFT3_SERVER
Status Dump Taken At 5/6/93 4:12:12 pm

*****

*****

START MIRRORED SERVERS STATUS DUMP
This IOEngine Name: IO_LEFT Other IOEngine Name: IO_RIGHT
MSEngine Name: SFT3_SERVER
Status Dump Taken At 5/6/93 4:13:05 pm
```

Status Dump Reason:

Mirrored server to server comm link hardware failure

*** Begin Dumping IOEngine Synchronization And Communications State ***

IOEngine state: Secondary Server Mirrored With Primary
Server Number: 1; Failure Detected In MSEngine
Maximum server to server comm message size = 4096

No messages currently being sent to the primary server

Previous 10 event(s) processed by the MSEngine:
EAdd = 0x2C091C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C092C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C093C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C094C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C095C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C096C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C097C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C098C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C099C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDD4C; ELen = 0x0

EAdd = 0x2C09AC; EType = Set Server Utilization; ECon = Single;
EData = 0x1BC; EPointer = 0x1EC; ELen = 0x0



No events available for the MEngine
Previous 10 requests already processed by the IOEngine
RAdd = 0x2DDCAC; RType = LSL Give Receive Buffer; RData = 0x7FA938;
RCheck = 7FA93883FE34; Gen Event:
EAdd = 0x2C055C; EType = IPX Receive Packet; ECon = Single;
EData = 0x7FA938; EPointer = 0x7FA946; ELen = 0x0

RAdd = 0x2DDCBC; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C056C; EType = Timer Tick; ECon = Single;
EData = 0x0; EPointer = 0x2DDCBC; ELen = 0x0

RAdd = 0x2DDCCC; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C057C; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDCDC; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C058C; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDCEC; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C059C; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDCFD; RType = Disk IO; RData = 0x80BC14; RCheck = 80BC1483FE34;
Gen Event:
EAdd = 0x2C059C; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDD0C; RType = Disk IO; RData = 0x81A98C; RCheck = 81A98C83FE34;
Gen Event:
EAdd = 0x2C059C; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDD1C; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C05AC; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDD2C; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C05BC; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

RAdd = 0x2DDD3C; RType = Kernel Reschedule Last; RData = 0x2B426C;
RCheck = 2B426C83FE34; Gen Event:
EAdd = 0x2C05CC; EType = Schedule Process; ECon = Single;
EData = 0x2B426C; EPointer = 0x19A6CC; ELen = 0x0

No requests available for the IOEngine

11899 IOEngine hold offs occurred

4095 messages enqueued for the primary server:
(only the first 10 and last 10 messages will be dumped)
MAdd = 0x16FE0C; MType = Primary Check Registration;MCon = Single;
MData = 0x1; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE20; MType = Ask About Raw Hook INT7;MCon = Single;
MData = 0x1; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE34; MType = Add Screen To List;MCon = Single;
MData = 0x151E20; MPointer = 0x1428A8; MLen = 0xB

MAdd = 0x16FE48; MType = Add Screen To List;MCon = Single;
MData = 0x152012; MPointer = 0x1428B4; MLen = 0xF

MAdd = 0x16FE5C; MType = Ask For Server Screen List PRequest;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE70; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE84; MType = Update IO Screen State;MCon = Single;
MData = 0x151E20; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FE98; MType = Ask For IO Screen State;MCon = Single;
MData = 0x151E20; MPointer = 0x0; MLen = 0x0

MAdd = 0x16FEAC; MType = Update IO Screen State;MCon = Single;
MData = 0x152012; MPointer = 0x1; MLen = 0x0

MAdd = 0x16FEC0; MType = Ask For IO Screen State;MCon = Single;
MData = 0x152012; MPointer = 0x0; MLen = 0x0



Now skipping 4075 messages; next is the final 10 messages

MAdd = 0x183D30; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D44; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D58; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D6C; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D80; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183D94; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DA8; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DBC; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DD0; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

MAdd = 0x183DE4; MType = Secondary Ready For Memory Image;MCon = Single;
MData = 0x0; MPointer = 0x0; MLen = 0x0

*** End Dump Of IOEngine Synchronization And Communications State ***

*** Begin Dumping Miscellaneous MEngine Support Lists ***

##MEngineThreadReschedules = 0

##MEngineMemoryFrees = 0

*** End Dump Of Miscellaneous MEngine Support Lists ***

*** Start Dump Of IOEngine To MEngine IO Requests ***


```
##SecondaryOutstandingAllocCount = 0
##SecondaryOutstandingDoReqCount = 0
##SecondaryOutstandingDoneReqCount = 0
##SecondaryOutstandingPrimaryDoReqCount = 0
##SecondaryOutstandingPrimaryDoneReqCount = 0

*** End Dump Of IOEngine To MEngine IO Requests ***

*** Start Dump Of MEngine DOS IO Outstanding Requests ***

##OtherEngineRequestListCount = 0
##DoneRequestListCount = 0

*** End Dump Of MEngine DOS IO Outstanding Requests ***

*** Start Dump Of Memory Borrowed From MEngine By IOEngine ***

##AmountMemoryBorrowedFromMEngine = 0
##AmountUsedOfMemoryBorrowedFromMEngine = 0
##NumberOfMemoryBlocksBorrowedFromMEngine = 0
##OutstandingSecondaryBorrowRequestAmount = 0

*** End Dump Of Memory Borrowed From MEngine By IOEngine ***

*** Start Dump Of Secondary Timer Calibrate Messages ***

##OutstandingSecondaryCalibrateRequests = 0
##OutstandingCalibrateRequestToPrimaryServer = 0

*** End Dump Of Secondary Timer Calibrate Messages ***

*** Start Dump Of LSL State ***

ReceiveBuffersCount = 100; ReceiveBuffersSize = 1574

##OutstandingMEngineSends = 0
##GetInfoRequest = 0
##SecondaryAlreadyKnowsAboutIt = 0
##SecondaryHoldOff = 0
##SecondaryFragmentedMessage = 0
##SecondaryGotTheData = 61

*** End Dump Of LSL State ***

*** Start Dump Of IPX Protocol Stack State ***
```



This IOEngine IPX Internal Net Number = 0x30
Other IOEngine IPX Internal Net Number = 0x20
MSEngine IPX Internal Net Number = 0x25

*** Start Dump Of IPX Protocol Stack State ***

*** Start Dump Of IOEngine To MSEngine Comm State ***

###RegisteredIOToMScComm =
##CurrentlyRegisteringIOToMScComm = 0
##SecondaryTrackingMSEngineCommRegistration = 0
##SecondaryIOToMScCommRegistrationState = 0

*** End Dump Of IOEngine To MSEngine Comm State ***

*** Begin Dumping Adapter IOCTL Queue Information ***

Adapter
CPQDA386.DSKA
(1010047) IOCTL information

*** Begin Dumping Device Queue Information ***

Device COMPAQ IDA v2.30 (47000000) queue information
Device COMPAQ IDA v2.30 (47000000) dequeue information
Device COMPAQ IDA v2.30 (47000000) indevice information

*** Begin Dumping Generic Event Information ***

Pending generic events count = 0

*** Begin Dumping Generic Request Information ***

END MIRRORED SERVERS STATUS DUMP
IOEngine Name: IO_LEFT Other IOEngine Name: MSEngine Name: SFT3_SERVER
Status Dump Taken At 5/6/93 4:13:06 pm

Appendix C

EXAMPLE .NCF FILES

NetWare SFT III uses the following *.NCF* files to start and synchronize the mirrored servers:

- IOSTART.NCF
- IOAUTO.NCF
- MSSTART.NCF
- MSAUTO.NCF

Use the following *.NCF* files as examples when implementing your NetWare SFT III system.

NOTE: These *.NCF* files are examples. The *.NCF* files for your configuration may differ.

EXAMPLE *IOSTART.NCF* FILE

```
IOEngine name LEFT_SFTIII
IOEngine IPX Internal Net 222

# Load Multiprocessing Driver
LOAD CPQMP

# Perform SET parameters
Set Secondary Take Over Delay Amount = 1
Set Mirrored Server Comm ACK Wait Time Out = .8
Set IPX Internet Down Wait Time = 4
Set Comm Deadlock Detect Wait Time = 5
Set New Start Address For Unclaimed Memory Block = 3500000

# Load SCSI Support Files
LOAD CPQSXPT
LOAD CPQS710
LOAD CPQSDISK
LOAD CPQS94 slot=12
```



```
# Load and Bind Token Ring
LOAD CPQTKNWN slot=4
BIND IPX CPQTKNWN net=1604
```

```
# Load MSL Driver
LOAD NMSL
```

EXAMPLE IOAUTO.NCF FILE

```
# Load ASPI Support
LOAD CLIB
LOAD CPQSASPI

# Load RCONSOLE Support Files
LOAD remote remote
LOAD rspx

# Load RPL Support
LOAD tokenrpl

# Load ARCSERVE Tape Backup
LOAD TAPEBD ABOVE16
LOAD TAPEDRV ABOVE16
LOAD ARCSERVE
```

EXAMPLE MSSTART.NCF FILE

```
Set Concurrent Remirror Requests = 10
Set Cache Buffer Size = 8192
```



EXAMPLE MSAUTO.NCF FILE

```
MSEngine Name SFT3
MSEngine IPX Internal Net C00C00

# Set Packet Receive Buffers
Set Minimum Packet Receive Buffers = 100
Set Maximum Packet Receive Buffers = 500

LOAD MONITOR

# Load Oracle support files
ORALOAD
```



Appendix D

MULTIVENDOR INTEGRATION FROM COMPAQ

To help you successfully integrate and optimize your network or multivendor system, Compaq has developed a library of systems integration TechNotes for the NetWare, Microsoft Windows NT, and SCO UNIX operating system environments. TechNotes provide you with important information on topics such as network performance management, server management, and operating system interconnectivity.

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INDEX

A

ABEND

- error conditions and 4-4
- failure in IOEngine 4-2
- failure in MSEngine 4-2
- hardware failure 4-2
- secondary server 4-8

Abnormal shutdown *See ABEND*

ACTIVATE SERVER command 1-8, 3-5, 3-10, 4-6

Adding hardware to a server 3-12

Addressing scheme for servers 2-3

Alternate routing paths 3-1

Appletalk protocol support 1-13

Architecture, NetWare SFT III 2-2

Audit parameters, system 4-16

AUTOEXEC.BAT 4-5

AUTOEXEC.NCF 1-12, 3-9

B

Blocking, defined 2-6

Boards, MSL *See MSL*

Buffers, PB 3-11

C

CLIB.NLM 3-10

Client workstation

communication with servers 2-7

installation 3-12

shells 1-11

Coaxial cable 3-6

COMM DEADLOCK condition 1-10, 4-4, 4-7

Commands, console 1-8

Communications driver 1-10

Compaq drive mirroring, Dynamic Sector Repairing and 4-18

Compaq Insight Manager, NetWare SFT III support for 1-12

Compaq Management Agents, NetWare SFT III support for 1-12

Compaq Server Manager/R, NetWare SFT III support for 1-12

CONFIG command 1-9

CONFIG.SYS 4-5

Console commands for NetWare SFT III 1-8

Controller duplexing 2-6

CPQDA386.DSK 4-13, 4-19
CPQMP.NLM 1-6, 2-5, 3-8, 4-4
CPQSDISK.DSK 4-19
CRC checking, enabling 1-10

D

Data guarding, Dynamic Sector Repairing and 4-18
DEADLOCK condition, COMM 4-4, 4-7
Device drivers
 CPQDA386.DSK 4-13
 CPQDA386.DSK for drive array subsystems 4-19
 CPQMP.NLM 1-6, 2-5, 3-8
 CPQSDISK.DSK 4-19
 dual processing 1-2, 1-6, 2-4, 2-5, 3-8
 Fast-SCSI-2 Controller 4-13
 hard disk 4-13
 NPFC and 3-6, 4-13
DEVMON.NLM 1-8, 4-11
Diagnostics software, MSL boards 4-6
Disk *See Hard disk*
Disk Change Map 2-6
Distributed data guarding, Dynamic Sector Repairing and 4-18
DOS partition, MSSTART.NCF and 3-7

DOS version, requirement for NetWare SFT III 1-4, 4-5

Dual processing

 CPQMP.NLM 1-6, 2-5, 3-8, 4-4
 defined 2-4
 device driver 1-6, 2-5, 3-8
 implementation 3-8
 performance 4-21
 support 1-2

Duplexing 2-6

Dynamic routing 2-3

Dynamic Sector Repairing 4-18

E

Eagle Technology 1-3, A-1

Engine naming scheme 2-3

Error log files

 IO\$LOG.ERR 4-2, B-1
 MSSTATUS.DMP 4-2, B-4
 SYS\$LOG.ERR 4-2, B-3

Error messages 4-3

"Error transferring IOEngine error log" message 4-3, 4-14

Ethernet frame types, IPX checksums and 1-12

Expanded system memory, packet burst 1-12

Extended system memory, packet burst
1-12

F

Failure

error log files and, 4-2
hard disk 3-3
LAN connection 4-3
primary server hard drive subsystem
4-4, 4-14
server 2-7

Failure recovery

hard disk 2-11
MSL 2-13
NIC 2-12
power loss 2-10

Fast-SCSI-2 Controller device driver 4-13

Fault tolerance

controller duplexing 2-6
data guarding 4-18
distributed data guarding 4-18
drive mirroring, Compaq 4-18
Dynamic Sector Repairing and 4-18
NetWare SFT III and hard disk 3-3
performance and 3-4
read-after-write verification and 4-18

Features, NetWare SFT III

client shells 1-11
console commands 1-8
dual processing 1-2, 1-6, 2-4, 3-8
independent routing 1-6
packet burst 1-6, 3-11
SET parameters 1-9, 3-7, 3-12, 4-16

Fiber optic cable 3-6

Formula for calculating minimum system
memory 1-4

Frame types, Ethernet 1-12

H

HALT command 1-8, 3-13

Hard disk

controller duplexing 2-6
device drivers 4-13
failure in primary server 4-4, 4-14
failure recovery 2-11
Fast-SCSI-2 Controller 4-13
fault tolerance and NetWare SFT III
3-3
IOEngine Error Log 4-14
mirrored partitions 4-5
orphaned partition 4-14
remirroring 1-8, 1-10, 4-20

Hard disk (*Continued*)

troubleshooting 4-13

Hardware requirements for NetWare SFT III

1-4, 4-5

Holdoff 4-4, 4-7**Hot Fix Redirection Area**

Dynamic Sector Repairing and 4-18

read-after-write verification and 4-19

I

I'm alive packets 2-4, 2-8, 2-10, 4-3, 4-10

Independent routing 1-6**Input/Output Engine** *See IOEngine***Insight Manager** 1-12**INSTALL.NLM** 1-9, 3-9, 3-10**Installation**

adding hardware to the server 3-12

checklist 3-5

dual processing 3-8

upgrading from NetWare v3.1x 3-9

workstation 3-12

Interrupts, MSL board settings 3-6

"Invalid Server Initialization" message 4-3, 4-8

IO\$LOG.ERR 3-8, 4-2, 4-14, B-1**IOAUTO.NCF** 3-7, 3-8, 3-10, C-2**IOEngine**

as a router 1-6

defined 2-1

error log files 4-3

initialization 3-8

IOAUTO.NCF 3-7, 3-8, 3-10, C-2**IOSTART.NCF** 2-5, 3-7, 3-10, 3-12, 4-4, 4-13, C-1**IPX**

checksums 1-12

connections 1-10

internal network number 2-3

Internet is down/up 4-10

network no longer returning status check packets 4-12

server does not know how to route 4-11

"IPX Internet is down/up" message 4-3

"IPX network no longer returning status check packets" message 4-3

IRQ *See Interrupts***L****LAN**

connection failure 4-3

Information screen support 1-12



LAN (*Continued*)

"IPX Internet is Down/Up" message
4-10

"IPX Network (Address) No Longer
Returning Status Check Packets"
message 4-12

"This Server Does Not Know How to
Route IPX" message 4-11

troubleshooting 4-10

Linear memory 4-5

Log files 4-3

M

Management Agents 1-12

Map, Disk Change 2-6

Memory *See System memory*

MEMORY command 1-9

MEMORY MAP command 1-8

Microdyne A-1

MIRROR STATUS command 1-8

Mirrored Server Engine *See MSEngine*

Monitor, required for NetWare SFT III 1-4,
4-5

MONITOR.NLM 1-9, 1-12, 2-1, 3-7, 3-10,
4-19

MSAUTO.NCF 3-7, 3-9, 3-10, C-3

MSEngine

adding system memory 3-14

defined 2-1

files 3-7

synchronization check 1-10

"MSEngine Different Outputs" message
4-3

MSERVER.EXE 4-5, 4-19

MSL

coaxial cable 3-6

device driver 4-6

diagnostics software 4-6

failure recovery 2-13

fiber optic cable and 3-6

installation 3-6

interrupts 3-6

"Invalid Server Initialization" message
4-8

manufacturers 1-3

NICs as MSLs 3-3

redundant 3-2

requirement for NetWare SFT III 1-4

resynchronization 2-14

"Secondary Server ABENDS When
MSL Driver is Unloaded" 4-8

MSL (*Continued*)

speed rating 1-3

troubleshooting 4-6

MSL COMM DEADLOCK condition 4-4,
4-7

MSSTART.NCF 3-7, 3-10, C-2

MSSTATUS.DMP 4-2, B-4

N

Names, engine 2-3

.NCF files 3-10

NET.CFG 3-11

NetWare for Macintosh support 1-12

NetWare for SAA support 1-12

NetWare FTAM support 1-12

NetWare Management Services support
1-12

NetWare Name Service support 1-12

NetWare NFS support 1-12

NetWare Programs from Compaq
See NPFC

NetWare system and public files 4-5

NetWare v3.11 patch support 1-12

NetWare, read after write verify 4-17

Network number, IPX internal 2-3

NETX file 3-11

NIC

as an MSL 3-3

failure 4-3

failure recovery 2-12

"IPX Internet is Down/Up" message
4-10"IPX Network (Address) No Longer
Returning Status Check Packets"
message 4-12"IPX No Long Returning Status"
message 4-12requirements for NetWare SFT III 1-4,
4-5"This Server Does Not Know How to
Route IPX" message 4-11

troubleshooting 4-10

.NLM files

CLIB.NLM 1-8, 3-10

CPQMP.NLM 1-6, 2-5, 3-8, 4-4

DEVMON.NLM 1-8, 4-11

INSTALL.NLM 1-9, 3-9, 3-10

MONITOR.NLM 1-9, 1-12, 2-1, 3-7,
3-10, 4-19

PATCHMAN.NLM 1-12

PROTO.NLM 1-8, 3-10, 4-11



.NLM files (*Continued*)

SET.NLM 1-8

STREAMS.NLM 3-10

VREPAIR.NLM 3-10

NPFC

device drivers 3-6

dual-processing driver 3-8

Number, IPX internal network 2-3

O

Orphaned partition 4-4, 4-14

OS/2 Requester support 3-12

OS/2 support 1-13

"Other Server Requested This Server to Restart due to failure" message 4-3

P

Packet burst

extended and expanded memory shells
1-12

PB buffers 3-11

workstations and 1-6, 3-11

Packets

I'm alive 2-4, 2-8, 2-10, 4-3, 4-10

recovery of lost 2-7

status check 4-12

Parameters

communications 4-17

performance 4-20

recovery 2-15, 4-15

SET 1-9, 3-7, 3-12, 4-16

system audit 4-16

test mode 3-12

Partition

mirrored logical 4-5

orphaned 4-4, 4-14

Patches, NetWare v3.11 1-12

PATCHMAN.NLM support 1-12

Paths, alternate routing 3-1

PB buffers 3-11

Performance

dual processing 4-21

effect of hardware fault tolerance on
3-4

MSL interrupts 3-6

optimizing Fast-SCSI-2 Controller
when loading the device driver 4-13

tuning 4-20

PlainTree Systems, Inc. 1-3, A-2

Planning

alternate routing paths 3-1

Planning (*Continued*)

- using a print server 3-4
- using disk fault technology 3-3
- using redundant MSLs 3-2

Power loss, recovery from 2-10

Printing, NetWare SFT III and 3-4

PROTO.NLM 1-8, 3-10, 4-11

R

RAM *See System memory*

Random Access Memory *See System memory*

RAWV *See Read-after-write verification*

Read-after-write verification

- CPQSDISK.DSK device driver and 4-19

- enabling with CPQSDISK.DSK 4-19

- fault tolerance and 4-18

- Hot Fix Redirection Area and 4-19

"Ready to Synchronize" message 4-3, 4-7

Recovery

- parameters 2-15, 4-15

- server failure 1-10, 2-8, 4-15

Redundant MSL boards 3-2

Remirroring

- disk 1-10

- duplexing and 2-6

Requirements for NetWare SFT III, hardware 1-4

RESTART command 1-8

Restart, server 4-4, 4-15

Routing paths, alternate 3-1

Routing, dynamic 2-3

S

Secondary server ABENDS when MSL drive is unloaded 4-4

Server failure

- illustrated 2-7

- recovery 2-8

- recovery of lost packets 2-7

Server Manager/R 1-12

Server recovery 1-10, 4-15

Servers restart for no reason 4-4

SET parameters 1-9, 3-7, 4-16, 4-18, 4-19

SET.NLM 1-8

Shutdown, abnormal 4-4

STREAMS.NLM 3-10

Support

802.3 Ethernet frame types 1-12
AppleTalk protocol 1-13
Compaq Insight Manager 1-12
Compaq Management Agents 1-12
Compaq Server Manager/R 1-12
Edit System AUTOEXEC.NCF File option 1-12
IPX checksums 1-12
LAN Information screen 1-12
NetWare for Macintosh 1-12
NetWare for SAA 1-12
NetWare FTAM 1-12
NetWare Management Services 1-12
NetWare Name Service 1-12
NetWare NFS 1-12
NetWare v3.11 patches 1-12
OS/2 versions 1-13
packet burst 1-12
PATCHMAN.NLM 1-12
TCP protocol 1-13

Synchronization

blocking 2-6
Disk Change Map 2-6
MSEngine synchronization check 1-10

Synchronization (*Continued*)

MSERVER command and 3-13
MSL failure recovery 2-14
process 2-6
"Ready to Synchronize" message 4-7
SET parameters 4-16
SYS volume, MSAUTO.NCF and 3-7
SYSS\$LOG.ERR 4-2, B-3
SYSCON Utility 1-12
System audit parameters 4-16
System log files 4-3
System memory

- adding 3-12
- Compaq linear 4-5
- formula 1-4
- packet burst for extended and expanded memory shells 1-12
- requirement for NetWare SFT III 1-4, 4-5
- SET parameters for 1-10

System memory parity error 1-10

System processor

- dual processing 1-2
- requirements for NetWare SFT III 1-4

T

- TCP protocol support 1-13
- Test mode parameters 3-12
- "This Server Does Not Know How to Route IPX" message 4-3
- Thomas-Conrad Corporation 1-3, A-2
- Thomas-Conrad Networking System A-2
- Troubleshooting NetWare SFT III
 - error conditions 4-4
 - error messages 4-3
 - hard drive subsystem 4-13
 - LAN connections 4-10
 - "MSEngine Different Outputs" message 4-15
 - NICs 4-10
- Tuning, performance 4-20

U

- Updating NetWare SFT III 4-19
- Upgrading
 - from NetWare v3.1x 3-9

V

- VREPAIR.NLM 3-10

W

- Workstation *See Client workstation*