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Focus on Compaq Server Health in a NetWare Environment

Abstract: Computing networks continue to mushroom and multiply at explosive rates. That's because success in business today depends upon high performance, non-stop-computing power for mission-critical functions. Compaq recognizes the challenge that enterprises face in managing their complex distributed networks. And it continues to provide the best equipment and support software to meet that challenge.

In fact, from its inception, Compaq has led the computer industry in the effective integration and management of networked systems through (1) innovative hardware engineering, (2) high-availability and robust equipment; (3) dynamic network management solutions; and (4) effective and comprehensive server health and management tools.

In this Integration Note, we discuss the framework of systems management, network management, and server management and then focus more narrowly on optimizing server health while running within a NetWare environment.

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Integration Note prepared by OS Integration

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Overview

From its inception, Compaq has successfully engineered superior fault and recovery features into its servers and has integrated these features with premier server health drivers, powerful utilities, industry-standard options, state-of-the-art management application programs, and other support software/hardware products that optimize an enterprise environment. No other systems management products within the industry provide you with the breadth of functionality and depth of control required for successfully managing the critical components of your distributed enterprise systems.

This Integration Note focuses primarily on Compaq server health while running within a NetWare environment. However, in order for you to better understand the concept of server health and how this server management subset fits into the big picture of systems management, we begin with an overview of systems, network, and server management. Probing a little deeper, we discuss the three major components of server management:

- Configuration and integration management
- Performance analysis
- Fault detection and recovery or, simply, server health monitoring

Lastly, we focus in-depth on server health monitoring and the innovative and effective server health tools that allow you to proactively maintain and manage your mission-critical server operations in three ways:

- Prevent faults from happening
- Keep systems up and running in case of an unlikely failure
- Deliver rapid recovery to normal operation after a fault occurs

Systems Management

As the demand for fast, accurate information surges, your distributed computing networks have also expanded and continue to be a critical and costly resource. Compaq continues its commitment to help you wisely implement and effectively manage your distributed networks and their components. Traditionally, these smaller, overlapping systems have been grouped into one large umbrella, called a mega-system, or simply *the computer system*.

The management of this mega-system involves the configuration and integration management, performance analysis, and health monitoring of all the interacting subsystems. This enormous tasking is referred to as **systems management**, with network management and server management considered subsets.

Effective systems management requires the integration of all your intelligent hardware, firmware, and software with powerful diagnostic and management application programs. This management process begins when a system or subsystem is designed and continues through its deployment, operation, and removal. This is true whether the mega-system involves a mainframe-, midrange computer-, or a PC server-based distributed system.

Recognizing the demanding task of systems management, Compaq has developed a powerful systems management strategy to ensure its customers the most reliable, efficient, and easily managed networks in the market today. This strategy emphasizes three primary objectives:

- Engineer manageability into all Compaq products, thereby lowering the overall cost of managing Compaq products
- Deliver systems management and health products that enable comprehensive management of distributed Compaq systems throughout an enterprise
- Partner with other industry leaders in systems management to enable a broader management of Compaq products.

Compaq systems management strategy and objectives ultimately drive the design, operation, and management of each Compaq computing system and is particularly evident in the following discussions on network management and server management.

Network Management

In the most encompassing terminology, network management consists of a set of tools and processes that enable the management, performance analysis, and health monitoring of infrastructure and computing devices, as well as the network protocols that enable information transfers.

Let's look at Figure 1. When we typically describe a network, we often list only the infrastructure devices: bridges, routers, switches, repeaters, cables, gateways, and hubs—in other words, the physical elements that make your whole communication backbone work. But we need to also include another important resource: computing devices, or logical elements. These computing devices—servers, desktops, workstations, hosts, and mainframes—each *talk* to the other devices on your network through a network interface controller (NIC), a vital component of all network-computing devices.

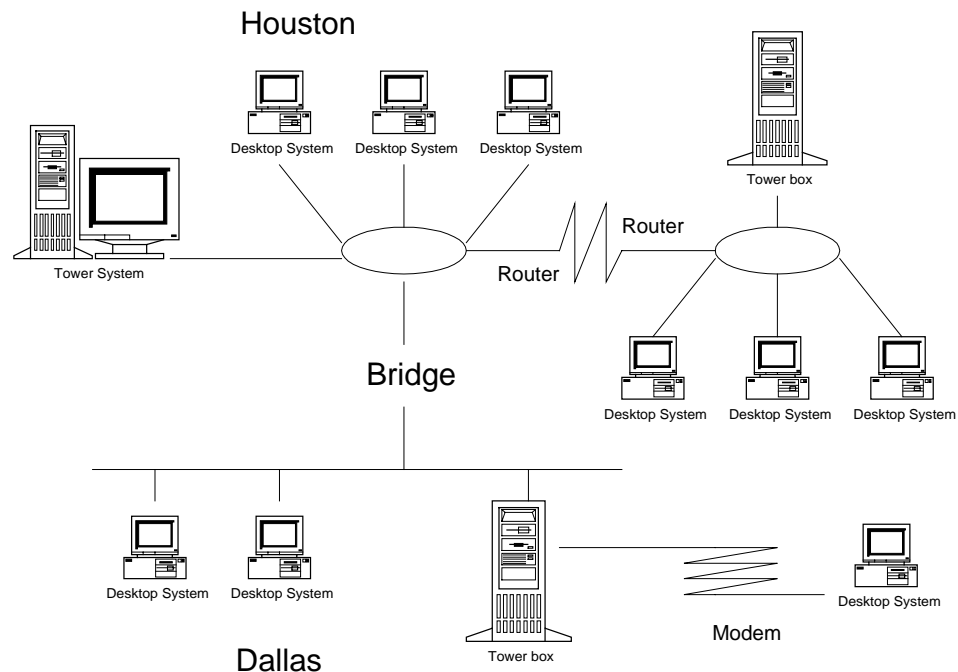


Figure 1. A typical computing network that includes both infrastructure and computing devices

In addition, each computing device is a system into itself. For example, your server houses several important subsystems, such as a processor, memory, storage, NIC, and server software,

that must also efficiently operate as one functional system. Your server system can also be an integral component of another overlapping subsystem, such as the client/server system. Within this framework, you need the right tools to manage your networks and the right tools to manage your server systems. Optimally, these tools should be integrated and complement each other.

Most enterprises today must astutely manage several networks and numerous overlapping subsystems. Premier network management tools include Compaq Netelligent Management Software that provides network configuration, integration, performance monitoring, and fault prediction and recovery features for manageable Netelligent products. Although the Netelligent Software was designed to manage networks, you can also integrate it with our powerful server management tool, Compaq Insight Manager, discussed later. Bottom line: the capability for total management control from a single console.

Managing an entire system or a single network would be extremely difficult without standards. When an organization purchases multiple management tools, each with a different method of managing particular hardware or software products, costs—of training managers and efficiently maintaining networks—soar. Consequently, the Internet standards committee (Internet Engineering Task Force) has defined an industry-standard, network-management protocol, called SNMP.

SNMP

Simple Network Management Protocol (SNMP) is an industry-standard protocol for the exchange of management data between management agents and management applications. It has garnered a major share of the market and has support of over 20,000 products, including Compaq Netelligent Management Software, Novell ManageWise, and Compaq Insight Manager.

Two important components of SNMP are **manageable devices**; such as routers, bridges, servers, and workstations, and **manageable objects**; such as storage subsystems, processors, NICs, and memory. Within the SNMP framework, these devices and objects are managed using managers, agents, and management information bases (MIBs).

Managers

Managers are software products that gather information about devices and objects, store the information in a format that your administrators can understand, and often provide a plan of action to correct faulty operations or kick-off other programs. You can think of the manager, or software management program, as a boss who wants to defray a costly work shutdown by proactively managing his employees and projects. Typically, this boss asks a lot of questions, wants detailed expedient answers, and has several recovery plans at the tip of his fingers. Compaq Netelligent Management Software, Compaq Insight Manager, and Novell ManageWise are all managers.

Management Agents

Within the SNMP network, each managed device contains software or firmware components called **management agents** that provide attribute information for a manager. At specific intervals, the agent monitors the various subsystems of the managed device and stores this information in its database, but does nothing else unless it is polled for information or detects an error.

Compaq servers support Compaq developed, SNMP-based management agents running under network operating systems, such as NetWare, Microsoft Windows, SCO UNIX, and IBM OS/2.

When a manager wants information concerning the status of a particular device, he polls the responsible agent who gathers the information from a device driver. The agent then sends the status information to the manager, or sophisticated software application, that processes the information. This manager/agent scenario parallels a boss [management application] asking an employee [agent] how a project is coming. The employee assesses the project and returns a reply [alarm], such as “All’s well” or “Oops! Behind schedule,” or “Missing important information.”

The employee, or agent, can also initiate the conversation. When a monitoring device, such as the Compaq Server Health Driver (*CPQHLTH.NLM*), detects a fault, the agent grabs the message (trap) and sends notification to the manager.

Management Information Base (MIB)

A **management information base**, or MIB, is a device-specific database or attribute table, readable and writable by a management application using the SNMP standard.

Typically when you add a device to a network, you must also load the device’s MIB into the management software so that you will be able to manage the device. A MIB database can consist of literally hundreds of elements, arranged in hierarchical order. You can navigate through the various levels to locate the precise attributes you will need to manage a specific device.

Setting up Data Strings

In order for the agent to report a problem, you first must setup SNMP System Description (*SNMP.CFG*) and Trap Destination (*TRAPTARG.CFG*) files. The *SNMP.CFG* file is an ASCII text configuration file that provides the *SNMP.NLM* management agent with a server name, hardware, location, and contact information. The *TRAPTARG.CFG* file tells the *SNMP.NLM* where to send the alarm information by listing the addresses of management consoles that should be alerted when the management agents detect an important event.

To determine the network address of your management CD when using IPX, you can execute the USERLIST program.

You should update your *SNMP.CFG* and *TRAPTARG.CFG* files to match your network and server management configurations. These sample files are available from the Compaq Management Agents on the Compaq Management CD Release 4.60 or later in the `\AGENTS\NETWARE\ENG\NOVELL\ETC` directory.

IMPORTANT: Do not use the Compaq Management CD Release 4.50.

If your system does not already have these files in your `SYS: \ETC` directory, copy the sample files to your directory. Create a `SYS: \ETC` directory on the system, if one doesn’t already exist.

You can also download the Management Agents from the website:
<http://www.compaq.com/support/files/server/softpaqs/>.

IMPORTANT: Be sure you place the alarm destination address under the appropriate protocol section and indent at least one space for each address.

When SNMP messages are exchanged, they contain two parts:

- Community Name — Identifies the authentication mechanism.
- Data — Includes specific information to validate the sending SNMP entity as a member of an identified community.

SNMP defines a community as a relationship between a SNMP agent and one or more SNMP managers. The SNMP-compatible Compaq Management Agents for NetWare allow two different user communities to be identified.

- **Monitor Community** — Provides you with access to all SNMP attributes with read-only access.
- **Control Community** — Provides **READ/WRITE** or **SET** privileges.

To enable Compaq Insight Manager to perform **SET** operations on system parameters on a NetWare system, you must specify a control community. To configure these community strings, use the Compaq Management Agents Installation and Configuration Utility (*CPQAGIN.NLM*) or the Network Configuration Utility (*INETCFG.NLM*).

For more detailed information on network management, see the white paper: *Network Management Overview* (Document #ECG043/0996) on the Compaq website: <http://www.compaq.com/support/techpubs/whitepapers/index.html>.

We will now probe into the server system and its management.

Server Management

Server management includes the in-depth control, analysis, and monitoring of the configuration and integration, performance, and fault aspects (health) of your server operation. Your server management process begins when you deploy a server. However, for your server to operate at intended levels of throughput and availability, every hardware and software component must have first been properly designed and configured. They must also be compliant with your other subsystem components.

That's why effective server management requires the following:

- **Built-in server and options capabilities**

Every hardware subsystem, or manageable object, in Compaq servers has a robust set of management capabilities, designed-in, that address one or more of the fault, performance, and configuration management aspects of your server operation. Refer to Figure 2.

Manageable objects include the following:

- Storage
- NIC
- System Memory
- Processor
- NetWare active applications
- Environment (hardware configuration)
- Strict adherence to popular network management standards for communication protocols and data interchange (Compaq supports industry-standard SNMP protocol, discussed in the "Network Management" section.)
- Tools that operate within the customer's preferred environment

Compaq provides a well-integrated and thoroughly tested library of support software—drivers, applications, operating systems, patches, and utilities—for servers running NetWare.

These server management products help you install, configure, and monitor Compaq servers; they are available on the Compaq SmartStart and Support Software CD and the Compaq Management CD that accompany each Compaq server purchase. You can also download the software from the Compaq website:

<http://www.compaq.com/support/files/server/Netware/index.html>.

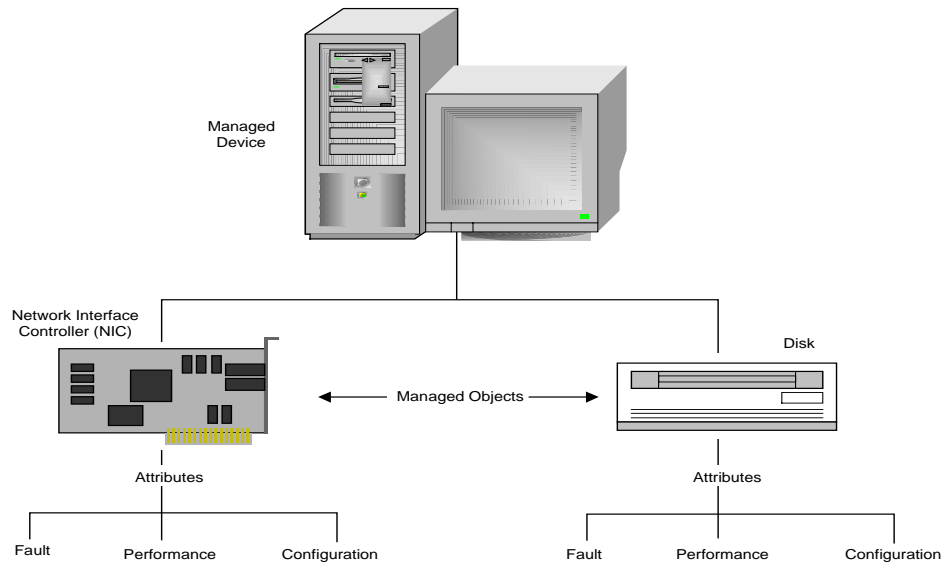


Figure 2. Managed device and its manageable objects

Compaq Insight Manager

Compaq Insight Manager delivers configuration and integration, performance, and fault management for Compaq servers, workstations, desktops, and portables and provides several configuration-reporting options at-a-glance. The software supports 32-bit addressing and multi-threaded operations, so it can support hundreds of network operating systems, such as NetWare.

Additionally, Insight Manager can provide insight into CPU and, in some servers, PCI-bus or EISA-bus utilization. Compaq Insight Manager for NetWare adds the ability to program utilization thresholds into the comprehensive alerting and reporting management system.

Most importantly, Insight Manager increases the reliability of your Compaq servers by helping to prevent failures. Predictive parameters coupled with trend analysis capabilities can predict impending failures of many server components, such as NICs, CPU, memory, environment, and SCSI drives.

This sophisticated software application, or manager, collects and processes information from management agents. It can poll (using the **GET** and **GET-NEXT** commands) a specific agent at specific times (intervals) or only when you request the information. If software or a device fault does occur, the manager reports the problem to a higher authority, your network or server administrator. Additionally, Insight Manager can send alarms to your server management console, activate pager responses, log errors for later diagnosis, and launch other programs and utilities. Insight Manager can be installed from the Compaq Management CD, or from an

Integration Server, discussed later. You can also download the utility bundle from the Support Software website: <http://www.compaq.com/support/files/server/softpaqs/>.

Compaq Management Agents

Compaq Management Agents run on your server, collect and measure parameters, and provide access to the advanced hardware technologies in key server subsystems previously mentioned. These standards-based Management Agents (see Table 1) provide Insight Manager with over 1,000 fault and performance parameters (attributes) from a device's database (MIB), as well as parameter values and your server configuration information provided by device drivers and utilities while the server is active. As previously mentioned, the agent passes this information to the manager through the Simple Network Management Protocol (SNMP).

Table 1. Compaq Management Agents

File Name	Description
<i>CPQBSSA.NLM</i>	Compaq Base System Agent
<i>CPQHOST.NLM</i>	Compaq Management Host Agent
<i>CPQNCSA.NLM</i>	Compaq NIC Management Agent
<i>CPQDSKSA.NLM</i>	Compaq Storage System Agent
<i>CPQHTHSA.NLM</i>	Compaq Server Health Agent
<i>CPQTHRSA.NLM</i>	Compaq Threshold Agent
<i>CPQAGIN.NLM</i>	Compaq Server Agent Installation and Configuration Agent
<i>CPQRISA.NLM</i>	Compaq Remote Insight Agent
<i>CPQIDES.A.NLM</i>	Compaq IDE Subsystem Agent
<i>CPQSCSA.NLM</i>	Compaq SCSI Subsystem Agent
<i>CPQDASA.NLM</i>	Compaq Array Subsystem Agent
<i>CPQFCSA.NLM</i>	Compaq Fibre Channel Array Agent
<i>CPQWEBAG.NLM</i>	Compaq Web-enabled Server Management Agent

The architecture of the Compaq Management Agents has changed. Now they're grouped into four sets: Compaq Foundation Agents, Compaq Server Agents, Compaq Storage Agents, and Compaq NIC Agents.

- **Compaq Foundation Agents** — Collect information for the host server, including clustering, software version, and external MIB status. They also provide threshold support and SNMP alerts.
- **Server Agents** — Collect and display configuration information on the system and the Remote Insight Board. They also provide SNMP alerts.
- **Compaq Storage Agents** — Display information on mass storage subsystems configured on the system being viewed. The agents collect information from Fibre Channel, drive array, SCSI, and IDE subsystems, as well as provide SNMP alerts.
- **Compaq NIC Agents** — Display information on logical Compaq Network Interface Controllers (NICs) that are configured on the system being viewed.

Under the new architecture, you now have the choice to update individual pieces for new functionality instead of having to install all the agents. For example, if you decide to add a new storage subsystem to a server, you only have to update the Compaq Storage Agent.

Better yet: Compaq can more efficiently address your needs by (1) delivering new agent functionality independent of hardware releases and (2) expediting hardware releases by adding management support independent of each other.

You can establish the update interval values when you load your management agents. In other words, you decide the number of seconds that the agent should wait before checking for new alarms to be issued. The default is 60 seconds; the maximum is 300 seconds.

IMPORTANT: A value below 15 seconds might affect the performance of your NetWare system and, consequently, is not recommended.

Agents also trap parameter values, such as thermal sensing and disk pre-failure alerting. Your Compaq Server Health Driver (*CPQHLTH.NLM*), for example, might recognize an out-of-limit parameter value from a manageable device, then passes the fault information to the Compaq Server Health Agent (*CPQHTHSA.NLM*) that uses the **TRAP** command to send them to the Compaq Insight Manager. Other agents, listed in Table 1, perform similar actions.

At the server console, the alarms and traps are pre-configured with alarm severity: critical, major, minor, warning, and unknown. The status of the manageable device is reported as operational, degraded, or non-operational.

Remember also that Compaq disk drives, NICs, memory and CPU are covered by Pre-Failure Warranties. You should immediately contact Compaq service representatives if a problem does arise.

These alarms and traps allow you to proactively manage the server, minimize unplanned downtime, and maximize performance. With advance notification—depending upon the severity of the fault—your administrator can also schedule preventive maintenance downtime rather than ultimately experience a devastating loss of unplanned processing time.

In fact, with the latest hot-plug and redundancy features of Compaq servers and support software, you probably will be able to quickly solve the problem with no downtime.

Installation of Compaq Management Agents

You can install the Compaq Management Agents (listed in Table 1) from the Compaq Management CD using the Compaq Management Agent Installation and Configuration Utility, *CPQAGIN.NLM*. You can also download the four bundles—Foundation Agents, Storage Agents, Server Agents, and NIC Agents—from the Compaq website: <http://www.compaq.com/support/files/server/softpaqs/>.

Minimum Requirements

You will need the following:

- At least 5 MB of reserved disk space
- NetWare 3.12, 3.2, 4.11, 4.2, or 5.x
- Compaq Support Software for Novell Products (Novell SSD) discussed later

Note: Additionally, the version of the Compaq Insight Manager installed on your management console must be identical to or higher than the version of server agents you are loading.

Installation from the Compaq Management CD

To load your Management Agents from the Compaq Management CD, follow these steps:

1. Insert the Compaq Management CD into the CD-ROM drive.

2. If you accessed the CD-ROM drive as a DOS drive, enter the following:

```
LOAD [CD DRIVE]:\AGENTS\NETWARE\ENG\COMPAQ\CPQAGIN
```

If you mounted the CD as a NetWare volume, enter the following:

```
LOAD [NetWare VOL]:\AGENTS\NETWARE\ENG\COMPAQ\CPQAGIN
```

3. Follow the instructions on the screen for loading the specific set of agents. If needed, press **F1** for online help.

IMPORTANT: The Compaq Base System Agent (*CPQBSSA.NLM*), listed in Table 1, must be loaded in a managed system for the Insight Manager to recognize the NetWare OS as a manageable system. *CPQBSSA.NLM* is one of the Foundation Agents and is designed to operate on any PCI, ISA, or EISA computer system running NetWare 3.12, 3.2, 4.11, 4.2, or 5.x.

After the installation is complete, you must restart the system to enable the Management Agents. These agents will now automatically start each time you reset the system.

Compaq Insight Manager Management Information Base (MIB)

Conceptually, the Compaq Insight Manager Management Information Base (MIB) is a database, readable and writable by any SNMP-compliant management platform, such as Compaq Netelligent Management Software, Novell ManageWise, and Compaq Insight Manager. These MIBs provide the base structure for managing Compaq hardware. With these MIBs, your management application can understand Compaq SNMP traps.

Compaq MIB items show up as SNMP events for configuration of the alarm dispositions. This means you can configure how Insight Manager logs the SNMP trap and whether the trap should launch an application. Management Agents monitor your various server subsystems and gather information from device drivers that have captured attributes described in the device's (MIB). The agent then stores this information in its internal database.

Compaq was the first PC Company to develop a MIB that enabled SNMP management of a server.

Let's look at three important server health MIBs:

- The Health MIB (*CPQHLTH.MIB*) contains information about system health features, including critical errors, correctable errors, Automatic Server Recovery (ASR) feature, thermal (temperature and fan) sensing features, POST message tracking, system lifetime, and EISA bus utilization.
- The Recovery MIB (*CPQRECOV.MIB*) contains information about the Compaq Recovery Server Option.
- The Threshold Management MIB (*CPQTHRSH.MIB*) contains information about user-defined thresholds for sending alarms and reporting error conditions.

Table 2 lists all the current Compaq Insight Manager MIBs, organized by category and purpose. Attributes from these MIBs are discussed in more detail in the "More on Server Health Monitoring" section.

Table 2. Compaq Insight Manager MIBs

MIB Filename	MIB Name	Purpose
CPQHLTH.MIB	Health	Information about system health features, including critical error log [IML], correctable error log [IML], ASR feature, thermal sensing features, POST message tracking, system lifetime, and EISA bus utilization.
CPQHOST.MIB	Host Operating System	Information about host operating system: OD ID, CPU utilization, file system, NIC interface to hardware mapping, and loaded modules.
CPQIDA.MIB	Intelligent Drive Array	Information about the Compaq Drive Array Controllers and drives connected to these controllers, including SMART Controller, IDA-2 Expansion Controller, and IDA Controller.
CPQRECOV.MIB	Recovery	Information about the Compaq Recovery Server Option.
CPQSCSI.MIB	SCSI Device System	Information about the Compaq SCSI interface products, including SCSI drives and generic SCSI device and controller information. Information about SCSI tape and CD-ROM. Does not include SMART controller. See CPQIDA.MIB
CPQSINFO.MIB	System Information	Information about Compaq-specific features, including security features, Memory Modules, board revisions, asset management, and so forth.
CPQSRVMN.MIB	Server Manager	Information about the Compaq Server Manager/R board.
CPQSTDEQ.MIB	Standard Equipment	Information that is available on any ISA or EISA system, including system processor, memory, ISA, CMOS, EISA NVRAM, serial port, ROM, diskette drives, and IDE-compatible drive information.
CPQSTSYS.MIB	SCSI Storage System	Information about the Compaq ProLiant Storage System.
CPQTHRSH.MIB	Threshold Management	Information about the Insight software components that can generate alarms based upon user-defined thresholds and can track statistics on attributes based upon user inputs.

The Insight Manager MIBs contain many attributes that provide you with a comprehensive picture of the (1) configuration, (2) operating statistics, and (3) condition (health) of the system. Table 3 lists the Compaq Health MIB data items and fault identification attributes. Fault identification attributes for other MIBs can be found in the *Compaq Insight Manager* manual.

Table 3. CPQHLTH.MIB fault identification attributes

Data Item Description	MIB Attribute
Automatic Server Recovery	cpqHeAsrCondition
Correctable Memory Error	cpqHeCorrMemErrDesc
Correctable Memory Log	cpqHeCorrMemLogCondition
CPU Fan Status	cpqHeThermalCPUFanStatus
Critical Error Description	cpqHeCriticalErrorDesc
Critical Error Log Condition	cpqHeLogCondition
Critical Error Type	CpqHeCriticalErrorType
Overall Thermal Condition	cpqHeThermalCondition
POST (Power-on Self Test) Error Code	cpqHePostMsgCode
POST Error Description	cpqHePostMsgDesc
POST Error Message Recording Status	cpqHePostMsgCondition
System Fan Status	cpqHeThermalSystemFanStatus
System Temperature Status	cpqHeTempStatus

Compaq Remote Insight Board

Another powerful feature of the Compaq Insight Manager is the optional Compaq Remote Insight Board. Remote Insight provides an OS-dependent remote connection to a managed server, allowing your remote PCs to display all phases of server activity (including Power-on Self Test (POST) sequence and OS loading) without lost or corruption. In addition, Remote Insight allows your server administrator to remotely restart your servers and obtain alphanumeric or digital pagers when an alert occurs. Remote Insight will be discussed in more detail in the “Compaq Remote Insight Board Driver (*CPQRI.NLM*)” section.

Server Configuration and Integration Management

In order for your systems to operate at intended levels of throughput and availability, each of your hardware and software components must be astutely designed and then optimally configured. In simple terms optimally configured means being in the right place, at the right time, and with the right information.

Unfortunately, your server might have the latest and greatest software with more bells and whistles than any other system on the market and still have the wrong information—for your unique enterprise system. That’s because server systems are not static; they are dynamic. The success of distributed enterprise systems depends not only on high performance and the ability to proactively manage those systems, but success also depends upon how efficiently the system itself deals with change.

Every time that software, hardware, and firmware are upgraded, added, or deleted, even the most ingenious integration and configuration plan must change. Let’s think about one other major fact: not only must your server subsystem operate as one efficient system, your server must also be compatible with other servers and network components. The network or server administrator—with the aid of Compaq integration and management tools—ensures this compatibility.

We have stated earlier that the systems integration and management process begins when system components are designed and continues through their implementation and removal. Compaq realizes just how important integration testing is to the success of an enterprise. As a result, countless hours are spent jointly developing and testing Compaq servers and options with Novell (and other major vendors) operating systems.

But it doesn’t stop there. The integration and testing process must continue as you introduce new elements—whether due to changing requirements of your organization or because more effective (higher availability, reliability, and performance) components become available from other manufacturers. So, Compaq developed two primary tools to make your configuration and integration tasks easier: Compaq Insight Manager and SmartStart for Servers.

Compaq Insight Manager monitors and controls the operation of Compaq servers and desktops.

With Compaq Insight Manager, discussed earlier, your server administrator can monitor your server configuration and quickly diagnose integration errors. The Compaq Insight Manager Version Control feature compares system, driver, firmware, and utility versions

on your server to a reference platform (usually the Integration Server) that is constantly upgraded with the most up-to-date versions available from the Compaq website, <http://www.compaq.com>. Software that needs to be upgraded is flagged with a red or yellow indicator based on the urgency of the upgrade. A description of the upgrade and its benefits are also included.

With the new generation of SmartStart for Servers, a comprehensive and intelligent integration tool, Compaq simplifies the process of configuring proven and reliable server platforms. SmartStart is discussed in more detail in the next section.

In addition to Insight Manager and SmartStart for Servers, Compaq has also introduced a new set of functionality for effective setup and maintenance of NetWare servers, called Integration Management. Through Integration Management, your system administrator sets up an Integration Server, developed to aid you with integration and configuration tasks. This Integration Server acts as a library, or organized repository, for server and network software. It not only stores and catalogues specific software versions but ensures their compatibility with new software and can download this software—over the network—to your production servers.

SmartStart and Support Software for Compaq Server Products

If you start off on the right foot with Compaq SmartStart support software, components—such as agents, BIOS updates, server maintenance utilities, and Compaq Support Software for Novell Products (Novell SSD)—will be seamlessly integrated with NetWare.

- **Compaq Array Configuration Utility** — Setup program for Compaq array controllers that configures physical drives attached to the controller into arrays and logical drives that the OS uses.
- **Compaq Array Diagnostic Utility** — Diagnostics for Compaq drive arrays.
- **Compaq Diagnostics Systems ROMPaq** — ROM BIOS updates for Compaq servers.
- **Compaq Options ROMPaq** — Upgrades of programmable ROMs on Compaq options, such as disk controllers and drives.
- **Compaq Support Software for Novell Products (Novell SSD)** — Drivers, utilities, patches, installation instructions, installation troubleshooting, and other information for enhancing NetWare operations on Compaq systems.
- **Compaq System Configuration Utility** — Configuration tool for the server and its expansion boards.

Integration Server

Many enterprises maintain hundreds of software applications, drivers, and patches. The nightmares begin when the network administrator must not **only** keep track of all the necessary software required to run enterprise operations, but must also keep pace with a myriad of software versions and release dates. Organization goes a long way in managing your server and network software libraries.

One or more designated Integration Servers could be the solution to those configuration *blues*. As stated previously, an Integration Server is one that has been designated as a software repository. The software can include operating systems, databases, drivers, management agents, software applications, utilities, and patches.

Your network or server administrator configures both the type of connection and the Integration Server access information. Then whenever you want to add or modify the software on other servers, just log in to the Insight Manager. Then follow these steps: (1) select the Integration Server filter to view all of the Integration Servers on the network, (2) select an Integration Server from the list, and (3) select the Integration Server task. When you choose the Maintenance Option task, Insight Manager, using either an Internet or a modem connection, automatically connects to the server that is storing your Compaq support software.

The Insight Manager then displays the software and versions already stored on the Integration Server. As an added bonus, for any Compaq software, you can also view a description of what

software has been updated in the selected version, including notes on enhancements or problems that have been fixed with that version.

The Internet address and dial-up telephone number for the Compaq Support Server are pre-configured in the Insight Manager.

This information assists you in making informed decisions on which updates are appropriate for *your* environment. You can also insert a SmartStart-enabled CD provided with each Compaq server or a more current version obtained through the Compaq SmartStart Subscription Service (see <http://www.compaq.com>). Insight Manager will display both your Compaq and third-party software available on the CD. Once you have completed the software selections, the appropriate software is automatically downloaded to the Integration Server.

For more detailed information on (1) using SmartStart to setup an Integration Server, (2) using an Integration Server with SmartStart and the Integration Utility, or (3) using Insight Manager for Integration Server Maintenance, refer to your *Integration Server User Guide*.

Note: This Integration Server document is included in the Setup and Management Pack provided with every Compaq server.

Server Configuration and Integration Management Utilities

The following utilities ease your server configuration and integration management tasks. They are also integral to the task of server health monitoring. In fact, both your server health drivers and your server health utilities need these configuration and integration utilities. So, be sure to refer back to these utilities when we discuss server health monitoring.

Compaq Integration Maintenance Utility (CPQMAINT.NLM)

The Compaq Integration Maintenance Utility is a software tool designed to help you add or update the latest software on your NetWare servers without having to restart your system. This Integration utility runs in your local server environment and eases the administrative task of keeping software on the server consistent across the network. It allows you to install software and updates of the Novell SSD, Management Agents, and the Compaq Survey Utility—from either the Integration Server on the network or from the SmartStart and Support Software CD provided by Compaq.

Remember! SmartStart is the intelligent integration tool for setting up Compaq servers.

The Maintenance Utility for NetWare 5.x.x is automatically loaded on the server during the initial SmartStart process. It can also be manually installed by copying *CPQMAINT.NLM* and *CPQMULIB.NLM* files from the *SSNW\CIMU* directory on the SmartStart CD to the *SYS:SYSTEM*

directory on the file server. Once you have installed the Maintenance Utility on the server, execute the **CPQMAINT** command from the NetWare 5.x console in order to perform software integration tasks.

Compaq Online Configuration Utility (CPQONLIN.NLM)

Available on the Novell SSD and supported on NetWare 3.12 through NetWare 5.x, *CPQONLIN.NLM* allows your server administrator to (1) create or delete arrays, (2) reconfigure arrays, (3) expand arrays, and (4) assign spare drives. Most importantly, with this configuration utility, you can configure the SMART-2 Controller without taking down your NetWare 4.11 or NetWare 5.x server or any existing NetWare 5.x volumes.

To better manage your system, your network or server administrator can also glean basic information about the status of logical drives attached to the SMART-2 Controller.

- Failed logical drive
- Expanding array
- Rebuilding array
- Queued expansion or rebuild of an array

For more information on configuring the SMART-2 Controller, see the white paper: *Compaq SMART-2 Controller and NetWare*, available from the Compaq website:

<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

For detailed instructions on installing *CPQONLIN.NLM*, see the “Installing Software from the NSSD” section of the Novell SSD.

IMPORTANT: *CPQONLIN.NLM* does requires support modules *NWIDK.NLM* and *NSS.NLM* to be loaded on your NetWare 5.x servers to warn you that a volume exists on a logical drive before allowing you to delete it.

Compaq Survey Utility

Designed as a service tool to enhance serviceability for your Compaq servers, the Compaq Survey Utility increases overall server availability. The primary information requirement and the one that provides the greatest insight into potential server issues is the configuration of your server.

There is no requirement to take the server offline or restart the server in order to use the Survey Utility.

To streamline the server process and resolve problems quickly, you need to provide the right information when a service call is placed. This results in faster problem resolution, minimized administrative costs/resources, and higher server availability. By storing multiple configuration snapshots and by highlighting changes and differences, the Survey Utility is able to provide you with a detailed record of your server history. This critical configuration data ensures higher server availability and is made possible through the Survey Utility’s comprehensive design features.

- Online installation and operation — Restarts the server without taking it offline.
- Comprehensive configuration capture — Gathers detailed hardware and operating system configuration information under a single tool.
- Automatic configuration audit trail — Automatically maintains a configuration history for the server.

Online Installation of Compaq Survey Utility

You can install the Survey Utility for NetWare 5.x from any of the following:

- SmartStart and Support Software CD (Survey is selected by default if the server is created using SmartStart.)

Note: Survey can be de-selected during the SmartStart process by opening the Compaq directory under Additional Software Selection screen and then selecting Compaq Survey Utility for NetWare 5.x.

- Compaq Integration Maintenance Utility
- Compaq Management CD

- Support Software website:
<http://www.compaq.com/support/files/server/softpaqs/Netware/nwsurvey.html>.

You can configure Survey to run automatically or to create ad hoc reports of system configuration changes. At any time, you can ascertain the configured state of the system by reviewing a particular session, which is an organized group of data describing the system configuration at a specific point in time. The session information is organized into three distinct types and maintained in the file *SURVEY.IDI* in the same directory as *SURVEY.NLM*.

- Original — The first session sampled (referenced as Session Number 2). The Survey Utility will treat this session as a *master configuration* that will never be overwritten by the utility.
- Checkpoints — These sessions (referenced as Session Numbers 3 to 10) are the next eight samples that *differ significantly* from the original session.
- Active — This session (referenced as Session Number 1) is the *last information captured* and is overwritten each time you take another sample.

The Survey Utility can also access the Integrated Management Log (IML) and will be further mentioned in the Server Health sections. For more detailed information, see the white paper: *Compaq Survey Utility* (Document #ECG075/0798) on the Compaq website:
<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

Now we will discuss the second subset of server management: performance analysis.

Server Performance Analysis

Everyone wants the quickest, most efficient system. After all, efficiency equates to lower costs. Enabling consistent, reliable server performance is a key component to improving overall quality of service. Compaq Insight Manager provides extensive thresholding capabilities for all major subsystems. Examples of real-time performance monitoring and graphing include CPU, PCI, and EISA bus utilization, as well as NIC throughput.

For the recently released NetWare 5.1, as well as for NetWare 5.0, NetWare 4.x and NetWare 3.x, *MONITOR.NLM*, a menu-driven utility, provides you with real-time measurements of OS performance parameters.

The NetWare Console Monitor is primarily an operating system monitor.

While Monitor does not provide for logging data to an external file, the on-screen, real-time feedback provides clear insight to the efficiency and effectiveness of the operating system. By observing trends in parameters, such as storage systems, cache utilization, and network traffic, you can pinpoint hardware and software bottlenecks.

Since Monitor does not affect server performance while monitoring your system, you can perform analyses while your server is under normal operation, even with active connections to clients. Certain parameters that are displayed within Monitor directly measure the performance of a given system; others, however, might require calculation and cross-referencing to other parameters to fully understand the implications. Similarly, some measurements reflect your OS and software parameters, some reflect purely hardware performance or utilization, while others reflect the interdependence of your many systems.

Monitoring server performance and statistics, even if serious problems might not have occurred, also informs you of a changing environment and can alert you to potential, more impacting server health issues. Sometimes it's difficult to draw a definitive line between performance analysis and server health monitoring, or between performance analysis and configuration and integration management. For this reason, managing your server depends upon a well-integrated server

management plan that includes overlapping tasks in configuration and integration management, performance analysis, and server health monitoring.

For this Integration Note, however, we are primarily focusing on specific server health concerns: fault prediction, avoidance, and recovery. In other words, we are working under the following premise:

- Server configuration and integration involves the birthing of your system: setting up your hardware, installing the proper software, and testing your server hardware and software for compatibility with all other server components.
- Server health is concerned with keeping the system alive.
- Server performance is primarily concerned with a live system operating at peak efficiency.

For more detailed information on performance analysis, see the white paper: *I/O Performance Tuning on Compaq Servers* (Document #ECG044/0399) on the Compaq website:

<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

Server Health Monitoring

Server management, in general, and server health monitoring, in particular, are mandatory functions whenever the reliability of your server is imperative. The primary purpose of server health monitoring is to keep your server operating as continuously as possible by diagnosing the cause of failures while protecting the hardware components.

In the next section, we will primarily focus on the server health drivers and utilities that are supported on the currently shipping Compaq Family of Servers. Refer to the information that came with your Compaq server for more specific information about the Server Health features included in your server. You can also refer to the white paper: *History of Innovation and Value-Add in Compaq Server Families* (Document #ECG072/0798) on the Compaq website:

<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

More on Server Health Monitoring

Although Compaq server failure is rare, the unexpected downtime it might cause your enterprise, makes detecting and quickly reacting to server anomalies an essential component of server management and more specifically, server health monitoring. Compaq uses advanced technologies to build-in fault prediction and detection capabilities into each of its servers; Compaq also delivers server health software to optimize these hardware capabilities within your NetWare environment.

And just like two medical approaches to maintaining a person's well being, you can approach server health in two ways:

- Proactive — Anticipate and prevent problems.
- Reactive — Resolve problems once they occur.

Server dependability is enhanced by proactively delivering timely information on the operational status of critical server subsystems. After all, we would all like to correct a fault before our server fails. However, not all server failures can be predicted. That's why quick analysis and server recovery options must also be incorporated into your server management strategy. Compaq refers to its comprehensive server strategy, or design approach to server and network uptime, as ***Full-Spectrum Fault Management***.

This server health strategy is both proactive and reactive and includes three main objectives:

- Prevent faults before they happen
- Keep the system up and running in case of an unlikely failure
- Deliver rapid recovery to normal operations after a fault condition

Compaq server value-add capabilities and Compaq innovative software enable you to meet these objectives in your enterprise operations. Let's take a closer look at each objective.

Fault Prevention — The server system will timely monitor fault, performance, and configuration/integration parameters of critical subsystems—I/O configuration, processor, memory, storage, OS and other software, and the network interface controller—and immediately notify your administrator of impending component failures. Subsequently, preventive maintenance will avoid server failures and maximize server uptime.

Fault Tolerance — In case of a fault, the server will maintain a high level of server availability and ensure data integrity by using (1) industry-standard, hot-pluggable drives, fans, and other components, (2) ECC Memory, (3) the Compaq Smart SCSI Array Controller, (4) the Off-Line Backup Processor, and (5) redundant components.

Rapid Recovery — If a critical server failure occurs, the server will diagnose the problem, then rapidly return the server to full operation because of the **Compaq Rapid Recovery Engine** engineered into Compaq ProLiant servers. These built-in server capabilities perform several server health monitoring tasks, including the following:

You can use the Rapid Recovery Engine independently of other server health monitoring tools or in sync with other Compaq server management tools.

- **Server Health Logging** — Stores information in the nonvolatile RAM (NVRAM) Integrated Management Log (IML) so that your server administrator can retrieve and analyze the data using Compaq management applications, such as Compaq Insight Manager or using Compaq utilities, such as the Diagnostics Utility, or the Survey Utility, or the IML Viewer. See Figure 7.
- **Snapshot Capture** — Captures snapshots of subsystem parameters that indicate failure and places them into the IML.
- **Automatic Server Recovery-2 (ASR)** — Analyzes failures to the processor, memory, and software; then intelligently restarts the server.
- **Recovery Server Option** — Provides support for the automatic switch of your external SCSI disk storage to a Recovery Server upon failure of your Primary Server.

Rapid Engine Recovery tasks will be discussed in greater detail in the “Compaq Support Software for Novell Products (Novell SSD)” section.

NetWare 5.x ABEND Recovery Feature

Novell has added more diagnostic and server health monitoring features with its latest release of NetWare 5.1. Since Compaq and Novell design, integrate, and jointly test their products for compatibility and high performance, you can be assured that a Compaq and Novell solution provides you with top-of-the-line fault detection and recovery capabilities. The NetWare 5.x ABEND Recovery feature illustrates this.

Hardware or software problems can cause an abnormal ending, or ABEND. Some of your server ABENDs can be critical. In these cases, ideally the server should be restarted in an orderly fashion. Others are non-critical and your server does not have to be restarted immediately.

Before NetWare 5.x, when a server had problems (ABENDs), you really couldn't do too much to improve the situation. In some cases, the cached file information could be written to disk before restarting, but only if you issued the right commands from the debugger screen on your server console. Unfortunately, server administrators seldom knew commands of this technical level. Usually, any information not already written to disk was lost when the server abnormally ended.

ABEND core dumps used for diagnostic analysis now write to a file much faster with NetWare 5.x than in previous versions.

However, a NetWare 5.x server has the capacity not only to recover gracefully from ABENDs, but, in some cases, report the probable cause and identify the faulty NLM or hardware. In the case of a non-critical ABEND, your server can suspend and quarantine the running process, leaving your server up and running. In the case of a critical ABEND, the

ABEND Recovery feature would **DOWN** and **RESTART** your server automatically after two minutes.

Optionally, you can change two **SET** parameters to control what happens in an ABEND situation.

The **SET AUTO RESTART AFTER ABEND DELAY TIME** = (2 through 60 minutes). Default is 2 minutes.

The **SET AUTO RESTART AFTER ABEND** = (0 = disabling ABEND Recovery altogether; 2 = restart after any ABEND, not just critical ones. Default is 1, which behaves as previously described).

Let's take a closer look at the NetWare ABEND Recovery feature and how it handles server failures. See Figure 3. Server failures can be grouped into five primary categories:

- Software Exception ABENDs — Typically caused by software errors.
- Processor Exception ABENDs — Typically caused by software errors but discovered by the processor. In the ABEND message, these errors are identified by the phrase *Processor Exception*. Faulty hardware might also cause these errors.
- Non-Maskable Interrupts (NMIs) ABENDs — Always caused by a hardware failure, such as memory or an expansion board, and are identified by the phrase *NMI*. NetWare reports most NMIs as *Parity errors generated by the system board* because it is unable to actually diagnose hardware failures.
- Server Lockups — Caused by software waiting for operations that will never complete. The software never returns control to NetWare so the OS cannot execute; the server just hangs or ceases to respond.
- Debugger Entry — Caused by an illegal operation in software. A debugger entry requires knowledge of the internal debugger in order to diagnose and correct the problem. Unfortunately, your administrator is left with almost no indication of why the failure occurred or what corrective action to take.

With the first three errors, your NetWare OS, the processor, or the hardware can detect a catastrophic failure. If it does, NetWare then produces an ABEND, sends a message to your server console, and halts server action, which prevents data corruption. However, if the Compaq Server Health Driver, *CPQHLTH.NLM*, is loaded, it adds supplemental information to the ABEND message, and if the Automatic Server Recovery (ASR) feature of the Server Health driver is enabled, ASR can even restart your server. See the "Compaq Server Health Driver (*CPQHLTH.NLM*)" section.

Note: By default, the NetWare OS ABEND Recovery feature will handle an ABEND situation before Compaq ASR responds, however, ASR can restart a server if a server locks up or a debugger entry occurs. ABEND Recovery cannot.

For server lockups and debugger entries, however, NetWare cannot identify the software error. As a result, your server hangs and cannot be automatically restarted by the ABEND Recovery feature. We will expound upon these five types of server failures when discussing the Compaq Server Health Driver. We will also discover how the NetWare ABEND Recovery feature, the Compaq Server Health Driver (*CPQHLTH.NLM*), and the Compaq Server Health Agent (*CPQHTHSA.NLM*) can be successfully integrated to produce a winning fault detection and recovery strategy and, subsequently, a more reliable enterprise server system.

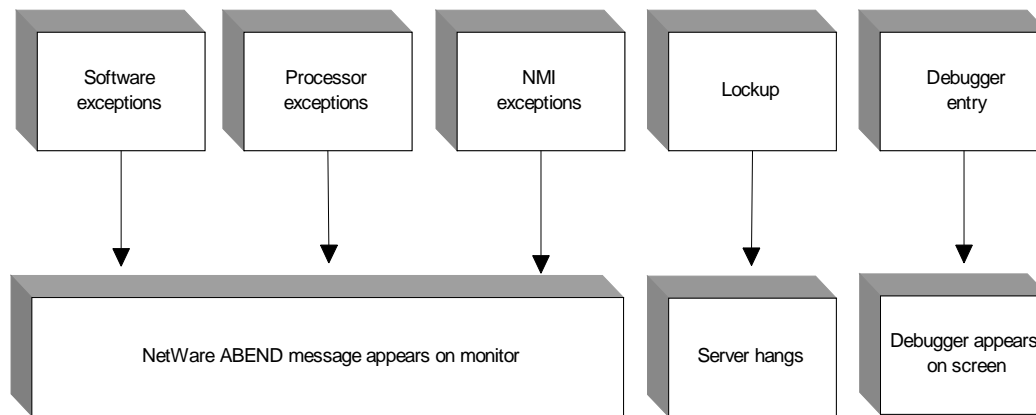


Figure 3. Server failure with the NetWare ABEND feature

Compaq Diagnostics Utility

If your server is already down, you can use the Compaq Diagnostics Utility to access and display the IML (portion of NVRAM that stores server system errors). Your administrator can use the data to streamline testing and to quickly pinpoint problems.

Compaq Support Software for Novell Products (Novell SSD)

Compaq has developed powerful drivers and utilities that optimize Compaq server hardware features. The most current ones (as of February 2000) are available from the Novell SSD, v5.40 or greater, on the Compaq Smart Start and Support Software CD Release 4.60.

IMPORTANT: Do not use the Novell SSD on the Compaq SmartStart and Support CD Release 4.50.

Smart Start for Servers automatically installs the correct drivers for your system during the Install process. You can also download the support software bundle from the Compaq website: <http://www.compaq.com/support/files/server/softpaqs/Netware/nwsurvey.html>.

You may also choose to manually install the drivers and utilities. For instructions, refer to the “Installing Software from the NSSD” section in the Novell SSD. Let’s look at Figure 4 for the big

picture on these server health drivers and utilities. (You might want to paperclip this diagram or make a copy of it so you can easily refer back to it whenever necessary.)

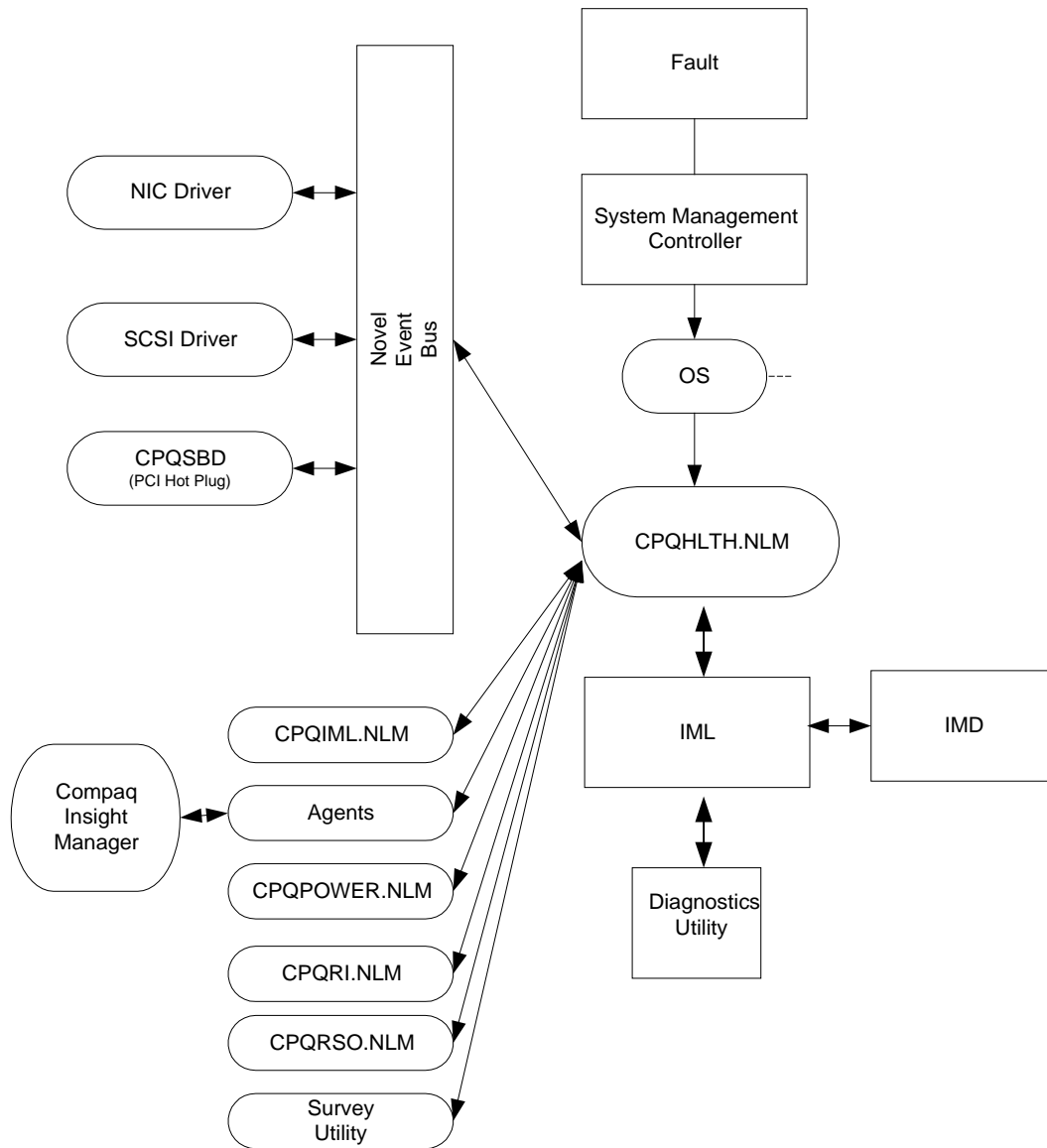


Figure 4. The Compaq Server Health Driver (*CPQHLTH.NLM*) is the focal point for Server Health monitoring

We will devote the rest of this paper discussing six primary server health drivers and utilities that enhance server health monitoring in a NetWare environment.

- ***CPQHLTH.NLM*** — The Compaq Server Health Driver enables the server health features of Compaq servers. These features help detect and correct critical server software and hardware failures; hostile thermal conditions; memory errors; power loss; and critical disk, NIC, and LAN errors.

- ***CPQIML.NLM*** — The Compaq Integrated Management Log Viewer allows you to view and manage server event data stored in the Compaq Integrated Management Log (IML). In addition, you can view and edit data displayed on the server Integrated Management Display (IMD).
- ***CPQPOWER.NLM*** — The Compaq Power Subsystem Utility provides online viewing of your server power supply health and condition.
- ***CPQRI.NLM*** — The Compaq Remote Insight Board Driver provides health monitoring of your remote servers.
- ***CPQRSO.NLM*** — The Compaq Recovery Server Option Driver provides support for the automatic switching of external SCSI disk storage to your Recovery (Standby) Server upon failure of your Primary Server.
- ***CPQSBD.NLM*** — The Compaq System Bus Driver controls the system hardware necessary to support the PCI Hot Plug feature on Compaq ProLiant servers.

Compaq Server Health Driver (*CPQHLTH.NLM*)

The Compaq Server Health Driver, a major component of server health monitoring, ensures the integrity of your server and reduces downtime by providing early warning and logging of impending component and subsystem failures. The Server Health driver sends warnings, or error messages, to the server console, as well as to the Compaq Insight Manager (by way of the Compaq Server Health Agent (*CPQHTHSA.NLM*)). The Server Health driver also logs events in the IML for further diagnosis. See Appendix B.

IMPORTANT: The *CPQHTHSA.NLM* is required for any Compaq server that supports SNMP monitoring via Compaq Insight Manager and *CPQHLTH.NLM*.

Six primary functions of *CPQHLTH.NLM* include the following:

- Perform diagnostics on your server after a failure
- Automatically restart your server after a failure
- Gracefully down your server if overheating is predicted
- Detect, correct, and log ECC and AECC Memory errors
- Monitor your server power supply
- Log critical disk, NIC, and LAN hardware errors

Perform Diagnostics on Your Server after a Failure

Perhaps, the most important function of the Server Health driver is to perform diagnostics on your server after a failure. As previously explained in the “NetWare ABEND Recovery Feature”

CPQHLTH.NLM records server failures in the IML. See Appendix B.

section, server failures can be divided into five basic categories, or causes, of server failure. However, because of Server Health driver capabilities, more detailed fault information can be added to the ABEND message, as well as logging the error message in the IML. Consequently, you can take the necessary and appropriate actions to prevent server failures from reoccurring. Let’s look at Figure 5.

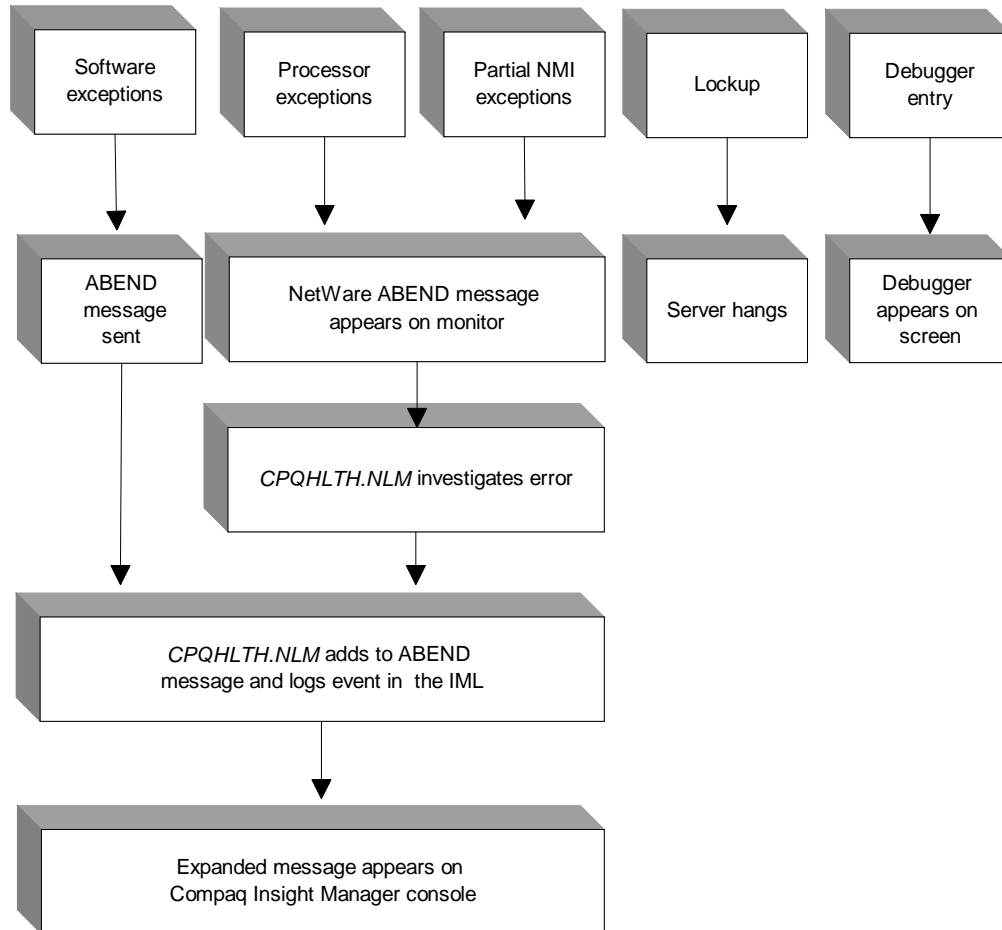


Figure 5. Server failure with the NetWare ABEND feature and the Compaq Server Health Driver

Again we will discuss the five types of server failures and how the Compaq Server Health Driver aids in resolving server failures.

Software Exception ABENDs — Typically caused by software errors. If your server experiences a software exception, you should upgrade to the newest version of the program identified in your IML and apply any relevant patches to the NetWare OS. If you do not have a newer software version or the applicable patches available, contact the software vendor and provide him with the information found in the IML.

- **Processor Exceptions ABENDs** — Typically caused by software errors but discovered by the processor. If your server experiences a processor exception, you should upgrade to the newest version of the program identified in the IML and apply any relevant patches to the NetWare OS. If you do not have a newer software version or the applicable patches available, contact the software vendor and provide him with the information found in your IML. Faulty hardware might also cause these processor errors. If you eliminate the software as the cause of the problem, the hardware controlled by that software might be the problem. For example, if a device driver is listed in the error message and you are certain that the driver is not the

problem, the controller associated with that driver might be at fault. Contact your hardware vendor for more information.

- Non-Maskable Interrupts (NMIs) ABENDs — Always caused by a hardware failure, such as memory or an expansion board, and are identified by the phrase *NMI* in the ABEND message and in the IML. NetWare reports most NMIs as *parity errors generated by the system board* because it is unable to diagnose hardware failures. When NetWare reports a NMI, the Server Health driver uses special hardware components in Compaq servers to identify the specific component that caused the failure. The Server Health driver then adds a detailed description of the hardware failure to the NetWare ABEND message and logs the information in the IML. You should run diagnostics on the hardware item identified in the IML and replace it if necessary. Here's a sample critical error message for a NMI ABEND:

ABEND: NMI (expansion bus master timeout: Slot 4)

This message shows a problem with the board in Slot #4. You should run the Compaq Diagnostic Utility on this board to determine the problem. You probably need to replace the board.

- Server Lockups — Caused by software waiting for operations, typically hardware or software flags, that will never complete. The software never returns control to NetWare so the OS cannot execute or send an ABEND message; the server just hangs or ceases to respond. Look at the “Automatically Restart Your Server after a Failure” section for Compaq server recovery features.
- Debugger Entry — Caused by an illegal operation in software, identifiable by the NetWare internal debugger on your server console. Typically, one of two things has happened: (1) the developmental test software caused an unusual or unpredicted fault, which instructs NetWare to enter the debugger, or (2) a software application accessed an illegal memory location.

A debugger entry requires knowledge of the internal debugger in order to diagnose and correct the problem. Unfortunately, in this case your NetWare OS cannot send an ABEND message and your server administrator is left with almost no indication of why the failure occurred or what corrective action to take. However, ASR can solve this problem. See the “Automatically Restart Your Server after a Failure” section for Compaq server recovery features.

As discussed in the “NetWare ABEND Recovery Feature” section, NetWare can only detect the first three server failures. Take another look at Figure 5. If you have already loaded the Server Health driver when a server failure occurs, NetWare reports the ABEND to the Server Health driver.

The Server Health driver then investigates the situation and adds supplemental information—the name of the program running, the program version number, and the program offset—to the NetWare ABEND message. The expanded ABEND message is then displayed on the server console and also added to the IML.

In the past, the Server Health driver logged server errors in two System Health Logs: the Critical Error Log and the Correctable Memory Error Log, both logs being in a designated area of NVRAM. Now the Server Health driver also logs these and other errors, as well as the error type and Memory Module information, into the Integrated Management Log (IML).

You can view and/or analyze this information with the Compaq Integrated Management Log Viewer (*CPQIML.NLM*), Survey Utility, Diagnostics Utility, and the Integrated Management Display (IMD). See Figure 7.

Automatically Restart Your Server after a Failure

The second function of *CPQHLTH.NLM* is to automatically restart your server. In the beginning of the “More on Server Health Monitoring” section, we mentioned the ***Compaq Rapid Recovery Engine*** and how built-in server capabilities provide rapid recovery after a fault. The Automatic Server Recovery (ASR) feature of *CPQHLTH.NLM* is one such recovery capability.

CPQHLTH.NLM records ASR errors in the IML. See Appendix B.

Let’s look at Figure 6. As you can see, in all five cases of server failure, ASR can restart your server. That’s because ASR can detect server failures—even Debugger Entries and Lockups—that the NetWare OS cannot detect. In doing so, ASR provides a cost-effective means of minimizing unplanned downtime since automatic restart of the server brings your users back online with minimal interruption of service.

Compaq provides integrated ASR hardware and software features that make this all possible.

- Hardware integrated onto the system board that, with the assistance of operating driver software, detects when one of your servers has malfunctioned
- Software that automatically corrects many errors: software, processor, memory, and server environment
- Recovery from over-temperature and recovery from failed processor boards; ASR does this by causing a system restart and mapping out bad parts or by waiting for the system to cool down via ROM POST
- Server failure notification that sends a pager alert to notify your server administrator of a server malfunction
- Intelligent restart to either the operating system or Compaq utilities on the System Partition
- Remote capabilities, via the network or modem, to reboot to the NetWare OS or to run Compaq utilities in order to quickly diagnose errors and reconfigure your server system (See the “Compaq Remote Insight Board Driver (*CPQRI.NLM*)” section).

To reap the benefits of ASR you must load the Server Health driver, enable Software Error Recovery, and configure the Automatic Server Recovery (ASR) Software Error Fault Isolation feature (see the “Enabling ASR” section). Then, when a lockout or a debugger entry occurs, the following scenario takes place:

1. ASR detects the error.
2. The ASR timer times-out, passes control to *CPQHLTH.NLM*, and informs it that a server failure has occurred.
3. The Server Health driver pinpoints the cause of the failure (the NLM, the version, and its offset) and logs the software error and location.
4. *CPQHLTH.NLM* sends fault notification to Compaq Insight Manager through the Server Health Agent.
5. ASR restarts the server. ASR polls your Compaq server hardware timer for the timeout value. Once started, if the software fails to refresh the timer within the specified timeout period (5 – 30 minutes), a hard system reset will occur and restore normal operations. This mechanism safeguards against hardware and software lockups and works in conjunction with the Compaq System Configuration Utility and Compaq Insight Manager. See the “Enabling ASR” section.

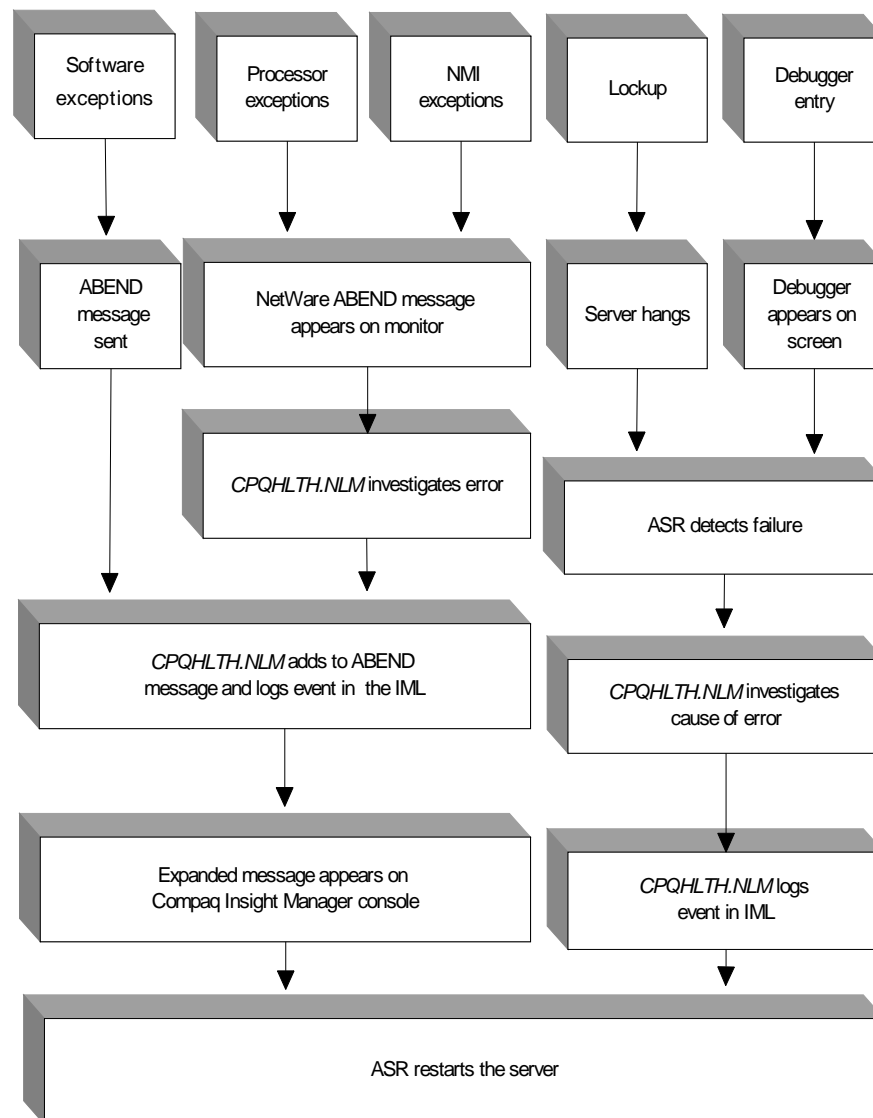


Figure 6. Server failure with Netware ABEND recovery feature, the Compaq Server Health Driver and with ASR enabled

To avoid further problems, if your server experiences a lockup or debugger entry, upgrade to the latest version of the program identified in the IML and apply any relevant NetWare patches. If you do not have the latest software version or the applicable patches, contact your software vendor and provide him with the IML information.

Enabling ASR

To enable the ASR feature of the Server Health, you must complete the following steps:

1. You must first enable the Software Error Recovery feature using the Compaq System Configuration Utility.

Note: For the ProLiant 4500, ASR remote access over the network is not supported. If you are using ASR, **SET** the remote dial-in to be done over the modem. Future software releases will contain this support and will be documented in the *WHATSNEW.RDM*

2. Now you can configure the Software Error Recovery Timeout value using the Compaq System Configuration Utility. This Timeout value determines how long in minutes, after the ABEND occurs, before ASR automatically restarts your server.

In your *AUTOEXEC.NCF* file, add the following **SET** command:

SET AUTO RESTART AFTER ABEND = 0 (This disables the NetWare ABEND Recovery feature for NetWare 5.x.)

For NetWare 3.20 or greater, the following statement should be added to your *STARTUP.NCF* file.

SET AUTO TTS BACKOUT FLAG = ON

This **SET** parameter will force NetWare to skip the user prompts related to TTS during the restart process and allows your server to complete the restart process

For NetWare 4.x or greater, the following statement should be added to your *STARTUP.NCF* file.

SET AUTOMATICALLY REPAIR BAD VOLUMES = ON

This **SET** parameter forces NetWare to automatically load *VREPAIR.NLM* when a volume cannot be mounted. *VREPAIR.NLM* allows your server to complete the restart process after an ASR reset by automatically correcting problems found while attempting to mount a NetWare volume.

Note: If your system was last reset by ASR (as opposed to a manual shutdown and restart), the Server Health driver cannot use the Quick ASR feature (described later) unless you have cleared the ASR condition using Compaq Insight Manager.

Disabling ASR

If you do not want to use the ASR feature, you need to disable this feature when you load the Server Health driver. Just add the parameter **DASR** to the **LOAD CPQHLTH** command.

CPQHLTH -DASR

Quick ASR

If Automatic Server Recovery is enabled, Quick ASR allows the Server Health driver to reset your server immediately after a NetWare ABEND, instead of waiting for the ASR time-out period to expire. The Server Health driver still preserves the ABEND information by storing it in the IML, however Quick ASR greatly reduces server downtime.

To enable Quick ASR, just add the parameter **Q** to the **LOAD CPQHLTH** command.

CPQHLTH -Q

Gracefully Down Your Server if Overheating is Predicted

CPQHLTH.NLM records hostile internal conditions in the IML. See Appendix B.

Fan failure or environmental problems cause hostile thermal conditions. These problems prevent normal server operations, however, they do not cause data corruption. In these cases, graceful shutdown is usually the

best cause of action.

Fan Failure Detection and Shutdown

If a fan in the server fails, the temperature of a hardware component, such as a processor, might reach dangerous levels, even though the surrounding temperature might remain at acceptable levels. If this happens, the Server Health driver detects the out-of-limit attribute (see Table 3), and sends a message (trap) to the Server Health Agent (*CPQHLTH.NLM*), which sends the error message to the Insight Manager.

In addition, the Server Health driver logs the event as a critical error in the IML. Let's take a look at Figure 7.

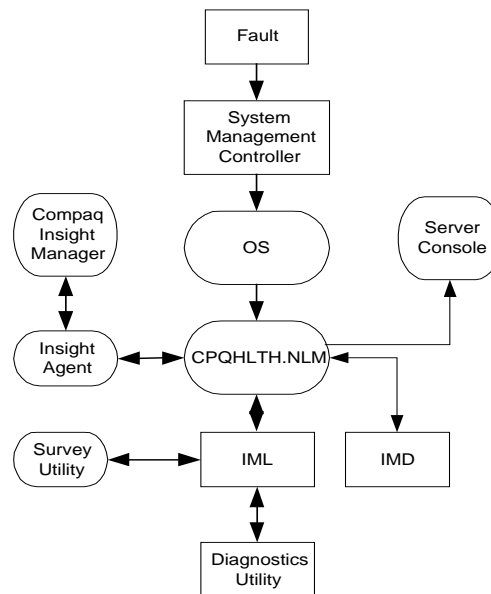


Figure 7. Compaq provides many avenues to detect, diagnose, and correct device faults

Through Compaq built-in fault-tolerant technology and integrated software health-monitoring tools, you have many avenues in which to analyze faults:

- Analyzing console error messages
- Receiving Insight Manager alerts
- Logging of events in the IML
- Using the IML Viewer
- Using the IMD
- Using the Survey Utility
- Using the Compaq Diagnostic Utility

These options give you the opportunity to diagnose the failing fan problem and choose a course of corrective action—such as replacing the failed fan from a pair of redundant fans.

In addition, if ASR is enabled, it will gracefully down your server, if necessary, to protect it from overheating. This not only prevents damage to the hardware, but also decreases the chance of creating more severe problems in the future.

Note: Even if the fan appears functional, you should promptly replace it.

Caution Temperature Detection

The Server Health driver also monitors the thermal conditions inside your server (see Table 3). Should the internal temperature approach dangerous levels, the Server Health driver will log the event as a critical error in the IML. If Thermal Shutdown is enabled, it will also gracefully down the server to protect it from overheating. After a short delay to allow the temperature to cool, ASR will restart your server. This prevents damage to the hardware and decreases the likelihood of more severe problems in the future.

If you have loaded the Server Health driver and you have enabled the Thermal Shutdown and ASR options using the Compaq System Configuration Utility, the following sequence occurs:

- 1) I/O requests are completed.
- 2) Your users are informed.
- 3) Data stored in cache is flushed to the hard drive before your server is downed.

Detect, Correct, and Log ECC and AECC Memory Errors

When your server detects a correctable memory error (for systems having Error Checking and Correcting (ECC) or Advanced ECC (AECC) memory features), your server corrects the error while continuing with normal operation. All single-bit memory errors can be detected and corrected. If the number of errors exceeds the threshold level, the Server Health driver logs the Memory Module that is generating the corrected memory error in the IML and reports the problem to the server console.

CPQHLTH.NLM records correctable memory errors in the IML. See Appendix B.

All 2-bit and 3-bit memory errors and most 4-bit memory errors are also detectable, but not correctable. However, these more severe errors are logged in the IML. To view the IML, see Figure 7. With early detection, you can manually correct the errors before more severe errors, like the loss of an entire 4-bit DRAM, sabotage your server system.

If the Server Health driver reports that a memory location consistently needs correcting, schedule maintenance downtime to replace memory that is beginning to cause parity errors as soon as possible to avoid a critical memory error. With AECC Memory, these errors are corrected without interrupting normal operations.

If a memory location constantly reports correctable memory errors, the Server Health driver will eventually stop reporting those errors in the IML (see Appendix B) to minimize the impact on the server. The Server Health driver displays a message to this effect at your server console (see the “Troubleshooting *CPQHLTH.NLM*” section). The memory errors, however, will still continue to be corrected.

Monitor Your Server Power Supply

Needless to say, a power loss is always critical. The Server Health driver continually monitors your power supply (current, redundant and/or hot-pluggable) and Processor Power Module when

CPQHLTH.NLM records critical power loss errors in the IML. See Appendix B.

present. The sensor information is passed to *CPQPOWER.NLM*, which displays the information. See the “Compaq Power Subsystem Utility (*CPQPOWER.NLM*)” section.

Serial Number

The Server Health driver stores the serial number, part number, model number, board revision, and internal firmware version of the power supply. *CPQPOWER.NLM* displays this information when you request it.

Failing System Battery

The system battery is necessary for your server non-volatile RAM (NVRAM), which stores your important server configuration information. The system battery also maintains your server realtime clock. If battery failure is imminent, the Server Health driver will log the event as a critical error in the IML. Operations will continue as normal, but you should replace the failing battery within seven (7) days to preserve your configuration data.

Now we move on to the last function of the Server Health driver and the last major fault condition that the *CPQHLTH.NLM* records in the IML: any critical disk, NIC, or LAN driver errors.

Log Critical Disk, NIC, and LAN Hardware Errors

The Server Health driver logs critical disk (SCSI) drive errors to the IML if (1) you have loaded the Novell Event Bus (NEB) on your Compaq server and (2) you have loaded the *NEB.NLM* file before your disk drivers.

CPQHLTH.NLM logs critical disk and LAN driver errors in the IML. See Appendix B.

The Server Health driver also logs critical NIC and LAN errors to the IML if (1) you have enabled the Novell Event Bus on your Compaq server and (2) you have loaded the *ODINEB.NLM* before your LAN drivers.

Refer to Figure 4 and Appendix A for a graphical representation of the interface between the NEB, SCSI, and NIC drivers; the Server Health driver; and the IML. For more detailed information, see the white paper: *Eliminating Single Points of Failure and Enabling Rapid Recovery in Server Subsystems* (Document #ECG077/0997) on the Compaq website: <http://www.compaq.com/support/techpubs/whitepapers/index.html>.

For specific event log entries after installation, refer to Appendix B.

Troubleshooting CPQHLTH.NLM

Table 4 describes *CPQHLTH.NLM* console messages (after driver installation) and the resultant action to restore normal operations. For a list of console messages that occur when you are loading the driver, see the “Driver/Utility Reference Forms” section of the Novell SSD.

For a list of IML event log entries, see Appendix B.

Table 4. CPQHLTH.NLM console messages

Console Message	Action
CPQHLTH: Initialization finished.	No action needed.
CPQHLTH: ECC Memory has detected and automatically corrected a memory error. Error information has been placed in the Corrected Error Log [IML].	View the IML using either <i>CPQIML.NLM</i> , Compaq Insight Manager, or Compaq Diagnostics to Identify the faulty Memory Module utility. Plan for maintenance downtime and replace module.
CPQHLTH: Excessive ECC Memory errors detected and automatically corrected. Subsequent ECC Memory errors will be corrected but not reported.	View the IML using either <i>CPQIML.NLM</i> , Compaq Insight Manager, or Compaq Diagnostics to Identify the faulty Memory Module utility. Plan for maintenance downtime and replace module.
CPQHLTH: Compaq Server Health temperature exceeds acceptable threshold.	Ensure that all system fans are functional and that airflow to all system vents is not obstructed. Check room temperature and make sure air conditioning is not turned off at night.
CPQHLTH: Compaq Server Health temperature exceeds acceptable threshold. Automatic Server Recovery enabled for thermal failures. Server will be shut down.	Ensure that all system fans are functional and that airflow to all system vents is not obstructed. Check room temperature and make sure air conditioning is not turned off at night.
CPQHLTH: Fan failure detected.	Replace specified fan in the system, even if the specified fan appears functional (spinning).
CPQHLTH: Critical fan failure detected. Thermal Protection is enabled. Server will be shut down.	Replace specified fan in the system, even if the specified fan appears functional (spinning). If the specified fan is still spinning, you can temporarily disable the Thermal Protection parameter using the System Configuration Utility until the fan can be replaced. This allows the system to restart NetWare.
CPQHLTH: Critical fan failure. Server will be shut down.	Replace specified fan in the system, even if the specified fan appears functional (spinning). If the specified fan is still spinning, you can temporarily disable the Thermal Protection parameter using the System Configuration Utility until the fan can be replaced. This allows the system to restart NetWare.
CPQHLTH: Redundant fan failure detected. Operation will continue using redundant fans.	Replace primary fans during scheduled maintenance.
CPQHLTH: Hot-plug fan failure detected.	Replace fan.
CPQHLTH: Redundant system fan pair no longer redundant.	Check fan configuration.
CPQHLTH: Redundant system fan pair is now redundant.	No action needed.
CPQHLTH: Hot-plug fan inserted.	No action needed.
CPQHLTH: Hot-plug fan removed.	No action needed.
CPQHLTH: Redundant power supply failure detected. Operation will continue using redundant power supply.	Replace specified power supply.
CPQHLTH: Redundant power supply has returned to normal operation.	Check status and connections on all power supplies.
CPQHLTH: System power supplies are now redundant.	Check status and connections on all power supplies.
CPQHLTH: Compaq server health previously failed. Fan is functioning properly.	No action needed.
CPQHLTH: System power supplies are no longer redundant. Check status and connections on all power supplies.	Check status and connections on all power supplies.
CPQHLTH: System fans are now redundant.	No action needed.

Table 4. CPQHLTH.NLM console messages (cont)

Console Message	Action
CPQHLTH: Additional power supply inserted in Bay # _.	No action needed.
CPQHLTH: Redundant power supply removed from Bay # _.	No action needed.
CPQHLTH: Compaq server health temperature has returned to acceptable range.	No action needed.
CPQHLTH: Redundant power supply has returned to normal operation.	No action needed.
CPQHLTH: Previously failed power module has returned to normal operation.	No action needed.
CPQHLTH: Warning! Low system battery. Replace the battery within 2 weeks to prevent loss of non-volatile configuration memory.	Replace battery within 2 weeks to prevent loss of non-volatile configuration memory.
CPQHLTH: Power module failure detected. This power module is no longer redundant. Operation will continue using remaining power module(s).	Replace specified processor power module.
CPQHLTH: Compaq Processor Pre-Failure Warning. Excessive errors have been detected and automatically corrected. Subsequent errors will be corrected but not reported to the critical error log [IML].	If the Server Health driver detects an excessive number of memory errors, remember that the Pentium Pro processor board is covered under the Compaq Pre-Failure Warranty. Refer to the Novell SSD <i>SUPPORT.RDM</i> file for more information.
CPQHLTH: Power supply is not providing power. Please confirm the power supply is correctly attached.	Confirm that the power supply is correctly attached.
CPQHLTH: Compaq server health processor fan failure. Server will be shut down.	Replace specified fan in the system, even if the specified fan appears functional (spinning).
CPQHLTH: A power supply is not providing power. Please confirm the power cord is correctly attached.	Confirm that the power cord is correctly attached.
CPQHLTH: Intelligent Power Down manager is not supported on this system. The parameter – SoftPwr will be ignored.	You need to upgrade your server if this feature is needed.
CPQHLTH: Intelligent power switch enabled.	No action needed.
CPQHLTH: Intelligent power switch disabled.	No action needed.
CPQHLTH: Shutting down processor pre-failure monitoring (this might take up to two minutes).	Just relax for a couple of minutes. No action needed.

Compaq Integrated Management Log Viewer (*CPQIML.NLM*)

The Compaq Integrated Management Log Viewer, *CPQIML.NLM*, is a utility that allows you to (1) view and edit data displayed on the server Integrated Management Display (IMD) and (2) view and edits server event data stored in the Integrated Management Log (IML). The IML, available on Compaq ProLiant Servers, records system events, critical errors, power-on messages, memory errors, and any catastrophic hardware or software errors that typically cause a system to fail. See Appendix B.

- Each event in the IML has one of the following statuses to identify the severity of the event. Informational — General information about a system event.
- Repaired — An indication that this entry has been repaired (Critical and caution events are marked as repaired once the indicated issue has been resolved.)

- Caution — An indication that a non-fatal-error condition has occurred.
- Critical — A component of the system has failed.

The severity of the event and other information in the IML helps you to quickly identify and correct problems thus minimizing downtime. The IML Viewer provides the following capabilities that enhance your administrator's ability to (1) identify, (2) correct, and (3) document your server health:

- Archiving the IML to a data file for input to a text editor or spreadsheet application or other IML Viewer utility
- Auto-refreshing
- Clearing the IML
- Filtering IML events (the viewing of only desired event types)
- Marking IML data as repaired
- Masking IML events (the customizing of IML reports by selecting only certain fields)
- Recording maintenance events
- Refreshing (manually re-reading and displaying entire IML)
- Sorting IML events
- Viewing and editing of the Integrated Management Display (IMD), the integrated LCD panel installed on many of the latest Compaq servers.
- Viewing IML events

IMPORTANT: *CPQIML.NLM* requires *CPQHLTH.NLM* v4.00 or later for complete functionality. *CPQIML.NLM* v1.00 is compatible with earlier versions of *CPQHLTH.NLM*, however, some *CPQIML.NLM* capabilities might not be available.

Troubleshooting CPQIML.NLM

CPQIML.NLM provides a rich set of online user messages describing all error conditions and suggested actions that you could encounter during execution of the utility. The IML Viewer additionally provides context-sensitive help panels through the **F1** function key for all *CPQIML.NLM* features.

Table 5 describes *CPQIML.NLM* console messages (after driver installation) and the resultant action to restore normal operations. For a list of console messages that occur when you are loading the utility, see the "Driver/Utility Reference Forms" section of the Novell SSD. For a list of IML event log entries, see Appendix B.

Table 5. CPQIML.NLM console messages

Console Message	Action
CPQIML: An IML event has occurred but cannot be displayed due to lack of memory available to CPQIML.	Execute Refresh from Main menu of <i>CPQIML.NLM</i> .
CPQIML: A new IML event has occurred but cannot be displayed due to an internal error in CPQIML.	Execute Refresh from Main menu of <i>CPQIML.NLM</i> . Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.

Table 5. CPQIML console messages (cont)

Console Message	Action
CPQIML: An existing IML event has been updated but cannot be displayed due to an internal error in CPQIML.	Execute Refresh from Main menu of <i>CPQIML.NLM</i> . Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: CPQIML could not allocate memory to contain new IML event for IML cleared.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: CPQIML could not allocate memory to contain new IML event for maintenance note.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Unable to create blank portal for clearing IML viewing list background.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Function to change IML event security is not defined in CPQHLTH. A later version of CPQHLTH is required.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Clear IML failed.	Contact your FSE.
CPQIML: Function to clear IML is not defined in CPQHLTH. A later version of CPQHLTH is required.	Load latest version of <i>CPQHLTH.NLM</i> .
CPQIML: An error occurred while writing the properties configuration file. The current properties will be lost on exit from CPQIML. However, the new properties you have selected will be used to display IML data.	No action required.
CPQIML: CPQIML could not allocate memory to contain viewer properties. Viewer properties must be set manually.	Select Viewer Properties on Main menu; then manually set viewer properties.
CPQIML: CPQIML could not create properties file to save viewer configuration. Default properties will be used.	No action. Default properties will be used.
CPQIML: File output failed.	Contact your FSE.
CPQIML: Acknowledge pending IMD alerts failed.	Verify ROM BIOS version and <i>CPQHLTH.NLM</i> version. If this doesn't work, contact your FSE.
CPQIML: Function to acknowledge pending IMD alerts is not defined in ROM BIOS. A later version of ROM BIOS is required.	Load the latest version of ROM BIOS.
CPQIML: Function to acknowledge pending IMD alerts is not defined in CPQHLTH. A later version of CPQHLTH is required.	Load the latest version of <i>CPQHLTH.NLM</i> .
CPQIML: Environment variable not found.	Contact your FSE.
CPQIML: The IMD is not supported on this server.	Contact your FSE.
CPQIML: Retrieval of LCD data failed.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: LCD BIOS failure.	Verify ROM BIOS version. If this doesn't work, contact your FSE.
CPQIML: Properties not saved.	Existing properties were unchanged.
CPQIML: Update of LCD data failed.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Function to write IML entry is not defined in CPQHLTH.	Update to a later version of <i>CPQHLTH.NLM</i> .
CPQIML: The functions to read/write IMD data were not found in CPQHLTH. A later version of CPQHLTH is required.	Update to a later version of <i>CPQHLTH.NLM</i> .

Table 5. CPQIML.NLM console messages (cont)

Console Messages	Action
CPQIML: Function to modify IML entry is not defined in CPQHLTH.	Update to a later version of <i>CPQHLTH.NLM</i> .
CPQIML: CPQIML could not allocate memory for viewer properties.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Writing IML event failed.	Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: CPQIML.NLM could not create properties file to save viewer configuration. Default properties will be used.	Default properties will be used.
CPQIML: CPQIML could not read properties file containing viewer configuration. Default viewer properties will be used.	Default viewer properties will be used.
CPQIML: An error occurred while attempting to read the IML. The data display might be incomplete.	Execute Refresh from Main menu of <i>CPQIML.NLM</i> . Unload <i>CPQIML.NLM</i> and re-load; try action again. If this doesn't work, contact your FSE.
CPQIML: Marking IML entry as Repaired Failed.	No action required.
CPQIML: File output completed successfully.	No action required.
CPQIML: The IMD alerts have been acknowledged.	No action required.
CPQIML: The password you typed is incorrect; login failed. The requested function will not be performed.	Try to login again. If this does not work, call your server administrator.
CPQIML: The viewer properties you selected are part of the baseline set provided by CPQIML and cannot be deleted.	No action required.
CPQIML: The viewer properties' label you entered already exists. Please re-enter a new label.	Re-enter a new label.
CPQIML: Multiple Repaired: Some marked events did not have a severity of Critical or Caution. Only events having a severity of Caution or Critical were marked as repaired. The event severity of all other marked events was not changed.	No action needed. Only Critical and Caution events can be marked as repaired.
CPQIML: Single Repaired: Only an event having a severity of Caution or Critical might be marked as repaired. The event severity was not changed.	No action needed. Only Critical and Caution events can be marked as repaired.
CPQIML: The current viewer properties were successfully saved. These property settings can be retrieved on demand at any future time by using the Restore option on the Viewer Properties menu.	No action required.
CPQIML: Properties successfully saved.	No action required.
CPQIML: Entire IML was output in binary format.	No action required.
CPQIML: Entire IML was output as a text file with comma separated fields.	No action required.
CPQIML: The entire IML was output in text format.	No action required.

Compaq Power Subsystem Utility (*CPQPOWER.NLM*)

The Compaq Power Subsystem Utility (*CPQPOWER.NLM*) is a Compaq server utility designed to provide online readings of all sensors within your server power supply, as monitored by *CPQHLTH.NLM*.

IMPORTANT: *CPQHLTH.NLM* must be running and *CPQPOWER.NLM* must be able to communicate with it successfully in order to get the power supply data.

In addition, the utility incorporates the Compaq Power Down Manager that allows you to configure the intelligent power switch on ProLiant servers. To enable this feature, you must add the **SoftPwr** parameter to the **LOAD CPQHLTH** command.

CPQHLTH -SoftPwr

CPQPOWER.NLM displays the following information:

- Power utilization and consumption: capacity, current usage, available, voltage, and temperature fan speed
- Configuration of intelligent power switch (Compaq Power Down Manager)

Servers with this feature can (1) do nothing when the power switch is turned off (Power Down Lock), (2) power down as soon as the power switch is turned off, or (3) gracefully down when the power switch is pressed and before power is shut off to the server, thus, preventing accidental data corruption or loss
- Redundant or non-redundant status of power supply
- System heat output status

Troubleshooting CPQPOWER.NLM

Table 6 describes *CPQPOWER.NLM* console messages (after installation) and the corresponding resultant action to restore normal operations. For a list of console messages that occur when you are loading the utility, see the “Driver/Utility Reference Forms” section of the Novell SSD. For a list of IML event log entries, see Appendix B.

Table 6. CPQPOWER.NLM console messages

Console Message	Action
CPQPOWER: Error getting power subsystem type information from <i>CPQHLTH.NLM</i> .	This software is not communicating correctly with <i>CPQHLTH.NLM</i> . Be sure you have <i>CPQHLTH.NLM</i> v.4.01 or greater.
CPQPOWER: Error allocating memory.	Insufficient server memory is available. Add or re-allocate memory.
CPQPOWER: Redundant power subsystem support is not present on this server.	Power supply redundancy is not a feature in this server. Call your FSE if you need this feature.
CPQPOWER: Error getting power subsystem data from <i>CPQHLTH.NLM</i> .	This software could not get or interpret the power supply data correctly. You might need to upgrade the Server Health driver. Also check your server features; you might need to upgrade your server.
CPQPOWER: There are no power supplies in the system with property information available.	This is a warning that none of the power supplies can be monitored.
CPQPOWER: Function to change intelligent power switch configuration is not defined in <i>CPQHLTH</i> . A later version of <i>CPQHLTH</i> is required.	Load <i>CPQHLTH.NLM</i> v.4.01 or greater.
CPQPOWER: The Compaq Power Down Manager data update failed.	The ROM function that this program called was not able to set one of the Power Down Manager configuration variable values.
CPQPOWER: The Compaq Power Down Manager failed to configure the intelligent power switch with the specified settings. The previous settings remain in effect.	This is a warning. No action required.

Table 6. CPQPOWER.NLM console messages (cont)

Console Message	Action
CPQPOWER: The Compaq Power Down Manager is not supported on this server.	This feature is not available and cannot be configured for this server. You might need to upgrade your server.
CPQPOWER: The Compaq Power Down Manager failed to configure the intelligent power switch with the specified settings. CPQHLTH.NLM reported that intelligent power switch configuration is not supported on this server.	This server does not have this feature.
CPQPOWER: The Compaq Power Down Manager failed to configure the intelligent power switch with the specified settings. CPQHLTH.NLM reported an error retrieving Compaq Power Down Manager data from the system.	Reading of Environmental Variable (configuration data) failed.
CPQPOWER: The Compaq Power Down Manager failed to configure the intelligent power switch with the specified settings. CPQHLTH.NLM reported an unknown intelligent power switch type in the Compaq Power Down Manager data.	This software does not recognize this type of power switch. You need CPQHLTH.NLM v.4.01 or greater.

Compaq Remote Insight Board Driver (CPQRI.NLM)

The Compaq Remote Insight Board Driver, *CPQRI.NLM*, allows system software and SNMP-standard Management Agents to communicate with the Compaq Remote Insight Board. A server option, the Remote Insight Board provides complete remote management of Compaq servers. Essentially, it's a "computer within a computer" with its own processor, memory, and battery

CPQRI.NLM allows system software and SNMP Management Agents to communicate with PCI and EISA-based products.

backup that permits complete independence from your server.

Remote Insight includes support for the Integrated Management Log (IML), available on most Compaq ProLiant platforms. This support requires a Compaq Remote Insight Board with ROM version 1.10 or higher. You can find ROM upgrades for the Remote Insight Board on the Compaq Management ROMPaq diskette. You can also create ROMPaq diskettes or CDs from the Compaq SmartStart and Support Software CD.

When loaded, Remote Insight no longer enables alerting on the Remote Insight Board. If you had previously disabled the alerting function, it would have remained disabled when you loaded Remote Insight. Previous versions of Remote Insight had enabled Compaq Remote Insight Board alerting each time the NLM was loaded. However, you may modify the Remote Insight Board alerting at any time through the Compaq Remote Insight Management Agent (*CPQRISA.NLM*), listed in Table 1 or available through the browser interface.

Troubleshooting CPQRI.NLM

Table 7 describes *CPQRI.NLM* console messages (after driver installation) and the corresponding resultant action to quickly restore normal operations. For a list of console messages that occur when you are loading the driver, see the "Driver/Utility Reference Forms" section of the Novell SSD.

For a list of IML event log entries, see Appendix B.

Table 7. CPQRI.NLM console messages

Console Message	Action
CPQRI: Initialization complete.	No action required
CPQRI: Remote Insight Board found in Slot#_.	No action required.
CPQRI: Remote Insight Board/PCI found in Slot#_.	No action required.
CPQRI: Adapter IRQ or memory settings not set.	Run the Compaq System Configuration Utility.
CPQRI: Unable to allocate Resource Tag.	Apply any relevant NetWare patches. Contact your service provider.
CPQRI: Unable to register NetWare hardware options.	Run Compaq Diagnostics on the Compaq Remote Insight Board.
CPQRI: Remote Insight interface type unknown.	You need to upgrade <i>CPQRI.NLM</i> to a newer version.
CPQRI: Unable to initialize the Remote Insight Board.	Run Compaq Diagnostics on the Compaq Remote Insight Board.
CPQRI: Unable to allocate memory.	Check available NetWare resources.
CPQRI: Remote Insight Board not found.	Diagnostics not installed; first, install the Remote Insight Board.
CPQRI: Unable to register with Compaq Server Health Driver.	Verify <i>CPQHLTH.NLM</i> version 4.00 or later is loaded. Reload <i>CPQHLTH.NLM</i> .
CPQRI: NetWare Bus Interface (NBI) error detected.	You need a newer version of <i>NBI.NLM</i> .
CPQRI: Required function missing from operating system.	You need a newer version of NetWare.
CPQRI: Remote Insight Board found in Slot#_.	No action required.
CPQRI: Remote Insight Board/PCI found in Slot#_.	No action required.

For more information, see the white paper: *Compaq Remote Insight Board PCI: Hardware and Software Architecture* (Document #ECG072/0798) on the Compaq website:

<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

Compaq Recovery Server Option Driver (*CPQRSO.NLM*)

CPQRSO.NLM, the device driver for the Compaq Recovery Server Option, is a major component of the Compaq Rapid Recovery Engine, previously discussed in the beginning of the “More on Server Health Monitoring” section. This built-in server capability increases the fault tolerance of your mission-critical servers through a simplistic, yet powerful design approach: two servers are paired and connected to the same disk storage; if your Primary Server fails for any reason, the

Loading CPQRSO.NLM automatically enables the Quick ASR feature of the Server Health driver discussed in the “Compaq Server Health Driver (CPQHLTH.NLM)” section.

Recovery Server will automatically start NetWare and continue operations using the original disk storage. That’s because *CPQRSO.NLM* provides support for the automatic switch of your external SCSI disk storage to a Recovery Server upon failure of your Primary Server.

For more information on the benefits of *CPQRSO.NLM*, refer to the Technology Brief: *Compaq Standby Recovery Server* (Document

#ECG042/1098) on the Compaq website:

<http://www.compaq.com/support/techpubs/whitepapers/index.html>.

Hardware Requirements

- Identically configured Compaq ProLiant servers (because they share certain *.NCF* files)
- Equal RAM
- The same controllers in the same slots
- Identical type and number of processors
- Upgraded ROM BIOS and SMART firmware on both servers because the ROM controls the switch
 - Upgraded ROM BIOS using the supplied ROMPaq flash utility (You need to also connect the Recovery Server Interconnect cable between the serial ports of each server.)
 - Upgraded SMART Array Controller firmware (You can use the Options ROMPaq flash utility).

Configuring Your SMART-2 Controller

To configure your SMART-2 Controller, perform the following steps:

1. Run the Compaq Online Configuration Utility for NetWare (*CPQONLIN.NLM*) to configure your Primary Server.
2. Verify that the Accelerator Ratio in the Controller settings is set to 100% Read and 0% Write.
3. Shut down the application software and the operating system on your Primary Server.
4. Turn off your Primary Server.
5. Turn on your Recovery Server.
6. Press the **F8** key on the Recovery Server to manually switch the storage disks to the Recovery Server.
7. Run the Compaq Online Configuration Utility for NetWare (*CPQONLIN.NLM*) to configure the Recovery Server. Verify that the Accelerator Ratio in the controller settings is set to 100% Read and 0% Write.
8. Shut down the application software and the NetWare OS on your Recovery Server.
9. Turn off your Recovery Server.
10. Turn off your ProLiant Storage System(s).
11. Turn on your ProLiant Storage System(s).
12. Turn on your Primary Server.
13. Turn on your Recovery Server.
14. Your Primary Server should start. Your Recovery Server should begin monitoring the Primary Server.

Troubleshooting CPQRSO.NLM

Table 8 describes *CPQRSO.NLM* console messages (after driver installation) and the corresponding resultant action to quickly bring up your Recovery Server and restore normal operations. For a list of console messages that occur when you are loading the driver, see the “Driver/Utility Reference Forms” section of the Novell SSD. For a list of IML event log entries, see Appendix B.

Table 8. CPQRSO.NLM console messages

Console Message	Action
CPQRSO: Communications with the Standby [Recovery] Server have been restored.	A cable fault might have caused this error because when a cable fault occurs, the Recovery Server Option is disabled. Check your cable connectors.
CPQRSO: AIO configuration fault detected.	The serial port driver <i>AIOCOMX.NLM</i> has been unloaded, or a critical serial port fault has occurred. Re-load the <i>AIOCOMX.NLM</i> driver.
CPQRSO: Recovery Server interconnect cable fault detected.	Ensure that the serial interconnect is properly connected to the serial ports on both the Primary and the Secondary Server. You must use the cable that shipped with your Recovery Server Option.
CPQRSO: Server shutdown initiated due to previously detected fault.	<i>CPQRSO.NLM</i> is performing a graceful server shutdown and operation will begin on the Recovery Server. Correct the cable fault with the serial interconnect and ensure that you have properly loaded <i>AIOCOMX.NLM</i> .
CPQRSO: Unable to allocate required resources.	Try adding memory to your Primary Server or unload unnecessary NLMs. If the problem does not clear, please contact your service provider. You might need to upgrade your driver.
CPQRSO: Recovery Server support has been disabled. Enable it using the System Configuration Utility.	You must enable the Recovery Server Option using the System Configuration Utility.
CPQRSO: This system is configured as the Standby [Recovery] Server.	Your server has already switched to the Recovery Server. Your Primary Server needs to be serviced.
CPQRSO: Unable to acquire COMxport. Check AIO configuration.	Ensure that you have loaded <i>AIOCOMX.NLM</i> for the proper serial port.
CPQRSO: COMx port is no longer available. Check <i>AIOCOMX.NLM</i> configuration.	The <i>AIOCOMX.NLM</i> has been unloaded or the serial port has failed. Re-load <i>AIOCOMX.NLM</i> for this serial port.
CPQRSO: Unable to import to a newer <i>CLIB.NLM</i> .	The version of <i>CLIB.NLM</i> loaded on the server does not support dynamic importing of required function calls. Upgrade to a newer version of <i>CLIB.NLM</i> .
CPQRSO: Unable to update Environment Variables.	Run the System Configuration Utility. If this does not alleviate the problem, please call your service vender. You might need to upgrade your driver.
CPQRSO: Unable to register for NetWare events.	You might need to upgrade your driver.
CPQRSO: Unable to establish communications with the Standby [Recovery] Server.	Check the Recovery Server and ensure that it is powered on and properly configured as a Recovery Server. Ensure that the serial interconnect cable is properly connected.
CPQRSO: Communications established with Standby [Recovery] Server.	Your system is properly configured.
CPQRSO: Server shutdown has been canceled. Shutdown will not occur.	A cable fault had occurred, but has been corrected. System will continue normal operation. No action required.
CPQRSO: Cable fault detected. Check Recovery Server Interconnect.	Ensure that the serial interconnect is properly connected to the appropriate serial ports on both servers. You must use the cable that shipped with your Recovery Server Option.
CPQRSO: WARNING . Critical fault detected. Standby [Recovery] Server is active.	Ensure that the serial interconnect is properly connected to the appropriate serial ports on both servers. You must also use the cable that shipped with your Recovery Server Option. Also ensure that you have loaded <i>AIOCOMX.NLM</i> for the proper serial port (it might have been loaded by mistake). If the condition does not clear, the Recovery Server will begin operation.
CPQRSO: Disabling Standby [Recovery] Server.	<i>CPQRSO.NLM</i> is in the process of unloading. Please wait.
CPQRSO: Standby [Recovery] Server is not responding to commands. Check Standby [Recovery] Server and serial connect.	Check your Recovery Server and ensure that it is powered on and properly configured as a Recovery Server.

Table 8. CPQRSO.NLM console messages (cont)

Console Message	Action
CPQRSO: The Standby [Recovery] Server could not be disabled due to a communications failure. The Standby [Recovery] Server must be manually disabled to avoid a switchover.	The <i>CPQRSO.NLM</i> has been unloaded or your server has been gracefully downed. Power off the Recovery Server to avoid an intentional switchover.

Compaq System Bus Driver (*CPQSBD.NLM*) and PCI Hot Plug

Our last Compaq server health driver available from the Novell SSD is the Compaq System Bus Driver (*CPQSBD.NLM*), which controls the system hardware necessary to support the PCI Hot Plug features on your Compaq ProLiant servers. The *CPQSBD.NLM* has two primary responsibilities:

- Enabling or removing power from a hot-plug slot upon request
- Configuring hardware and assigning resources; such as memory, I/O ports, and interrupts for PCI boards in hot-plug slots.

The driver works in conjunction with Compaq built-in server capabilities, as well as several Novell supporting modules.

Novell PCI Hot Plug Support Modules

The PCI Hot Plug architecture leverages the inherent modularity of NetWare to minimize the changes required of third-party adapter card software. Besides *CPQSBD.NLM*, the system relies on a new central component, the Novell Event Bus (NEB), which facilitates communications between software modules, management agents, and device drivers. See Appendix A.

Listed below are the key components of the PCI Hot Plug software architecture for NetWare. See the “Installing Software from the NSSD” section of the Novell SSD for detailed instructions on installing the following Novell support modules.

- ***NCMCON.CFG*** — The Novell Configuration Manager Console text file contains PCI adapter product names that are displayed by the Novell Configuration Manager Console.
- ***NCMCON.NLM*** — The Novell Configuration Manager Console module provides the interface for controlling all hot-plug operations. In addition, it displays slot configuration details, including adapter driver information and status.
- ***NCM.NLM*** — The Novell Configuration Manager module sequences actions related to PCI Hot Plug and ensures the stability of the system coordinating a hot-plug operation.
- ***NEB.NLM*** — The Novell Event Bus module facilitates communication between software modules. It allows PCI Hot Plug technology to be used on your existing versions of NetWare. You must load the Novell Event Bus before you load any storage (.HAM or .CDM) device drivers.

IMPORTANT: The latest NetWare Support Pack should also be installed on any of your servers utilizing PCI Hot Plug. The Support Pack includes updates for several operating system components that can affect PCI Hot Plug operations.

- ***ODINEB.NLM*** — This module connects the MSM (a component of the ODI networking architecture) to the Novell Event Bus. You must load *ODINEB.NLM* before you load the MSM or any networking (.LAN) device drivers.

PCI Hot Plug Technology Features and Benefits

Perhaps one of the most powerful Compaq server health features is PCI Hot Plug. With this fault-tolerant feature, you can ensure a high-level of server availability—a prime component of the Compaq Full-Spectrum Fault Management strategy. Refer back to the “More on Server Health Monitoring” section.

Recent trends to increase server availability have included hot swapping of components (power supplies, storage devices, controllers) and online capacity expansion of system components. These advances have reduced unplanned downtime, and with the Hot Add feature have even eliminated planned downtime in most cases. Now, server administrators do not have to power down the system to replace failed components.

The following PCI Hot Plug features allow you to replace system components, online, thus reducing your unplanned downtime and totally eliminating planned downtime, in some cases.

- High availability — Ability to remove, replace, or add network or I/O controller boards while a system is operating. In other words, you can add an array controller attached to an external storage chassis to increase storage capacity without any downtime.
- Industry standardization — Ability to use PCI Hot Plug industry-standard products from multiple system providers, operating system suppliers, and adapter board vendors. Any changes made to system hardware, operating systems, or adapter drivers should not affect functionality in an existing system.
- Backward compatibility — No need for you to overhaul entire systems just because certain components are hot-plug capable. The technology is fully backward compatible.

PCI Hot Plug Hardware

A PCI board must meet all PCI-specification guidelines to be hot-plug capable. The device also requires hot-plug-aware device drivers, such as *CPQSBD.NLM*, to obtain full PCI Hot Plug functionality.

- Expansion slot LEDs — Each PCI Hot Plug slot has two LED indicators above the slot-release lever. When the green LED (top) is on, power is being applied to the slot. When it is off, there is no power supplied to the slot. It is safe for you to insert or remove a board from a slot only when the green LED is off (power is off). The amber LED (bottom) indicates that a condition—such as a problem with the slot, board, or device driver—has been detected that requires corrective action for your normal operations to continue.
- Slot-release lever — The slot-release lever holds the cards in the expansion slots. When you close the lever, you can turn on the power using the Novell Configuration Manager Console (*NCMCON.NLM*). If you open the lever, you remove power from the slot. Prior to opening the lever, you must turn off power to the slot through your NetWare OS.

IMPORTANT: Never open the slot-release lever if the green LED is on. The green LED indicates that power is being applied to the slot. Opening a slot-release lever while the slot is powered on can cause data loss. Power down the slot using *NCMCON.NLM* or the PCI Hot Plug button.

- PCI Hot Plug buttons — The PCI Hot Plug buttons turn a PCI Hot Plug slot on or off. After you press the PCI Hot Plug button, the green LED blinks for five seconds before any action occurs. You may press the button again during the five-second delay to cancel the request.

The green LED stops blinking if the request is canceled. While a slot is being shut down or configured, any button depressed for that slot will be ignored.

PCI Hot Plug User Interface

From your server console you can load the user-interface components to the PCI Hot Plug support via your *AUTOEXEC.NCF* file.

- *CPQSBD.NLM*
- *NCM.NLM*
- *NCMCON.NLM*

You have three menus to use when navigating through the *NCMCON.NLM* user interface:

- Main menu
- Slot Detail screen
- Single Slot menu

Main Menu

The Main menu displays the following information:

- System board slot number
- Status of whether or not the slot is hot pluggable
- Adapter description or name
- State or status of the slot/adapter
- Powered off — Power to the slot is turned off, and you can open the lever on the slot.
- Powered on — Lever has been closed, power is on to the slot, and the slot is empty.
- Ready — Adapter is ready to be used, but there is currently no driver loaded for it. (When an adapter has been detected, the slot is given an initial configuration.)
- Active — A driver is loaded that is using this adapter, and the adapter is believed to be in good working order.
- Failed — This adapter driver or the Compaq System Bus Driver (*CPQSBD.NLM*) indicated some type of device failure.
- Degraded — A device on the multi-device adapter has failed, but other devices on the adapter continue to function.
- Processing — An action is being performed on a slot/adapter.

Slot Detail Screen

The Slot Detail screen displays the following information:

- Slot number
- Description of adapter in slot
- Bus type (PCI, EISA, or EMBEDDED)

- Bus number of the slot
- Status of the slot/adaptor
- Hot-plug features that are supported (hot replace or hot add)
- NetWare Hardware Instance Number (HIN) of each device
- Device driver name and status for each HIN
- Active — Driver is loaded for the device.
- Inactive — No driver is loaded for the device.
- Failed — A driver failed for the device.
- Suspended — Driver is loaded, but activity is suspended while the adaptor is being replaced.

Single Slot Menu

This menu lists your options available for the highlighted hot-plug slot. It is not available for non-hot-plug slots. Depending on the device highlighted, the contents of the menu vary. The following options might appear on your menu screen:

- Remove adapter
- Replace adapter
- Add adapter
- Power-off slot
- Slot detail information

Note: Non-hot-plug slots automatically proceed to the Slot Detail screen when they are selected.

Procedure for Removing a PCI Hot Plug Adapter

1. From the Main menu, select the slot and the adapter that you would like to remove.
2. Press **Enter** to display the Slot Options menu.
3. Use the **Arrow** keys to select Remove Adapter and press **Enter**. Any device drivers loaded for the adapter are unloaded or suspended and power to the slot is removed. Once the slot has a status of powered off and the slot's green LED is no longer lit, you can physically remove the adapter by opening the lever and taking the adapter out of the slot.

IMPORTANT: Do not open the lever if the green LED for the slot is on. This indicates that power is being applied.

Procedure for Removing a PCI Hot Plug Adapter Using PCI Hot Plug Buttons

1. Open the system access panel.
2. If the green LED for the desired slot is on, press the PCI Hot Plug button once. The green LED blinks for five seconds.
3. When the green LED stays off, remove the adapter from the slot.

IMPORTANT: Do not open the lever if the green LED for the slot is on. This indicates that power is being applied.

Procedure for Replacing a PCI Hot Plug Adapter

1. After removing the old adapter, place the new adapter in the slot and close the lever.
2. Once the new adapter is detected, the Novell Configuration Manager Console prompts you before configuring and applying power to the slot. If you answer Yes, power is applied to the slot, the slot's green LED is lit, and the status of the slot on the console changes to Ready or Active. Otherwise, continue to Step 3.
3. To later apply power and configure the slot, first select the slot from the Main menu.
4. Press **Enter** to display the Slot Options menu.
5. Select Replace Adapter and press **Enter**.
6. The Novell Configuration Manager Console prompts you to make sure that all cables are connected. Once you verify that all cables have been connected, press **Enter** to power on the slot and automatically load a driver.
7. *INSTALL.NLM* (or *NWCONFIG.NLM* in NetWare 5.x) will be launched into its automatic driver discovery mode. After responding to the prompts, you will be returned to the Novell Configuration Manager Console.

Procedure for Replacing a PCI Hot Plug Adapter Using PCI Hot Plug Buttons

1. If power to the slot is not already off, see “Removing a PCI Hot Plug Adapter Using PCI Hot Plug Buttons” section.
2. Open the slot lever and put the adapter in the slot.
3. Close the slot lever and connect any necessary cables to the adapter.
4. Press the PCI Hot Plug button once.
5. Once the green LED remains solid, *INSTALL.NLM* (or *NWCONFIG.NLM* in NetWare 5.x) will be launched into its automatic driver discovery mode. After responding to the prompts, you will be returned to the Novell Configuration Manager Console.

Procedure for Adding a PCI Hot Plug Adapter

1. If power to the slot is not already off, see “Removing a PCI Hot Plug Adapter” section.
2. Open the slot lever and put the adapter in the slot.

IMPORTANT: Do not open the lever if the green LED for the slot is on. This indicates that power is being applied.

3. Close the slot lever and connect any necessary cables to the adapter.
4. From within the Novell Configuration Manager Console, select YES if you are prompted to power up the slot. If no prompt is given for power to be applied to the slot, select the slot that you want to power up and press **Enter** to display the Slot Options menu.
5. Select Add Adapter and press **Enter**.
6. The Novell Configuration Manager Console prompts you to make sure that all cables are connected. Once you verify that all cables are connected, press **Enter** to power on the slot and automatically load a driver.

7. *INSTALL.NLM* (or *NWCONFIG.NLM* in NetWare5) will be launched into its automatic driver discovery mode. After responding to the prompts, you will be returned to the Novell Configuration Manager Console.

Procedure for Adding a PCI Hot Plug Adapter Using PCI Hot Plug Buttons

1. If power to the slot is not already off, see “Removing a PCI Hot Plug Adapter Using PCI Hot Plug Buttons” section.
2. Open the slot lever and put the adapter in the slot.

IMPORTANT: Do not open the lever if the green LED for the slot is on. This indicates that power is being applied.

3. Close the slot lever and connect any necessary cables to the adapter.
4. Press the PCI Hot Plug button once.
5. Once the green LED remains solid, *INSTALL.NLM* (or *NWCONFIG.NLM* in NetWare 5.x) will be launched into its automatic driver discovery mode.
6. After responding to the prompts, you will be returned to the Novell Configuration Manager Console.

NIC and SCSI Upgrades

For information on upgrading NICs and SCSI systems, refer to the white paper: *PCI Hot Plug Expansion Feature on Compaq Servers on Novell NetWare Environments* (Document #ECG026/109) on the Compaq website, <http://www.compaq.com>. This paper also provides more details on the interaction of the Compaq System Bus Driver (*CPQSBD.NLM*), the Novell Event Bus Module (*NEB.NLM*), the Novell Configuration Manager (*NCM.NLM*), and the Novell Configuration Manager Console (*NCMCON.NLM*).

Troubleshooting Hot-Plug Operations

Table 9 contains console messages that are generated while performing hot-plug operations (after installation of designated drivers and other related modules). For a list of console messages that occur when you are loading the drivers and modules, see the “Driver/Utility Reference Forms” section of the Novell SSD. For a list of IML event log entries, see Appendix B.

Table 9. Hot-plug operations console messages

Console Message	Action
Unable to allocate memory resources.	The driver was unable to obtain sufficient memory resources from the operating system. You might need to add memory or unload other modules.
Error calling <i>NBI.NLM</i> . Version of <i>NBI.NLM</i> might be old.	Upgrade to a newer version of <i>NBI.NLM</i> .
Error registering with the Novell Event Bus.	Either this version of the Novell Event Bus is incompatible with this version of the Novell Configuration Manager, or there is a problem with your Compaq System Bus Driver.
Could not perform action because of system failure for Slot #_ . See system error log for more information.	When this message occurs, it means that some type of system error has occurred but it cannot be identified in detail. This message might originate from an adapter driver, the Novell Configuration Manager (<i>NCM.NLM</i>), or the System Bus Driver (<i>CPQSBD.NLM</i>). Check the Main console for messages and whether <i>NCM.NLM</i> , <i>CPQSBD.NLM</i> , and adapter drivers have been loaded. Lastly, check the IML.

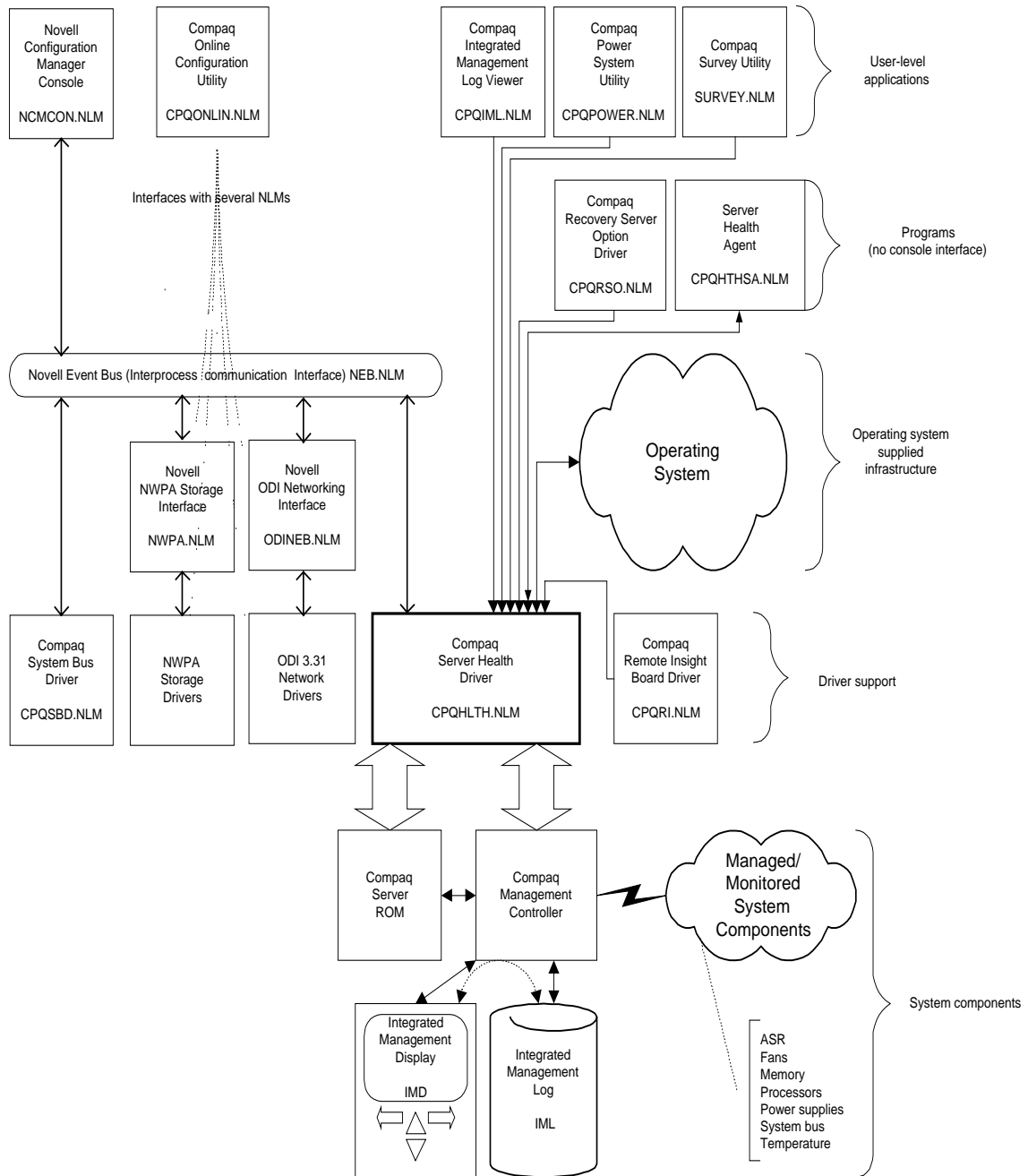
Table 9. Hot-plug operations console messages (cont)

Configuration Manager is not responding to the requested action for Slot #_. Check to see if the Configuration Manager is loaded and try again.	This message occurs when the Novell Configuration Manager (<i>NCM.NLM</i>) is not responding to requests made by the Configuration Manager Console. Check the Main console for messages and whether <i>NCM.NLM</i> is still loaded. If not, reload <i>NCM.NLM</i> from the Main console.
System Bus driver not responding for Slot #_. Check to make sure the System Bus driver is loaded.	This message occurs when <i>CPQSBD.NLM</i> is not responding to requests made by the Novell Configuration Manager. Check the Main console for messages and whether <i>CPQSBD.NLM</i> is still loaded. If not, reload <i>CPQSBD.NLM</i> from the Main console.
PCI Slot #_: Powering on due to button pressed.	A PCI Hot Plug button was used to initiate the power-on sequence for a slot.
PCI Slot #_: Powering off due to button pressed.	A PCI Hot Plug button was used to initiate the power-off sequence for a slot.
PCI Slot #_: Action canceled due to button pressed.	A PCI Hot Plug button was pressed during the 5-second time between the first press and when the action is initiated. The action has been canceled.
PCI Slot #_: Button press ignored. (Action in progress.)	A PCI Hot Plug button was pressed after the power-on or power-off sequence was initiated but before it had completed. The button pressed was ignored.
Volume(s) mounted for adapter in Slot #_. Do you wish to force removal?	This prompt displays when your disk controller is attached to a drive that is being used. Select Yes to force the drive to be dismantled and the driver for the adapter to be unloaded.
Remove for Slot #_ was not done because of the driver's inability to shut down.	The driver for the adapter is not responding to your request to shut down. Check the version of the driver to confirm that it supports hot-plug actions.
Configuration Manager is not responding to the requested action for Slot #_. Check to see if Configuration Manager is loaded and try again.	This message occurs when the Novell Configuration Manager (<i>NCMCON.NLM</i>) is not responding to requests made by the Novell Configuration Manager console (<i>NCMCON.NLM</i>). Check the Main console for messages and whether the <i>NCMCON.NLM</i> is still loaded. If not, reload the <i>NCMCON.NLM</i> from the Main console.
System Bus driver not responding for Slot #_. Check to make sure the System Bus driver is loaded.	This message occurs when the System Bus driver is not responding to requests made by the Novell Configuration Manager. Check the Main console for messages and whether your hot-plug driver is still loaded. If not, reload the System Bus driver from the Main console.
ADD/REMOVE performed on unknown Slot #_. Try the command again.	This error message occurs when the Novell Configuration Manager Console (<i>NCMCON.NLM</i>) receives a message from the Novell Configuration Manager (<i>NCM.NLM</i>) and the message refers to a slot number not recognized by <i>NCMCON.NLM</i> . Try the command again; if the error persists, unload <i>NCMCON.NLM</i> and reload it or unload <i>NCM.NLM</i> and reload it.
REMOVE action not supported for the adapter in Slot #_.	This message occurs when either the Novell Configuration Manager or the System Bus driver cannot shut down the slot. This might be caused by the special cases of multiple card sets and the inability of the Configuration Manager or the System Bus driver to perform the remove. If hot plug removal is not supported for these adapters, you must remove them by powering down the entire system.
REPLACE not supported for adapter in Slot #_. Do you still wish to force removal of adapter?	The PCI Hot Plug software cannot configure some adapters. Therefore, you must remove and replace those drivers, for example, a PCI to an ISA bridge. Selecting Yes at the prompt allows the adapter to be removed but not replaced.
Adapter is not the same as adapter being replaced in Slot #_. Hot Plug Replace cannot continue.	The REPLACE option requires that the adapter used for replacement be identical (hardware and low-level software) to the adapter being replaced. If the Configuration Manager or the System Bus driver detect any differences, the replacement is not allowed.
Adapter in Slot #_ is currently functioning. ADD/REPLACE is ignored.	This message occurs when you select REPLACE for a slot that currently has an Active adapter in it. If you wish to replace the adapter, it must first be REMOVED .

Table 9. Hot-plug operations console messages (cont)

Console Message	Action
A hardware failure was detected in the adapter in Slot #_ and REPLACE cannot continue.	This message occurs when the adapter driver, which is loaded—but in a suspended state—detects a hardware failure in the adapter and cannot initialize it. You cannot use the adapter; you need to replace it with another adapter.
Slot #_ cannot be initialized because the switch is open. Close switch and try the ADD or REPLACE again	The System Bus driver has detected that you have not completely closed the lever for the slot. Power cannot be applied to the slot until you close the lever. Check the lever to make sure it is closed and try the requested action again.
Unable to locate PCI Configuration resources for PCI Hot Plug Add.	This system has the Hot Plug Reservations Option disabled. Run the System Configuration Utility and set the Hot Plug Reservation Option to Normal or Extensive to enable PCI Hot Plug Add. This option configures the amount of resources that the ROM reserves to add PCI devices.
Slot #_ could not be initialized because there were insufficient configuration resources.	In order for hot-plug add to complete successfully, you must have enough resources available for the System Bus driver to completely configure the new adapter. If you do not have the necessary resources, the adapter will be left in the powered-down state. In order to add the adapter, you will need to remove other adapters to make sufficient resources available or power cycle the system.
Slot #_ could not be initialized because configuration of the adapter card type is not supported.	Your system might not support adding PCI video adapters or adapters with non-standard, PCI-configuration requirements.
Slot #_ cannot be initialized because a slot power fault occurred.	The system detected a power fault while adding the adapter. This usually indicates that you have an adapter that does not meet the power-up requirements for PCI Hot Plug.
No adapter is detected for Slot #_. The requested action cannot continue.	A command has been issued on a slot that has no adapter. You must have an adapter in the slot before it can be powered on.
The adapter was successfully replaced or added for Slot #_. Please load the driver from the Main console at this time.	The adapter was successfully added (the slot has been powered on and configured) so that the driver (s) for this adapter can be loaded. You must load the driver outside the Configuration Manager Console, via the Main Console or by using the Install program.
Install found the following hardware but was unable to find a matching driver: PCI LAN Controller 0E11.A0EC.0E11.A0EC.01. Press Enter for a list of drivers to choose from or F3 to continue.	This error message occurs when attempting to hot-plug add a Fibre Channel Adapter. The Configuration Manager Console receives a message from the Configuration Manager that refers to a driver not recognized by the console. Press Escape to bypass this message and properly install the matching driver.

Appendix A: Overview of Server Health Components



Appendix B: IML Event Log

Event
Unknown event (Class #_, Code #_)
System overheating (Zone _, Location _, Temperature _)
External chassis overheating (Chassis #_, Zone _, Location _, Temperature _)
External storage system overheating (Slot #_, Zone _, Location _, Temperature _)
Internal storage system overheating (Slot #_, Zone _, Location _, Temperature _)
System fan failure (Fan #_, Location _)
External chassis fan failure (Chassis #_, Fan #_, Location _)
External storage system fan failure (Slot #_, Fan #_, Location _)
Internal storage system fan failure (Slot #_, Fan #_, Location _)
Side panel removed or improperly installed
External chassis side panel removed or improperly installed (Chassis #_)
External storage system side panel removed or improperly installed (Slot #_)
Internal storage system side panel removed or improperly installed (Slot #_)
System fan inserted (Fan #_, Location _)
External chassis fan inserted (Chassis #_, Fan #_, Location _)
External storage system fan inserted (Slot #_, Fan #_, Location _)
Internal storage system fan inserted (Slot #_, Fan #_, Location _)
System fan removed (Fan #_, Location _)
External chassis fan removed (Chassis #_, Fan #_, Location _)
External storage system fan removed (Slot #_, Fan #_, Location _)
Internal storage system fan removed (Slot #_, Fan #_, Location _)
System fans not redundant (Location_)
External chassis fans not redundant (Chassis #_, Location _)
External storage system fans not redundant (Slot #_, Location _)
Internal storage system fans not redundant (Slot #_, Location _)
Corrected memory error threshold passed (Slot #_, Memory Module #_)
Corrected memory error threshold passed (System Memory)
Corrected memory error threshold passed (System Memory, Memory Module #_)
Corrected memory error threshold passed (Memory Module unknown)
Corrected memory error threshold passed (Slot #_, Memory Module #_, Serial Number)
Corrected memory error threshold passed (System Memory, Serial Number)
Corrected memory error threshold passed (System Memory, Memory Module #_, Serial Number)
Corrected memory error threshold passed (Memory Module Unknown, Serial Number)
Uncorrectable memory error (Slot #_, Memory Module #_)
Uncorrectable memory error (System Memory)
Uncorrectable memory error (System Memory, Memory Module #_)
Uncorrectable memory error (Memory Module unknown)

Event
Uncorrectable memory error (Slot #_, Memory Module #_, Serial Number)
Uncorrectable memory error (System Memory, Serial Number)
Uncorrectable memory error (System memory, Memory Module #_, Serial Number)
Uncorrectable memory error (Memory Module Unknown, Serial Number)
Uncorrectable main memory error (Slot #_, Memory Module #_)
Uncorrectable main memory error (System Memory)
Uncorrectable main memory error (System Memory, Memory Module #_)
Uncorrectable main memory error (Memory Module unknown)
Uncorrectable main memory error (Slot #_, Memory Module #_, Serial Number)
Uncorrectable main memory error (System Memory, Serial Number)
Uncorrectable main memory error (System Memory, Memory Module #_, Serial Number)
Uncorrectable main memory error (Memory Module Unknown, Serial Number)
Accelerator cache memory parity errors (Socket #_)
Processor correctable error threshold passed (Slot #_, Socket #_)
Processor uncorrectable internal error (Slot #_, Socket #_)
Unrecoverable host bus data parity error
Unrecoverable host bus address parity error
EISA expansion bus master timeout (Slot #_)
EISA expansion bus slave timeout
EISA expansion board error (Slot #_)
EISA expansion bus arbitration error
PCI bus error (Chassis #_, Slot #_, Bus #_, Device, Function)
PCI bus error (Slot #_, Bus #_, Device, Function)
Slot-release level open (Chassis #_, Slot #_)
Slot-release level closed (Chassis #_, Slot #_)
Slot power on (Chassis #_, Slot #_)
Slot power off (Chassis #_, Slot #_)
Slot power fault (Chassis #_, Slot #_)
Slot power up fault (Chassis #_, Slot #_)
Unexpected slot power loss (Chassis #_, Slot #_)
Adapter initialization failure (Chassis #_, Slot #_)
Adapter failure (Chassis #_, Slot #_)
Slot-release lever opened (Slot #_)
Slot-release lever closed (Slot #_)
Slot power on (Slot #_)
Slot power off (Slot #_)
Slot power fault (Slot #_)
Slot power up fault (Slot #_)
Adapter initialization failure (Slot #_)
Unexpected slot power loss (Slot #_)

Event
Adapter failure (Slot #_)
Post error (any string)
System power supply (Power Supply _)
External chassis power supply (Chassis #_, Power Supply _)
External storage system power supply (Slot #_, Power Supply _)
Internal storage system power supply (Slot #_, Power Supply _)
Realtime clock battery failing
Realtime clock battery failing [Battery 2] (Chassis #_)
A CPU power module has failed
A PCI power module has failed
An I/O power module has failed
A power module has failed (unknown)
System power supply removed (Power Supply #_)
External chassis power supply removed (Chassis #_, Power Supply #_)
External storage system power removed (Slot #_, Power Supply #_)
Internal storage system power supply removed (Slot #_, Power Supply #_)
System power supply inserted (Power Supply #_)
External chassis power supply inserted (Chassis #_, Power Supply #_)
External storage system power supply inserted (Slot #_, Power Supply #_)
Internal storage system power supply inserted (Slot #_, Power Supply #_)
System power supplies not redundant
External chassis power supplies not redundant (Chassis #_)
External storage system power supplies not redundant (Slot #_)
Internal storage system power supplies not redundant (Slot #_)
System power modules not redundant
External chassis power modules not redundant (Chassis #_)
External storage system power modules not redundant (Slot #_)
Internal storage system power modules not redundant (Slot #_)
System AC power problem (Power Supply #_)
External chassis AC power problem (Chassis #_, Power Supply #_)
External storage system AC power problem (Slot #_, Power Supply #_)
Internal storage system AC power problem (Slot #_, Power Supply #_)
System AC power overload (Power Supply #_)
External chassis AC power overload (Chassis #_, Power Supply #_)
External storage system AC power overload (Slot #_, Power Supply #_)
Internal storage system AC power overload (Slot #_, Power Supply #_)
ASR detected by system ROM
ASR lockup detected
Abnormal program termination [ABEND]
ASR reset limit detected by system ROM

Event
Automatic OS system shutdown initiated due to fan failure
Automatic OS system shutdown initiated due to overheat condition
Automatic OS system shutdown aborted
Automatic OS system shutdown initiated due to fan failure aborted
Automatic OS system shutdown initiated due to overheat aborted
Automatic OS system shutdown initiated by a soft power down
Automatic OS system shutdown initiated by software
Fatal exception (Number, Cause)
Network adapter fault (Chassis #_, Slot #_, Port #_)
Network adapter link down (Chassis #_, Slot #_, Port #_)
Network adapter transmit timeout (Chassis #_, Slot #_, Port #_)
Network adapters no longer redundant (Chassis #_, Slot #_, Port #_)
Network adapter fault (Slot #_, Port #_)
Network adapter link down (Slot #_, Port #_)
Network adapter transmit timeout (Slot #_, Port #_)
Network adapters no longer redundant (Slot #_, Port #_)
SCSI controller failure (Bus #_, Slot #_)
SCSI controller failure (Chassis #_, Bus #_, Slot #_)
SCSI device failure (Bus #_, Slot #_, Bay #_)
SCSI Controllers no longer redundant (Chassis #_)
SCSI Controllers no longer redundant
Drive array controller failure (Bus #_, Slot #_, Bay #_)
Drive array controller failure (Chassis #_, Bus #_, Slot #_)
Drive array device failure (Bus #_, Slot #_, Bay #_)
Drive array accelerator battery failure (Bus #_, Slot #_)
Drive array accelerator battery failure (Chassis #_, Bus #_, Slot #_)
Drive array controllers no longer redundant (Chassis #_)
Drive array controllers no longer redundant [2]
An unrecoverable system error (NMI) has occurred
An unrecoverable system error (BINIT) has occurred
IML cleared.