COMPAQ

Compaq IDA-2 Configuration for NetWare

Compaq TechNote

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Compaq IDA-2 Configuration for NetWare

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Chapter 1
Introduction

The COMPAQ Intelligent Drive Array Controller-2 (IDA-2) provides a subsystem that offers enhanced configuration, functionality, performance, and manageability for COMPAQ servers in a NetWare v3.11 environment. IDA-2 is available for the following COMPAQ PC Servers:

- COMPAQ SYSTEMPRO/XL
- COMPAQ SYSTEMPRO
- COMPAQ SYSTEMPRO/LT
- COMPAQ ProSignia

About This Compaq TechNote

This *COMPAQ TechNote for NetWare* is for system integrators with knowledge of COMPAQ server products and NetWare v3.x. This TechNote, a supplement to the COMPAQ product and NetWare documentation, provides guidelines for installing and configuring the COMPAQ IDA-2 Controller in a NetWare v3.11 environment, including the following topics:

- Technology overview, including caching schemes.
- Supported fault tolerance environments (Redundant Array of Inexpensive Disks (RAID) technology).
- IDA-2 Controller minimum requirements.
- Performance considerations.
- Fault prevention and server management.

Technology Overview

The IDA-2 Controller is a 32-bit, EISA-based dedicated I/O controller that distributes data over a drive array, allowing parallel data transfers and simultaneous servicing of multiple data requests. It incorporates a 16-MHz NEC V53 processor, which offloads drive array processing tasks from the system processor.

The IDA-2 Controller features the 4-Megabyte Array Accelerator Write Cache that provides non-volatile buffer memory for write operations. The Array Accelerator caches up to 2 megabytes of data before sending the data to disk. The remaining 2 megabytes of memory mirror the data, so that if a parity error or memory chip failure occurs, the Array Accelerator retains an undamaged copy of the data. The Array Accelerator includes on-board rechargeable batteries to preserve cached data for 5 to 8 days in the event of an unexpected power loss.

Once data is written to the Array Accelerator, the Array Accelerator returns control to the application, so the application does not wait for the data to be written to disk. Using the Array Accelerator improves disk I/O performance in write-intensive operations, such as database applications, and in fault-tolerant configurations such as data guarding and drive mirroring.

The IDA-2 Controller also includes software-upgradeable firmware; upgrading the firmware does not require physical replacement of the ROMs.

Unlike the 32-Bit IDA Controller, which supports up to two logical drives, the IDA-2 Controller supports configuration of up to three logical drives on a single drive array subsystem. This allows NetWare to recognize the drive array as up to three separate logical drives.

The IDA-2 Controller supports distributed data guarding (RAID 5), which is discussed in Chapter 2.

The IDA-2 Controller also includes status indicator lights that show activity or errors for the controller, Array Accelerator, or hard drives.
See Figure 1-1.

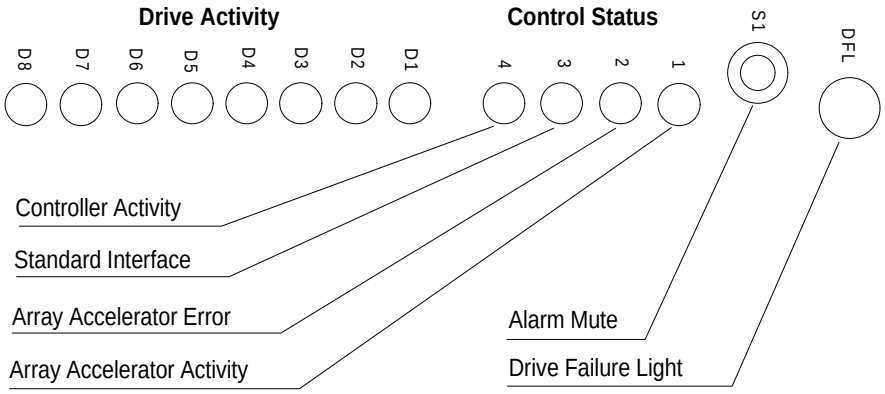

Figure 1-1. IDA-2 Status Indicators

The IDA-2 Controller includes fault prevention features that can be monitored by COMPAQ INSIGHT Manager and COMPAQ Server Manager/R as part of a complete server management solution. See Chapter 5 for more information.

Caching Schemes

Caching data to system memory or to memory on a controller can provide enhanced server performance in a resource-sharing environment. NetWare employs a disk-caching scheme that allows applications to write data to and read data from system memory instead of disk. The IDA-2 Controller provides additional caching capabilities with the 4-Megabyte Array Accelerator Write Cache. This caching operates independently of the NetWare cache.

NetWare Caching Scheme

NetWare uses a disk-caching scheme that enables the cache, under many circumstances, to satisfy most disk I/O requests. The system processes many read requests and posts write requests in the cache. When data is requested, it is obtained from the cache and not from the hard disk, providing faster access than in typical network environments. Most disk I/O requests under NetWare go through the cache, providing more efficient data access and storage.

When a write request enters the cache, NetWare reports to the application that the write operation has completed successfully. The cache accumulates multiple write operations and then passes them to the elevator when the cache is full, when dirty disk cache delay time is reached, or when an application forces the cache to flush.

The cache stores the data and combines it with other write requests of approximately the same size. When the server handles other tasks, such as NIC requests, this posting of similarly sized write requests in cache and "getting back to them later" is an efficient method of processing requests. Caching allows processing of multiple requests at one time, increasing performance.

NetWare's ability to cache files is based on two major factors:

- Size of the files and write requests.
- Amount of system memory available to create a cache area large enough to handle most requests.

You can control some of the aspects of the NetWare disk cache system using the NetWare SET parameters. For example, you can use the SET MAXIMUM CONCURRENT DISK CACHE WRITES parameter to accommodate more write requests. When dirty cache blocks are ready to be written to the hard disk, the SET MAXIMUM CONCURRENT DISK CACHE WRITES parameter determines how many write requests are put into the elevator for disk I/O. Increasing this parameter can improve performance in write-intensive environments.

You can also use the SET DIRTY CACHE DELAY TIME parameter to control the amount of time the cache holds a request that does not fill the buffer. Network users performing more small write requests than large ones may require additional system processor bandwidth, causing the server to spend more time on hard disk I/O and less time on other tasks. Increasing the dirty cache delay time forces the cache to hold these requests longer, making more efficient use of the cache area.

NOTE: For more information on these SET parameters, see the COMPAQ TechNote, *Performance Management in a NetWare v3.11 Environment*, or the NetWare documentation.

Since most read/write operations involve the cache, the size of the disk cache area can directly impact network performance. A network server with inadequate system memory may not have enough cache buffers to perform large file requests. Almost all write requests must go through the cache. If the file is larger than the cache, it must wait until the cache is flushed before the operating system will accept data from the workstation. Thus, a smaller amount of cache is acceptable as long as it can flush to disk faster than incoming data.

IDA-2 Caching Scheme

The IDA-2 Controller's 4-Megabyte Array Accelerator Write Cache provides additional write cache capabilities that are transparent to the NetWare caching scheme.

When a request enters the NetWare cache, NetWare reports that the write operation has been successfully completed. When the NetWare cache becomes full (and at other specific times), NetWare flushes the cache. Instead of flushing directly to the hard disk, NetWare flushes to the Array Accelerator. The Array Accelerator accumulates multiple write operations and passes them to the hard disk when the cache is full, during idle times, and before an orderly system power-down.

The Array Accelerator caches up to 2 megabytes of data, using the remaining 2 megabytes of memory to mirror the data. In the event of a system failure, on-board batteries preserve the data for 5 to 8 days. The Array Accelerator verifies that the data in the cache is valid and flushes the saved data to disk when the server reboots.

The additional caching capabilities of the IDA-2 Controller and Array Accelerator provide enhanced IDA performance and data integrity in a NetWare environment.

Chapter 2
Fault Tolerance

Fault tolerance and the associated technology of Redundant Array of Inexpensive Disks (RAID) combines multiple disks into a subsystem that appears as one logical drive to NetWare. The fault tolerance associated with RAID technology adds hardware redundancy using parity information and other techniques to improve the reliability of your disk subsystem. If a hard drive fails, the server continues operating until the drive is repaired or replaced, and then reconstructs the data onto the new drive.

The IDA-2 Controller provides support for distributed data guarding (RAID 5), which improves data guarding performance in environments involving multiple, simultaneous I/O requests. However, the misconception that "the higher the level of RAID, the better the redundancy" is not necessarily true. RAID levels represent the way that the data and the parity information are stored on hard disk. The following sections discuss the levels of RAID technology supported by the IDA-2 Controller and the benefits of each of these levels.

Drive Mirroring (RAID 1)

Drive mirroring (RAID 1) provides redundant hard drives and stores complete sets of data on primary drives and secondary drives. When the system writes data to the hard drive, it writes to the primary drive and to the secondary drive. If a primary hard drive or primary drive array pair fails, the system can read the data via the same controller from the secondary drive or drive array pair.

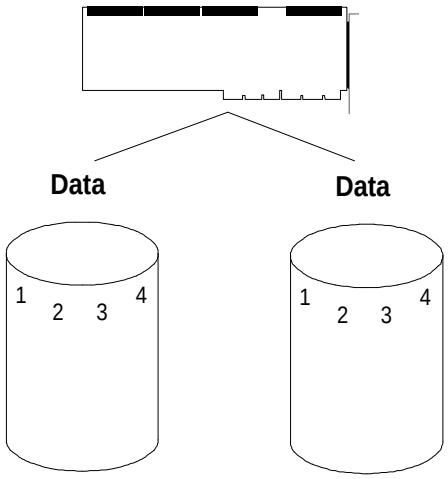

Figure 2-1. Drive Mirroring (RAID 1)

Two supported methods of drive mirroring for the IDA-2 Controller are:

- COMPAQ drive mirroring
- NetWare drive mirroring

The method you use depends on the type of COMPAQ server product you configure. Both methods provide fully mirrored drives. The difference is that COMPAQ drive mirroring offloads the burden of fault tolerance from the NetWare operating system to the hardware. Additional NetWare cycles to support drive mirroring are no longer necessary, and the mirroring is transparent to NetWare. COMPAQ drive mirroring increases server performance.

Controller Duplexing

Controller duplexing is similar to drive mirroring, but provides complete redundancy of the hard drive subsystem (hard drives, cables, and controller). If a component of one subsystem (the primary channel) fails, the duplexed subsystem (the secondary channel) can service requests until you repair the primary channel.

Controller duplexing is a NetWare software-implemented method of fault tolerance. Since controller duplexing is software-driven, any COMPAQ PC product with two hard drive controller boards and equal storage capacity for each controller can support it. Controller duplexing may not be *recommended* in every configuration. For example, controller duplexing is not recommended for the COMPAQ ProSignia PC Server configured with an IDA-2 subsystem. An IDA-2 controller-duplexing configuration on the COMPAQ ProSignia provides a limited upgrade path for the growth of the server, because it supports a maximum of three drive array pairs. Controller duplexing requires two EISA expansion slots for the IDA-2 Controllers, a minimum of two drive array pairs, and a multiple of two drive array pairs.

Data Guarding (RAID 4)

Data guarding (RAID 4) uses a dedicated parity drive. The IDA-2 Controller writes data to each of three drives, while using the fourth drive to hold parity data. The block size is defined when the IDA-2 Controller is configured using the COMPAQ EISA Configuration Utility. The NetWare volume block size should match the striping factor on the drives. This can significantly improve IDA-2 I/O performance. See Chapter 4 for more information.

NOTE: Data guarding requires a multiple of four drives.

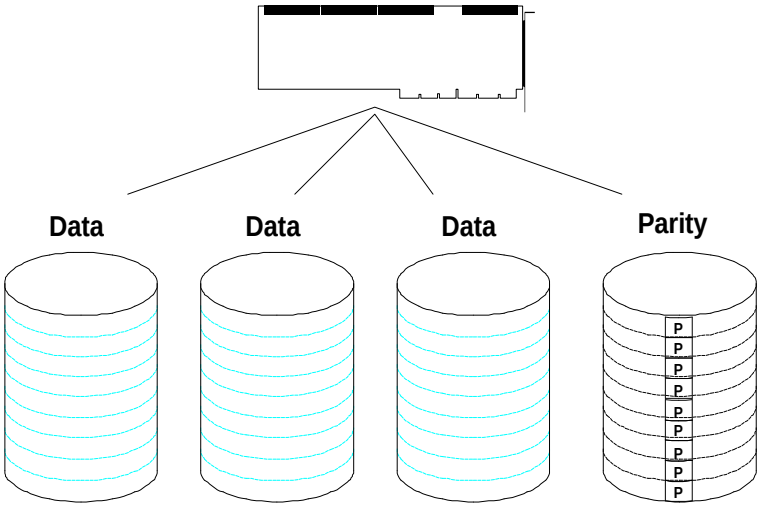

Figure 2-2. Data Guarding (RAID 4)

One disadvantage of data guarding is degraded write performance. While data is written to the hard disk, data is read from the parity drive and the data drives, and the new parity information is calculated and written to the parity disk. The additional read and write operations reduce write performance.

However, despite this write performance degradation, data guarding can still improve the overall I/O performance in a read-intensive environment. Statistically, most resource-sharing environments are read-intensive (80 percent read operations to 20 percent write operations). Read and write operations can occur independently, allowing the server to read data concurrently from multiple drives and improving performance. Since data guarding supports concurrent reads, your network server can provide sufficient performance in this environment.

Distributed Data Guarding (RAID 5)

Distributed data guarding (RAID 5) does not require a dedicated parity disk. Instead, a "parity area" is implemented at the sector level on each hard disk in the array, so parity data is spread over the entire array. Because it interleaves the parity information, distributed data guarding is not limited by single-write transactions. It performs multiple, concurrent, independent read and write operations. If a drive fails, the IDA-2 Controller rebuilds the data from the parity data and data on the remaining drives. Distributed data guarding provides improved I/O performance over data guarding (RAID 4).

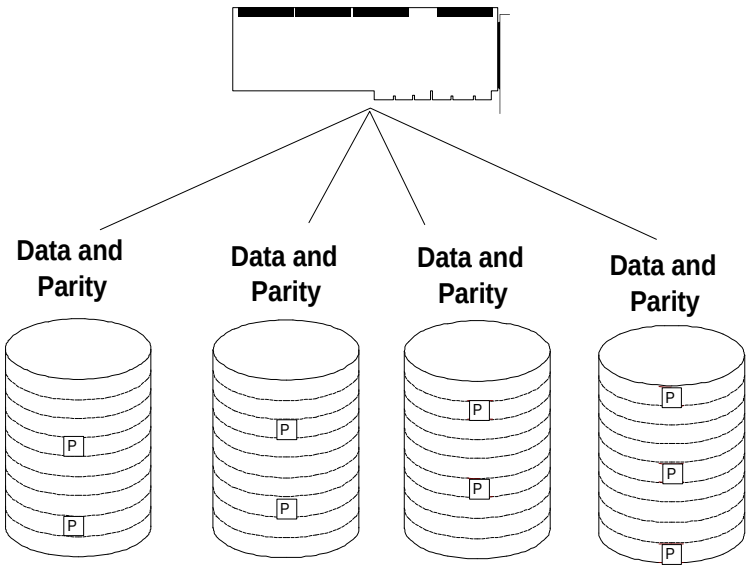

Figure 2-3. Distributed Data Guarding (RAID 5)

Distributing the parity data allows simultaneous parity update operations, which improves performance in environments dominated by small, random disk I/O, such as databases. It also allows data to be spread across four drives rather than three, allowing more simultaneous read operations than RAID 4.

However, distributed data guarding, like RAID 4, generates additional read and write operations when writing to disk, so network server performance degrades slightly in a write-intensive environment.

The 4-Megabyte Array Accelerator Write Cache helps mask distributed data guarding performance degradation by caching the data. The on-board cache is also fault tolerant. The Array Accelerator caches up to 2 megabytes of data, using the remaining 2 megabytes of memory to mirror the data. It also includes on-board rechargeable batteries to preserve data for up to 5 to 8 days in the event of an unexpected power loss at the server.

Table 2-1 compares fault tolerance features.

Table 2-1
Fault Tolerance Features Comparison

Fault Tolerance Method	No Fault Tolerance	Mirroring (RAID 1)	Controller Duplexing	Data Guarding (RAID 4)	Distributed Data Guarding (RAID 5)
Usable Disk Space	100%	50%	50%	75%	75%
Parity and Redundancy	None	Duplicate data	Duplicate data	Dedicated parity drive	Dedicated parity area on each drive
Minimum # of Drives in Array	N/A	2	2	4	4
Advantage	Highest performance. Maximum available storage.	Data redundancy. Multiple reads and writes. Split reads.	Data and controller redundancy. Multiple reads and writes. Split reads.	Multiple simultaneous reads and writes. Data integrity via parity.	Multiple simultaneous reads and writes. Data integrity via parity.
Disadvantage	High risk. No data redundancy.	Requires twice the disk space of no fault tolerance.	Requires two controllers and twice the disk space of no fault tolerance.	Performance degradation with write operations.	Minimal performance degradation with write operations (less than with RAID 4). Degradation decreases with additional drive array pairs.
Typical Environment	Non-critical data.	High performance database; real-time critical data	High performance database; real-time critical data	Store and forward critical data where disk space is more important than performance	Store and forward critical data; database

Chapter 3
Installation and Configuration

The IDA-2 subsystem requires the following firmware and software:

- COMPAQ EISA Configuration Utility v2.10 or later, which contains IDA-2 specific configuration files.

NOTE: Earlier versions of the EISA Configuration Utility may show a discrepancy involving logical drive capacity information.

- *CPQDA386.DSK* device driver version 2.20, dated 05/20/92 or later. Version 2.20 includes support for three logical drives on the IDA-2 Controller and for the 4-Megabyte Array Accelerator Write Cache. *CPQDA386.DSK* is on the NetWare Programs from Compaq v2.0 diskette.
- System ROM firmware:
  - COMPAQ SYSTEMPRO/XL - 386E5 (flash)
  - COMPAQ SYSTEMPRO with two system ROMs - 386E
  - COMPAQ SYSTEMPRO with one system ROM - 386E1
  - COMPAQ SYSTEMPRO/LT - 386E07
  - COMPAQ ProSignia - 386E4 (flash)

CAUTION: Use the *CPQDA386.DSK* device driver for the IDA-2 Controller. Configuring the IDA-2 Controller with other device drivers can greatly reduce performance.

Do not attempt to load both the *CPQDA386.DSK* and *ISADISK.DSK* device drivers for a single IDA-2 Controller. If the hard drives are set up and volumes are created using *CPQDA386.DSK*, and then *ISADISK.DSK* is loaded, all data is lost.

This section outlines the configuration and fault tolerance setup of the IDA-2 subsystem in the following COMPAQ PC Servers (unless otherwise noted):

- COMPAQ SYSTEMPRO/XL
- COMPAQ SYSTEMPRO
- COMPAQ SYSTEMPRO/LT
- COMPAQ ProSignia

COMPAQ Drive Mirroring, Distributed Data Guarding, Data Guarding, and No Fault Tolerance

Perform the following procedures to install and configure the IDA-2 Controller, partition the drives, install MS-DOS, and install NetWare.

! **IMPORTANT:** If you are installing and configuring the COMPAQ SYSTEMPRO/XL or the COMPAQ ProSignia, review the Appendix, *Configuring Server Health Features*, before proceeding. You may want to create a system partition and copy the COMPAQ EISA Configuration Utility and COMPAQ Diagnostics software to the partition for Automatic Server Recovery support.

Configuring the IDA-2 Controller

The following steps use the COMPAQ EISA Configuration Utility v2.11. Steps may be slightly different with other versions.

1. Install the drive array pairs if necessary.
2. Install the IDA-2 Controller in the slot closest to the drive array pairs in the COMPAQ SYSTEMPRO, COMPAQ SYSTEMPRO/LT, and COMPAQ SYSTEMPRO/XL. Install the IDA-2 Controller in slot 6 of the COMPAQ ProSignia.

! **IMPORTANT:** Do not install the IDA-2 Controller in slot 2 of the COMPAQ ProSignia. The EISA Configuration Utility will not configure the IDA-2 Controller in this slot. Slot 2 is configured for use with the QVision 1024/E Controller, including the QuickBlank feature. When you install a hard drive controller in slot 2, the monitor on the COMPAQ ProSignia goes blank when the hard drive controller LEDs illuminate.

3. Boot the server with the COMPAQ System Configuration diskette in the diskette drive, and execute the EISA Configuration Utility.
4. At the Auto Config screen, select *Yes* to have the system automatically configured.
5. Select *NetWare* from the Primary Operating System menu.
6. The Intelligent Drive Array Controller-2 - Slot *x* screen displays. Press the **ENTER** key to continue.
7. Select *NetWare* at the Operating System - Slot *x* screen.
8. Select the number of physical drive pairs to configure at the Physical Drive Selection - Logical Drive 1 screen.
9. Select *No Fault Tolerance*, *Data Guarding*, *Distributed Data Guarding*, or *Drive Mirroring* at the Fault Tolerance Selection - Logical Drive 1 pop-up window.
10. Press the **F7** key to check the cabling information available at the IDA-2 Logical Drive Configuration - Slot x screen. Press the **ENTER** key twice to continue.
11. Press the **ENTER** key at the NetWare Performance screen. The COMPAQ EISA Configuration Utility loads the configuration files on the system.
12. Select *Save and exit* at the Information screen.
13. Press the **ENTER** key at the Reboot screen.

Partitioning the Drives and Installing MS-DOS

Perform the following steps to partition the drives and install MS-DOS.

1. Boot the server with the COMPAQ FASTART utility in drive A.
2. Select the keyboard and country support.
3. At the Welcome screen, select *Use Custom Method*.
4. Select *Continue* at the FASTART: Custom Method screen.
5. Select *Continue* at the 1. Preparing the Fixed Disk screen.
6. Select *Specify your own* at the Fixed Disk Preparation screen.
7. Fixed Disk 1 is highlighted on the Standard Fixed Disk Preparation screen. Press the **ENTER** key to select *Fixed Disk 1*. Then select *Add*.
8. At the Add Disk Drive screen, enter the size for the new drive. For this configuration, 10 megabytes is recommended. After the drive is added, select *Continue*.
9. At the 1. Preparing the Fixed Disk screen, select *Continue* to restart the server.
10. When FASTART is reloaded, select *Continue* to begin partition formatting.
11. To begin MS-DOS installation, select *Continue* at the 1. Preparing the Fixed Disk screen.
12. If you do not want MS-DOS installed on your server, select *Exit* at the 1. Preparing the Fixed Disk screen. The C drive is bootable without a complete DOS installation.
13. To install DOS, specify the target drive and directory. Press the **ENTER** key to accept the default directory.
14. Insert the MS-DOS System and Operating diskettes when prompted.

15. Select *Do not load MS-DOS Shell*.
16. MS-DOS installation is complete. Select *Continue*.
17. Select *No, I do not have a diskette* to avoid installing COMPAQ User Programs on the hard drive.
18. Exit FASTART at the Installation Complete screen. The server reboots.
19. FASTART automatically places memory management utilities in the *CONFIG.SYS* file. NetWare memory management may conflict with the DOS memory management utilities. Remove the utilities from the *CONFIG.SYS* file, or edit the *CONFIG.SYS* file to resemble the following:

```
rem device=c:\himem.sys
rem dos=high
```

Installing NetWare

Perform the following steps to install NetWare for COMPAQ drive mirroring, distributed data guarding, data guarding, and no fault tolerance.

1. At the DOS prompt, create a NetWare subdirectory, such as \NW311. Copy the following files to this subdirectory:
   - *SERVER.EXE* from the NetWare System - 1 diskette.
   - *INSTALL.NLM* and *VREPAIR.NLM* from the NetWare System - 2 diskette.
   - *MONITOR.NLM* from the NetWare System - 3 diskette.
   - *CPQDA386.DSK* v2.20, dated 05/20/92 or later, from the \DRV_ARRY\NW31X subdirectory on the NetWare Programs from Compaq diskette.
   - Appropriate network interface card (NIC) device driver. For example, if you have the COMPAQ NetFlex Controller installed, copy *CPQETHNW.LAN* for Ethernet or *CPQTOKNW.LAN* for Token Ring from the NetWare Programs from Compaq diskette.

2. Execute *SERVER.EXE* from the NetWare subdirectory.
3. Name the server and provide a unique internal network number.
4. From the NetWare prompt, load the IDA-2 Controller driver as follows:

   ```
   LOAD C:\NW311\CPQDA386.DSK SLOT=[slot # for primary controller]
   ```

5. Load the appropriate NIC driver. If you have a COMPAQ NetFlex Controller installed, enter one of the following commands:

   ```
   LOAD C:\NW311\CPQETHNW.LAN
   ```

   or

   ```
   LOAD C:\NW311\CPQTOKNW.LAN
   ```

6. Bind IPX to the NIC driver, specifying the network number. For this example, "1A" is used as the network number. Substitute your own network number for 1A.

   ```
   BIND IPX TO CPQETHNW NET=1A
   ```

7. From the NetWare prompt, load *INSTALL.NLM* as follows:

   ```
   LOAD INSTALL
   ```

8. From the Installation Options menu, select *System Options*.
9. Select *Create STARTUP.NCF File* from the Available System Options menu.
10. Press the **ENTER** key to select the default path for the *STARTUP.NCF* file.
11. Ensure that the *STARTUP.NCF* file includes the LOAD statement for the IDA-2 Controller driver. Press **ESCAPE**.
12. Select *Yes* at the Save STARTUP.NCF File? screen.
13. Return to the Available System Options menu, and select *Create AUTOEXEC.NCF*.

14. Press the **ENTER** key to select the default path for the *AUTOEXEC.NCF* file.
15. Ensure that the LOAD and BIND statements for your NIC are included in the *AUTOEXEC.NCF* file. Press **ESCAPE**.
16. Select *Yes* at the Save AUTOEXEC.NCF file? screen.
17. Return to the Installation Options menu, and select *Disk Options*.
18. Select *Partition Tables* from the Available Disk Options menu. Create the NetWare partition.

Continue NetWare installation by creating and mounting NetWare volumes and installing the System and Public files. The IDA-2 Controller subsystem, the NIC, MS-DOS, and NetWare are now installed and configured. Chapter 4 discusses performance considerations in optimizing your IDA-2 Controller subsystem.

Controller Duplexing

Although IDA-2 Controller duplexing is supported in the COMPAQ ProSignia, it is not recommended. An IDA-2 Controller duplexing configuration on the COMPAQ ProSignia provides a limited upgrade path for the growth of the server, since the ProSignia supports a maximum of three drive array pairs. Controller duplexing requires two EISA expansion slots for the IDA-2 Controllers, a minimum of two drive array pairs, and a multiple of two drive array pairs.

! **IMPORTANT:** If you are installing and configuring the COMPAQ SYSTEMPRO/XL or the COMPAQ ProSignia, review the Appendix, *Configuring Server Health Features* before proceeding. You may want to create a system partition and copy the COMPAQ EISA Configuration Utility and COMPAQ Diagnostics software to the partition for Automatic Server Recovery support.

Configuring the IDA-2 Controller

NOTE: The following steps use the COMPAQ EISA Configuration Utility v2.11. Steps may be slightly different with other versions.

Perform the following steps to install and configure the IDA-2 Controller for controller duplexing.

1. Install the drive array pairs if necessary.
2. Install the IDA-2 Controllers in the EISA slots nearest the drives, and connect the cables to the drives for controller duplexing.
3. Boot the server with the COMPAQ System Configuration diskette in the diskette drive, and execute the EISA Configuration Utility.
4. At the Auto Config screen, select *Yes* to have the system automatically configured.
5. Select *NetWare* at the Primary Operating System screen.
6. The Intelligent Drive Array Controller-2 - Slot *x* screen displays. Press the **ENTER** key to continue.
7. Select *NetWare* at the Operating System - Slot *x* screen.
8. Select the number of physical drive pairs to configure at the Physical Drive Selection - Logical Drive 1 screen.
9. Select *No Fault Tolerance* at the Fault Tolerance Selection - Logical Drive 1 pop-up window.
10. Press the **F7** key to check the cabling information available at the IDA-2 Logical Drive Configuration - Slot *x* screen. Press the **ENTER** key twice to continue.
11. Press the **ENTER** key at the NetWare Performance screen. The COMPAQ EISA Configuration Utility loads the configuration files on the system.

12. The Intelligent Drive Array Controller-2 - Slot *x* screen displays for the second IDA-2 Controller. Press the **ENTER** key to continue.
13. Select *NetWare* at the Operating System - Slot x screen.
14. Select the number of physical drive pairs to configure at the Physical Drive Selection - Logical Drive 1 screen.
15. Select *No Fault Tolerance* at the Fault Tolerance Selection - Logical Drive 1 pop-up window.
16. Press the **F7** key to check the cabling information available at the IDA-2 Logical Drive Configuration - Slot *x* screen. Press the **ENTER** key twice to continue.
17. Press the **ENTER** key at the NetWare Performance screen. The COMPAQ EISA Configuration Utility loads the configuration files on the system.
18. Select *Save and exit* at the Information screen.
19. Press the **ENTER** key at the Reboot screen.

Partitioning the Drives and Installing MS-DOS

Perform the following steps to partition the drives and install MS-DOS.

1. Boot the server with the COMPAQ FASTART utility in drive A.
2. Select the keyboard and country support.
3. At the Welcome screen, select *Use Custom Method*.
4. Select *Continue* at the FASTART: Custom Method screen.
5. Select *Continue* at the 1. Preparing the Fixed Disk screen.
6. Select *Specify your own* at the Fixed Disk Preparation screen.
7. Select *Fixed Disk 1* at the Standard Fixed Disk Preparation screen. Then select *Add*.
8. At the Add Disk Drive screen, enter the size for the new drive. For this configuration, 10 megabytes is recommended.
9. After the first drive is added, select Fixed Disk 2 from the Standard Fixed Disk Preparation screen. Then select *Add*.
10. At the Add Disk Drive screen, enter the size for the new drive, matching the 10 megabyte size for the previous drive. Select *Continue*.
11. Select *Continue* again to restart the server.

12. When FASTART reloads, select *Continue* to begin partition formatting.
13. After the disk has been prepared for MS-DOS, select *Continue* to begin the next step.
14. Select *Continue* to begin MS-DOS installation. Select *Exit* if you do not want MS-DOS installed on your server. The C drive is bootable without complete DOS installation.

> **!** **IMPORTANT:** If DOS is not completely installed, the second IDA-2 Controller is not recognized by DOS. NetWare does, however, recognize the second IDA-2 Controller.

15. To install DOS, specify the target drive and directory.
16. Insert the MS-DOS System and Operating diskettes when prompted.
17. Select *Do not load MS-DOS Shell*.
18. Select *Continue* when MS-DOS installation is complete.
19. Select *No, I do not have a diskette* to avoid installing COMPAQ User Programs on the hard drive.
20. Exit FASTART at the Installation Complete screen. The server reboots.
21. FASTART automatically places memory management utilities in the *CONFIG.SYS* file. NetWare memory management conflicts with the DOS memory management utilities. Remove the utilities from the *CONFIG.SYS* file, or edit the *CONFIG.SYS* file to resemble the following:

```
rem device=c:\himem.sys
rem dos=high
```

Installing NetWare

When configuring the IDA-2 subsystem for controller duplexing under NetWare, perform the following steps.

1. At the DOS prompt, create a NetWare subdirectory, such as \NW311. Copy the following files to this subdirectory:
   - *SERVER.EXE* from the NetWare System - 1 diskette
   - *INSTALL.NLM* and *VREPAIR.NLM* from the NetWare System - 2 diskette
   - *MONITOR.NLM* from the NetWare System - 3 diskette
   - *CPQDA386.DSK* from the \DRV_ARRY\NW31X subdirectory on the NetWare Programs from Compaq diskette
   - Appropriate network interface card (NIC) device driver. For example, if you have the COMPAQ NetFlex Controller installed, copy *CPQETHNW.LAN* for Ethernet or *CPQTOKNW.LAN* for Token Ring from the NetWare Programs from Compaq diskette.
2. Execute *SERVER.EXE* from the NetWare subdirectory.
3. Name the server and provide a unique internal network number.
4. From the NetWare prompt, load the primary IDA-2 Controller driver as follows:

   ```
   LOAD C:\NW311\CPQDA386.DSK SLOT=[slot # for primary controller]
   ```

5. Load the secondary IDA-2 Controller driver as follows:

   ```
   LOAD C:\NW311\CPQDA386.DSK SLOT=[slot # for secondary controller]
   ```

6. Load the appropriate NIC driver. If you have a COMPAQ NetFlex Controller installed, enter one of the following commands:

   ```
   LOAD C:\NW311\CPQETHNW.LAN
   ```

   or

   ```
   LOAD C:\NW311\CPQTOKNW.LAN
   ```

7. Bind IPX to the NIC driver, specifying the network number. For this example, "1A" is used as the network number. Substitute your own network number for 1A.

   ```
   BIND IPX TO CPQETHNW NET=1A
   ```

8. From the NetWare prompt, load INSTALL.NLM as follows:

   ```
   LOAD INSTALL
   ```

9. From the Installation Options menu, select *System Options*.
10. Select *Create STARTUP.NCF File* from the Available System Options menu.
11. Press the **ENTER** key to select the default path for the *STARTUP.NCF* file.
12. Ensure that the *STARTUP.NCF* file includes a LOAD statement for each IDA-2 Controller driver. Press **ESCAPE**.
13. Select *Yes* at the Save STARTUP.NCF File? screen.
14. Return to the Available System Options menu, and select *Create AUTOEXEC.NCF*.
15. Press the **ENTER** key to select the default path for the *AUTOEXEC.NCF* file.
16. Ensure that the LOAD and BIND statements for your NIC are included in the *AUTOEXEC.NCF* file. Press **ESCAPE**.

17. Select Yes at the Save *AUTOEXEC.NCF* file? screen.
18. Return to the Installation Options menu, and select *Disk Options*.
19. Select *Partition Tables* at the Available Disk Options menu.
20. Select *Device #0 COMPAQ 32-Bit IDA v2.20* at the Available Disk Drives menu.
21. Select *Create NetWare Partition* at the Partition Options menu. The Partition Information menu displays.
22. Press the **ESCAPE** key.
23. At the "Create Partition?" screen, select *Yes*. NetWare creates a NetWare partition for the primary channel.
24. After NetWare creates the primary partition, the Partition Options menu displays. Select *Return to Previous Menu* to repeat the procedure for the secondary channel.
25. Select *Device #1 COMPAQ 32-Bit IDA v2.20* at the Available Disk Drives menu.
26. Select *Create NetWare Partition* at the Partition Options menu. The Partition Information menu displays. Press the **ESCAPE** key.
27. At the "Create Partition?" screen, select *Yes*. NetWare creates a NetWare partition for the secondary channel.
28. After NetWare creates the secondary partition, the Partition Options menu displays. Select *Return to Previous Menu*. Press **ESCAPE** to return to the Available Disk Options menu.
29. Select *Mirroring* at the Available Disk Options menu.
30. Select the logical partition you wish to be primary from the Partition Mirroring Status screen.
31. The Mirrored NetWare Partitions screen displays. Press the **INSERT** key to display the Available Partitions screen, which displays the partitions available to mirror the primary partition.

32. Press the **ENTER** key to select the secondary logical drive that will mirror the primary logical drive.

33. When the partitions are mirrored, the Mirrored NetWare Partitions screen displays the primary partition, and then the secondary partition. Press the **ESCAPE** key to verify that the devices are "mirrored" from the information on the Partition Mirroring Status screen.

34. Press **ESCAPE** to return to the previous menu.

Continue NetWare installation by creating and mounting NetWare volumes, and installing the System and Public files. The IDA-2 Controller subsystem, the NIC, MS-DOS, and NetWare are now installed and configured. Chapter 4 discusses performance considerations in optimizing your IDA-2 Controller subsystem.

Chapter 4
Performance Considerations

Performance of a server depends on the performance of each subsystem, and each subsystem affects the performance of others. For example, lack of sufficient system memory will affect the hard drive subsystem, network communication subsystem, and system processor. For complete performance management information, see the COMPAQ TechNote *Performance Management in a NetWare v3.11 Environment*.

This chapter discusses performance issues that relate specifically to the IDA-2 subsystem.

Volume Block Size and Cache Buffer Size

The default volume block size for NetWare is 4 Kbytes. When you are implementing a COMPAQ drive array subsystem, however, you can improve disk I/O performance by as much as 20 percent if you modify this volume block size to match the striping factor of the hard drive subsystem. When configuring your server, ensure that the cache buffer size is the same as the NetWare volume block size.

! **IMPORTANT:** In the NetWare environment, the striping factor for the IDA-2 subsystem is 16 sectors (8 Kbytes). For optimal performance, set the volume block size for the IDA-2 subsystem to 8 Kbytes. Set the cache buffer size to 8192.

While these volume block sizes provide optimal performance, using them may result in inefficient use of disk space by failing to fill an 8-Kbyte block with data. The percentage of disk space sacrificed depends on the average file size; many smaller files have more impact. In cases where the use of these values results in improved performance but the inefficient use of disk space, you must address the trade-off between performance of the server and use of the disk space.

Hot Fix Redirection Area

If you accept the system default and do not align the volume blocks with the drive array striping factor, the NetWare volume blocks (which immediately follow the Hot Fix Redirection Area on the drive) may cross the stripe boundaries. A significant number of write requests crossing the stripe boundaries results in decreased performance. Figure 4-1 illustrates this concept. Modify the size of the Hot Fix Redirection Area to improve performance of your COMPAQ drive array subsystem by ensuring that the NetWare volume blocks align with the drive array striping factor.

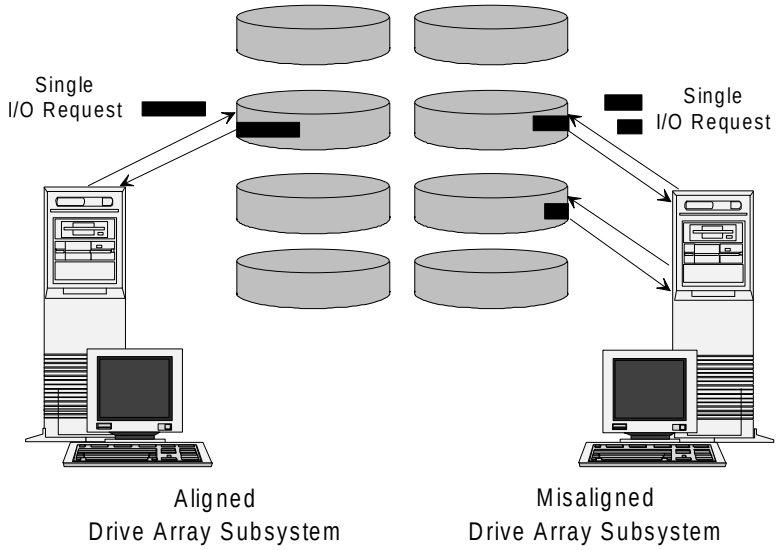

Figure 4-1. Effect of Aligned and Misaligned Striping

The following procedure provides guidelines for configuring Hot Fix Redirection Area blocks for COMPAQ IDA-2 drive array subsystems.

CAUTION: Always perform a complete backup before changing the size of the Hot Fix Redirection Area. Changing the size of the Hot Fix Redirection Area will destroy data on the volume.

1. Ensure that you have created a 10 megabyte (minimum) DOS partition. See Chapter 3 for information on creating the DOS partition.
2. Load the *CPQDA386.DSK* device driver for the IDA-2 Controller.
3. Load *INSTALL.NLM* at the NetWare prompt.
4. Select *Device #0* (primary logical drive) from the Available Disk Drives menu, and press the **ENTER** key to display the current partition information for the IDA controller and logical drive 1.
5. Select *Create NetWare Partition* from Partition Options menu.
6. Modify the number of Hot Fix Redirection Area blocks based on the values in Tables 4-1 through 4-4.

   For example, to modify the Hot Fix Redirection Area blocks for a 2.04-gigabyte array with a 10-megabyte DOS partition (11 cylinders), see Table 4-4. Table 4-4 specifies that the optimal number of Hot Fix Redirection Area blocks for two 1.02-gigabyte drive array pairs configured for data guarding is *even*. Specify any even number of blocks to align the file system data area with the drive array striping factor.

Table 4-1
120-MB Hard Drives

Number	Fault Tolerance	Drive Type	Number of Hot Fix Redirection Blocks
1 pair	None	69	Even or odd if DOS cylinders are even or odd, respectively
1 pair	Mirroring	50	Even or odd if DOS cylinders are even or odd, respectively
2 pairs	None	71	Even number
2 pairs	Mirroring	69	Even or odd if DOS cylinders are even or odd, respectively
2 pairs	Data Guarding	70	Even number
3 pairs	None	76	Even number
3 pairs	Mirroring	70	Even number
4 pairs	None	82	Even number
4 pairs	Mirroring	71	Even number
4 pairs	Data Guarding	76	Even number

Table 4-2
210-MB Hard Drives

Number	Fault Tolerance	Drive Type	Number of Hot Fix Redirection Blocks
1 pair	None	84	Even number
1 pair	Mirroring	51	Even number
2 pairs	None	87	Even number
2 pairs	Mirroring	84	Even number
2 pairs	Data Guarding	85	Even number
3 pairs	None	94	Even number
3 pairs	Mirroring	85	Even number
4 pairs	None	100	Even number
4 pairs	Mirroring	87	Even number
4 pairs	Data Guarding	94	Even number

Table 4-3
340-MB Hard Drives

Number	Fault Tolerance	Drive Type	Number of Hot Fix Redirection Blocks
1 pair	None	72	Even number
1 pair	Mirroring	63	Even number
2 pairs	None	96	Even number
2 pairs	Mirroring	72	Even number
2 pairs	Data Guarding	90	Even number
3 pairs	None	74	Even number
3 pairs	Mirroring	90	Even number
4 pairs	None	80	Even number
4 pairs	Mirroring	96	Even number
4 pairs	Data Guarding	74	Even number

Table 4-4
510-MB Hard Drives

Number	Fault Tolerance	Drive Type	Number of Hot Fix Redirection Blocks
1 pair	None	90	Even number
1 pair	Mirroring	61	Even number
2 pairs	None	74	Even number
2 pairs	Mirroring	90	Even number
2 pairs	Data Guarding	102	Even number
3 pairs	None	92	Even number
3 pairs	Mirroring	102	Even number
4 pairs	None	98	Even number
4 pairs	Mirroring	74	Even number
4 pairs	Data Guarding	92	Even number

Set Enable Disk Read After Write Verify

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

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

The IDA-2 subsystem provides fault tolerance features that detect and correct single-sector media failures, multiple-sector media failures, and hard drive failures.

Considering the detection and correction capabilities of each hard drive in the intelligent drive array, the levels of fault tolerance on the IDA-2 subsystem, the negative performance impact, and the increased system memory required, the software Read After Write Verify feature has not been implemented in *CPQDA386.DSK* for NetWare.

Read after write verification is supported at the hardware level through Dynamic Sector Repairing (DSR). DSR is completely independent of the NetWare Hot Fix feature. The NetWare SET parameter is ignored in favor of performing this task at the controller. When you select a method of fault tolerance with the IDA-2 controller (mirroring, distributed data guarding, or data guarding) DSR is automatically enabled as a controller background task. DSR works much like NetWare Hot Fix in remapping bad sectors.

When you select no fault tolerance for the IDA-2 controller, DSR is not enabled. However, you still have protection through the NetWare Hot Fix feature. The IDA-2 subsystem includes the intelligence to determine if a write has been successfully completed. If a write operation has not properly completed, the driver communicates with the operating system to flag the bad area on the disk and have it remapped to an available area in the Hot Fix Redirection Area.

Chapter 5
Fault Prevention and Server Management

The ability to monitor your NetWare server for faults and to track potential fault trends requires several interconnected elements. You need intelligent hardware capable of tracking operational parameters and reporting faults and changes in status. This level of intelligence has been integrated into the IDA-2 Controller. You also need tools to present the hardware information and assist you in interpreting the data. In some configurations, you may also need remote diagnostic and management capabilities so you can detect and correct faults at remote sites.

The IDA-2 Controller is part of an intelligent hardware subsystem that reports data on system activity, system errors, and anomalies for fault prevention. COMPAQ INSIGHT Manager and COMPAQ Server Manager/R are options that provide the tools to interpret this information.

COMPAQ INSIGHT Manager and COMPAQ Server Manager/R allow you to manage your server configurations, monitor server status, and receive alerts when a status change occurs.

System Features

The COMPAQ IDA-2 Controller offers features to enhance manageability and performance of your server. The COMPAQ SYSTEMPRO/XL and the COMPAQ ProSignia also contain specific Server Health features that track changes in system configuration and critical and correctable errors, and assist in more rapid server recovery if a fault should occur.

This section will discuss performance, fault prevention and server management features of the IDA-2 Controller and the Server Health features of the COMPAQ SYSTEMPRO/XL and COMPAQ ProSignia.

Performance and Configuration Management

The following IDA-2 Controller performance and configuration management features are designed to assist you in managing your NetWare server:

- **Software Upgradeable Firmware** allows the IDA-2 read only memory (ROM) to be upgraded by using a firmware upload utility available from Compaq. You do not need to physically replace the ROM chip to upgrade the firmware.

  For more information about this utility, contact your Authorized COMPAQ Computer Reseller or Service Provider or call the Compaq Customer Support Center at 1-800-345-1518 in North America. In Canada, call 1-800-263-5868. Outside the United States and Canada, contact the local Compaq Computer Corporation office from which you normally receive support.

- **Array Accelerator Configurability** allows you to enable or disable the Array Accelerator Write Cache on a per-logical-drive basis using the COMPAQ EISA Configuration Utility.

  The Array Accelerator Write Cache benefits environments that have heavy write activity or peaks of write activity that might otherwise adversely affect system response. Databases have their own specialized cache for optimizing I/O. A write I/O bottleneck can often be traced to specific files, such as transaction logs or very large data tables. Configuring the Array Accelerator Write Cache to a specific logical drive is especially helpful if there is a tremendous imbalance of reads to writes between groups or files. Files with heavy write activity can be placed on a different logical drive than the files with heavy read activity. This will improve the write throughput and decrease the risk of overrunning the cache.

The IDA-2 Controller offers the following fault prevention features:

- **Dynamic Sector Repairing (DSR)** provides background hardware diagnostic capabilities that scan the hard drives and automatically remap any bad sectors. DSR is automatic with hardware-handled fault tolerance. DSR is not available with controller duplexing or with no fault tolerance configurations.
- **Drive Parameter Tracking (DPT)** automatically monitors more than 15 drive operational parameters within user-defined thresholds. DPT information can alert you to repair or replace a degraded drive before it fails.

  The following preset thresholds are monitored for Server Manager/R and COMPAQ INSIGHT Manager's Physical Drive Threshold Exceeded alerts:

  - Spinup Time
  - Functional Tests #1 - #3
  - Used Reallocation Sectors
  - Other Timeouts
  - Failed Recovery Read Error
  - Failed Recovery Write Error
  - Format Error
  - Self Test Error
  - Drive Not Ready Errors
  - Reallocation Aborts
- **Array Accelerator Tracking (AAT)** automatically monitors the Array Accelerator battery status and memory consistency. AAT allows you to replace the battery or Array Accelerator before it fails.

The IDA-2 Controller offers the following fault tolerance features in addition to the features mentioned in Chapter 2:

- **Automatic Data Recovery (ADR)** automatically reconstructs data on a replaced drive if a drive fails. ADR is not available with controller duplexing.
- **Array Accelerator Data Integrity** is provided by the Array Accelerator's on-board battery. The battery protects data in the Array Accelerator buffered memory in the event of a power loss. The cached data is also mirrored, which provides a clean copy of the data in case of parity errors.

Server Health

The COMPAQ SYSTEMPRO/XL and the COMPAQ ProSignia include integrated server health features that assist in identifying and logging system errors and provide more rapid recovery from failures. Although many of these features are not IDA-2 Controller-specific, they do enhance overall system reliability and manageability of the COMPAQ SYSTEMPRO/XL and the COMPAQ ProSignia.

Server Health Logs

Server Health Logs store error and configuration information in nonvolatile memory. This information, stored for later retrieval and analysis, can increase your speed in analyzing problems, and can help prevent future errors in the system. The Server Health Logs are the Critical Error Log, Corrected Error Log, and Revision History Table.

- **Critical Error Log** records catastrophic errors such as uncorrectable memory, expansion board, expansion bus arbitration, and various processor errors. After a critical error has occurred, the ROM indicates on boot-up that an error has occurred and prompts the user to run COMPAQ Diagnostics software.
- **Corrected Error Log** is supported by COMPAQ PC Servers that incorporate Advanced ECC Memory. At this time, only the COMPAQ SYSTEMPRO/XL supports this feature. The Corrected Error Log contains the time, date, frequency and other information about errors that have been automatically corrected by the system. When an error is logged, the user is notified when the system is rebooted.
- **Revision History Table** stores board revision information in nonvolatile memory. The first entry in this table is the system board revision. Other boards that support this feature, such as the IDA-2 Controller and the COMPAQ NetFlex Controller, are also recorded. When a board supporting this feature is updated or new boards are added to the system, this information is recorded in the Revision History Table. When you are troubleshooting server problems, this information is useful in determining whether or not a change has been made to the server configuration.

You can view the contents of these logs using the INSPECT utility on the Diagnostics software diskette (version 8.11 or later) or COMPAQ INSIGHT Manager (version 1.1 or later). The Diagnostics software uses the information in the error logs to streamline its testing and quickly pinpoint problems.

After a corrected or non-corrected error is logged and the server is rebooted, a message instructing the user to run Diagnostics software is displayed. Diagnostics software displays the suspected cause of the error and offers possible resolutions. It also updates the logs when corrective action is taken. If Diagnostics software determines that a new entry is similar or identical to an entry that is marked as receiving corrective action, the utility assumes that the corrective action did not resolve the problem and refers you to additional documentation sources to isolate the cause of the failure. Critical errors logged within the same hour are treated as related errors. Critical errors logged more than one hour apart are treated separately.

In the NetWare environment, *CPQHLTH.NLM* must be loaded for the Server Health Log features to function. *CPQHLTH.NLM* is on the NetWare Programs from Compaq v2.0 diskette.

Automatic Server Recovery

If a critical error or failure occurs, Automatic Server Recovery (ASR) can speed system recovery by rebooting the server and notifying you that a failure occurred. ASR is currently supported by the COMPAQ SYSTEMPRO/XL and COMPAQ ProSignia. When you are notified, you can dial into the server via modem and remotely diagnose and reconfigure the server.

ASR comprises:

- Hardware integrated onto the system board that, with the assistance of an operating system driver, detects when a server has malfunctioned and reboots the system.
- Server failure notification that dials a pager to alert you of a failure. (Requires modem.)
- Ability to remotely reboot the operating system or to run Diagnostics software and remotely reconfigure the system.

NOTE: *CPQHLTH.NLM* is required for ASR. *CPQHLTH.NLM* is on the NetWare Programs from Compaq v2.0 diskette.

CPQHLTH.NLM interfaces with ASR timer hardware integrated on the system board. *CPQHLTH.NLM* enables the ASR timer during server initialization. When the system has no problems, *CPQHLTH.NLM* periodically resets the timer.

If *CPQHLTH.NLM* cannot reset the ASR timer, then the system will reboot when the timer reaches zero. The operating system will log the system failure information in the Critical Error Log. This failure information can be retrieved later to assist you in diagnosing the system malfunction. When the server reboots, the system determines if a pager alert has been configured, and dials the pager number. Once connected, the pager transmits a unique string that identifies the malfunctioning server.

See the Appendix, *Configuring Server Health Features*, for more information.

Management Tools

Integrated system features gather operational data and record errors. Systems that support the Automatic Server Recovery feature can reboot and notify you in the event of a catastrophic failure. Compaq also offers COMPAQ INSIGHT Manager and COMPAQ Server Manager/R, two server management tools that allow you to spot trends indicating necessary system maintenance. They automatically present the data gathered while the server is online, and take advantage of the integrated system features, while providing additional management functionality.

COMPAQ INSIGHT Manager and COMPAQ Server Manager/R provide configuration management, fault and status change alerting, and information reporting for NetWare environments. COMPAQ INSIGHT Manager and COMPAQ Server Manager/R monitor server hardware configuration and alert you to server status changes. These products can operate together or independently.

INSIGHT Manager operates on the network. The server reports collected information and alerts via the network cabling, which means you can collect information while the server is up and running. Server Manager/R operates remotely, or off the network. The server reports management information and alerts via an asynchronous connection, which means you can collect information even if the network is down.

For more detailed server management information, see the COMPAQ TechNote, *NetWare Server Management*.

Compaq Insight Manager

INSIGHT Manager provides a list of servers on the network. When you select an instrumented server (a server with the COMPAQ Management Agents loaded), INSIGHT Manager shows you an illustration of that server, as well as its system configuration, security configuration, and hardware subsystem information.

INSIGHT Manager takes advantage of the self-diagnostic features of the IDA-2 Controller and any integrated Server Health features. INSIGHT Manager displays all parameters monitored by the IDA-2 Controller, and sends alerts as needed when significant changes in these parameters occur. In systems with integrated Server Health features, such as the COMPAQ SYSTEMPRO/XL or COMPAQ ProSignia, INSIGHT Manager displays the Server Health Log information online. You can check the Server Health Logs without bringing down the server.

Table 5-1 illustrates key IDA-2 items monitored by INSIGHT Manager.

Table 5-1
Key IDA-2 Disk Items Monitored by INSIGHT Manager

Object Category	Item	Cause for Alerts	Comments
Device Driver	Corrected Reads/ Corrected Writes	A read or write was unsuccessful when first attempted; retries required. Corrected by the hard drive controller or the physical drive.	Warning alert; should be monitored. Value is reset when driver is unloaded. If increment is constant, check physical drives for errors.
Logical	Status	Multiple causes.	Logical drive status. Refer to online Help for details and action.
Physical	Thresholds Exceeded	Any monitored item within the Physical Disk Monitor List that exceeds the assigned threshold.	Review all physical drive monitored items to determine which error occurred. Run Diagnostics software.
	Functional Tests #1-#3	Wear from normal drive use over time.	Warning alert; indicates drive performance has degraded.
Physical/ Advanced	Thresholds Exceeded	Any monitored item within the Advanced Physical Disk Monitor List that exceeds the assigned threshold.	Review all Advanced Physical Disk Monitor List items to determine which error occurred. Run Diagnostics software.
	Used Reallocation Sectors	Controller attempted to write data addressed for unusable sectors. Data was written to usable sectors in Reallocation area.	Warning alert. Monitor increment rate; if rapid, run Diagnostics software.
	Spin Up Time/Spin Up Retries	Wear from normal drive use over time.	Warning alert; indicates drive performance has degraded.
	Recovered Read Errors/ Recovered Write Errors	Wear from normal drive use over time. Corrected through physical drive retries.	Warning alert; indicates drive may be developing problems.
	Seek Errors	Wear from normal drive use over time.	Warning alert. Monitor Functional Tests item. If drive appears to be degrading, run Diagnostics software.

NOTE: Diagnostics software must report a failure before drives or other assemblies should be considered for replacement. Even if the drive exceeds certain preset thresholds, it may still be operational, as the thresholds are set to provide warnings of degraded performance before actual failures occur. In some cases, it may be more effective to continue to monitor the drive for further problems and schedule system maintenance when appropriate.

INSIGHT Manager can also provide alerts from the IDA-2 subsystem and the Server Manager board. You receive failure alerts, degraded condition alerts, and status alerts at the management console. Failure alerts notify you of critical problems, so you can take immediate action. Degraded condition and status alerts, however, allow you to take corrective action before you experience a failure. Table 5-2 provides a complete list of IDA-2 alerts available from INSIGHT Manager.

NOTE: INSIGHT Manager monitors the status of the IDA-2 Array Accelerator, and alerts you of changes.

Table 5-2
INSIGHT Manager IDA-2 Alerts

Alert	Status	Indication
Logical Drive Status Change	OK	The logical drive is in normal operation mode.
	Failed	More physical drives have failed than the fault tolerance mode of the logical drive can handle without data loss.
	Unconfigured	The logical drive is not configured. Run the COMPAQ EISA Configuration Utility.
	Recovering	The logical drive is using Interim Recovery Mode. In Interim Recovery Mode, at least one physical drive has failed, but the logical drive's fault tolerance mode lets the drive continue to operate without data loss.
	Rebuild Ready	The logical drive is ready for Automatic Data Recovery. The physical drive that failed has been replaced, but the logical drive is still operating in Interim Recovery Mode.
	Rebuilding	The logical drive is currently performing Automatic Data Recovery. During Automatic Data Recovery, fault tolerance algorithms restore data to the replacement drive.
	Wrong Drive	The wrong physical drive was replaced after a physical drive failure.
	Bad Connect	A physical drive is not responding. Run Diagnostics software.

continued

Table 5-2 Continued

Alert	Status	Indication
Logical Drive Status Change (*Continued*)	Overheating	The enclosure that contains the logical drive is overheating. The array is still functioning, but should be shut down. Applies to the Intelligent Array Expansion System only.
	Shutdown	The drive array enclosure that contains the logical drive has overheated. The logical drive is no longer functioning. Applies to the Intelligent Array Expansion System only.
	Unknown	The instrumentation agent does not recognize the Logical Drive Status Change.
Physical Drive Status Change	OK	The drive is functioning properly.
	Failed	The drive is no longer operating and should be replaced.
	Unknown	The instrumentation agent does not recognize the drive or that the physical drive status is unknown because the logical drive has failed.
Physical Drive Threshold Exceeded		When the drive is shipped, certain factory thresholds are set to monitor performance of the drives. If the monitored item exceeds the factory threshold, there may be a problem with one of the drives. Run Diagnostics software.
Array Accelerator Board Status Change	Enabled	Write cache operations are currently configured and enabled for at least one logical drive.
	Temporarily Disabled	Write cache operations have been temporarily disabled. View the Array Accelerator Board Error Code monitored item to determine why the write cache operations have been temporarily disabled.
	Permanently Disabled	Write cache operations have been permanently disabled. View the Array Accelerator Board Error Code monitored item to determine why the write cache operations have been disabled.

continued

Table 5-2 ***Continued***

Alert	Status	Indication
Array Accelerator Board Status Change (*Continued*)	Unavailable	An Array Accelerator board has not been installed in this system.
	Unknown	The instrumentation agent does not recognize the status of the Array Accelerator.
Array Accelerator Board Bad Data		At power-on, the battery packs were not sufficiently charged, and the board has not retained any data that may have been stored in the write cache. If no data was on the board, no data was lost. This message also appears if the Array Accelerator board is replaced with a new board that has discharged batteries. No data has been lost in this case, and posted writes are automatically enabled when the batteries reach full charge.
Array Accelerator Board Battery Status	OK	Indicates that a particular battery pack is fully charged.
	Failed	The battery pack is below the sufficient voltage level and has not recharged in 36 hours. The battery needs to be replaced. Contact your Authorized COMPAQ Computer Reseller or Service Provider.
	Charging	The battery power is less than 75 percent and the drive array controller is attempting to recharge the battery.
	Degraded	The battery is still operating, but one of the batteries in the pack has failed to recharge properly.
	Unknown	The instrumentation agent does not recognize battery status.

continued

If you receive the Physical Drive Threshold Exceeded alert, the drive is still operational, but has degraded beyond one or more of the factory preset thresholds.

Diagnostics software must report a failure before drives or other assemblies should be considered for replacement. Even if the drive exceeds certain preset thresholds, it may still be operational, as the thresholds are set to provide warnings of degraded performance before actual failures occur. In some cases, it may be more effective to continue to monitor the drive for further problems and schedule system maintenance when appropriate.

! **IMPORTANT:** For more information and assistance with drive replacement, contact your Authorized COMPAQ Computer Reseller or Service Provider or call the Compaq Customer Support Center at 1-800-345-1518 in North America. In Canada, call 1-800-263-5868. Outside the United States and Canada, contact the local Compaq Computer Corporation office from which you normally receive support.

INSIGHT Manager provides Automatic Data Collection and report generation to assist you in tracking trends that may indicate a need for system maintenance or an impending system failure. Automatic Data Collection provides historical information about your servers. When Automatic Data Collection is enabled for a server, system parameters are collected every 30 minutes. You can print periodic reports of this data to spot trends or help isolate a suspected problem. The report generation menu includes a report template for tracking hard drive information. You can customize these health reports to suit your needs.

For more detailed information, see the COMPAQ TechNote, *NetWare Server Management*.

Server Manager/R

Server Manager/R provides configuration management, alerting, and remote server diagnosis and management via an asynchronous connection. You can monitor local or remote server subsystems and receive alerts.
You can take control of the server and make changes using the Remote Console feature.

Server Manager/R comprises the following:

- COMPAQ 32-Bit Server Manager/R Board
- COMPAQ Server Manager/R software
  - Server Manager Support software
  - COMPAQ Server Manager Facility/R (SMF)
- COMPAQ Server Manager Collector/R (SMC)

! **IMPORTANT:** If you have installed a 32-Bit Server Manager/R board and an IDA-2 Controller in your server, be sure to use the COMPAQ Drive Array Instrumentation NLM *CPQDAIA.NLM* v1.11 or later. (*CPQDAIA.NLM* is on the Server Manager Support software diskette.) Versions prior to 1.11 may cause your server to ABEND in the distributed data guarding fault tolerance mode (RAID 5) with *CPQDAIA.NLM* v1.10.

Disk storage is one of the classes of information monitored by Server Manager/R. Classes comprise objects, and objects consist of one or more monitored items.

Server Manager/R displays icons for the disk class only if you have the corresponding hardware and proper support software installed on the monitored server. SMF displays the proper icons for drive arrays when the following conditions are met:

- Drives have the appropriate IDA-2 Controller firmware version.
- Drives are properly initialized with Diagnostics software.
- COMPAQ Server Manager/R Support software is installed on the monitored server.

NOTE: Enable all of the disk monitored items and use the default threshold values in Server Manager/R.

Physical drives are the individual drives that make up the logical drive. SMF shows a separate icon for each physical drive. This particular object icon has 16 monitored items. Serial numbers display for some, not all, drive arrays. If the model and drive firmware are listed as unavailable, you have improperly initialized the drive array, or the server contains a drive that the Server Manager board does not recognize.

NOTE: Use all of the factory default values for physical drives. Using the defaults allows you to compare the performance of the drives against factory-preset thresholds.

By monitoring the drive values, you can make decisions based on performance trends for scheduling preventive maintenance. For more information, see the COMPAQ TechNote, *NetWare Server Management*.

Three items should always be enabled: Seek Errors, Read/Write Recovery, and Functional Tests. By monitoring these items, you can take preventive action in maintaining system health. Over time, a hard drive will produce Seek and Read/Write Recovery Errors. This is a natural event with normal disk use over time. If a rapid increase in these values occurs, monitor the Functional Tests items more closely to determine if the hard drive is degrading. If the drive performance appears to be degrading, run Diagnostics software. When the Functional Tests value degrades to 80 percent, you should consider replacing the drive.

NOTE: Server Manager/R does not send alerts for Seek Errors unless you set a threshold and enable alerting. For more information, see the COMPAQ TechNote, *NetWare Server Management*, or see the Server Manager/R documentation.

Table 5-3 lists and explains key IDA-2 disk items monitored by the Server Manager board. This table lists *key* items, not *all* items monitored.

Table 5-3
Key IDA-2 Disk Items Monitored by Server Manager/R

Object Category	Item	Cause for Alerts	Comments
Disk/Logical	Status/ Failed Drive	Multiple causes	Logical drive status. Refer to online Help for details.
Disk/Physical	Functional Tests # 1 - #3	Wear from normal drive use over time	Warning alert; indicates drive performance has degraded.
	Used Reallocation Sectors	Controller attempted to write data addressed for unusable sectors	Warning alert; monitor increment rate. If rapid, run Diagnostics software.
	Recovered Read Errors/ Recovered Write Errors	Wear from normal drive use over time, corrected through physical drive retries	Warning alert; indicates drive may be developing problems.
	Seek Errors	Wear from normal drive use over time	Warning alert; indicates drive may be developing problems. Monitor Functional Tests.

NOTE: For more information and assistance with drive replacement, contact your local Authorized COMPAQ Computer Reseller or Service Provider, or call the Compaq Customer Support Center at 1-800-345-1518 in North America. In Canada, call 1-800-263-5868. Outside the United States and Canada, call the local Compaq Computer Corporation office from which you normally receive support.

The following table lists possible Server Manager/R alerts for the IDA-2 Controller. For more information, see the Server Manager/R documentation.

Table 5-4
IDA-2 Server Manager/R Alerts

Object Category	Error	Alert Message Number	Default Alert	Alert Severity	Indication
IDA-2 Cc Logzz	Status	025	On	Warning	Values other than 0 indicate the state of the logical drive. See the online Help for descriptions of the states corresponding to these values.
	Failed Drv Cnt	026	On	Critical	Number of physical drives that have failed in the logical drive.
	Spare Status	027	Off	Warning	Values other than 33 indicate the state of the online spare drive. See the online Help for descriptions of the states corresponding to these values.
IDA-2 Cc Accel	Accel Alert	060	On	Warning	Posted write operations are disabled.
	Accel Rd Err	061	Off	Warning	Number of times that read memory parity errors were detected while reading from the Array Accelerator.
	Accel Wrt Err	062	Off	Warning	Number of times that write memory parity errors were detected while writing to the Array Accelerator.
IDA-2 CC Phys	Reference Time	028	Off	Status	Number of minutes a physical drive has been spinning since you initialized the drive for monitoring.
	Rd Err - Hard	029	Off	Warning	Number of read errors that could not be recovered by a drive's ECC algorithm or through retries.

continued

Table 5-4 *continued*

Object Category	Error	Alert Message Number	Default Alert	Alert Severity	Indication
IDA-2 CC Phys (*Continued*)	Rd Err - Recovrd	030	Off	Warning	Number of read errors corrected through physical drive retries.
	Wrt Err - Hard	031	Off	Warning	Number of write errors that could not be recovered by a physical drive.
	Wrt Err - Recovrd	032	Off	Warning	Number of write errors corrected through physical drive retries or recovered by a physical drive.
	Seek Errors	033	Off	Warning	Number of seek errors detected by a physical drive.
	Spin-up Time	034	On	Warning	Time it takes, in tenths of a second, for a physical drive to spin up to full speed.
	Functional Tst*x*	035 - 038	On	Warning	Percentage value representing how a drive currently works as compared with how it worked when new.
	Realloc Used	039	On	Warning	Number of sectors of the reallocation area used.
	DRQ Timeout	040	Off	Warning	Number of times that a physical drive requested data after a sector transfer operation had completed.
	Other Timeout	041	On	Critical	Number of times that a physical drive did not respond with an interrupt within a controller-defined period of time after a command had been issued.

continued

Table 5-4 *continued*

Object Category	Error	Alert Message Number	Default Alert	Alert Severity	Indication
IDA-2 CC Phys (*Continued*)	Spin-up Retries	042	Off	Warning	Number of times a physical drive had to retry to spin up before achieving operating speed.
	Recovry Fail - Rd	043	On	Warning	Whether read errors occurred during Automatic Data Recovery from this physical drive to another drive.
	Recovry Fail - Wt	044	On	Warning	Whether write errors occurred during Automatic Data Recovery from another drive to this physical drive.
	Format Error	045	On	Warning	Number of times a Format command failed during the controller's attempt to remap a bad sector.
	Self Test Error	046	On	Warning	Number of times a drive failed due to the failure of the drive Self Test command.
	Drive Not Ready	047	On	Warning	Number of times a drive failed because it never became ready after the Spin Up command was issued.
	Realloc Abort	048	On	Warning	Number of times a drive failed because an error occurred when the controller was reallocating a bad sector.
	IRQ De-glitch	049	Off	Warning	Number of times that spurious drive interrupts were detected and filtered out by the IDA-2 Controller firmware.

Diagnostics software must report a failure before drives or other assemblies should be considered for replacement. Even if the drive exceeds certain preset thresholds, it may still be operational, as the thresholds are set to provide warnings of degraded performance before actual failures occur. In some cases, it may be more effective to continue to monitor the drive for further problems and schedule system maintenance when appropriate.

! **IMPORTANT:** For more information and assistance with drive replacement, contact your Authorized COMPAQ Computer Reseller or Service Provider or call the Compaq Customer Support Center at 1-800-345-1518 in North America. In Canada, call 1-800-263-5868. Outside the United States and Canada, contact the local Compaq Computer Corporation office from which you normally receive support.

Drive Array - Advanced Diagnostics

Drive Array - Advanced Diagnostics (DAAD) is a DOS-based tool designed to run on all COMPAQ products that contain a COMPAQ Intelligent Drive Array Controller (IDA), COMPAQ Intelligent Drive Array Controller-2 (IDA-2), or COMPAQ Intelligent Drive Array Expansion Controller. The two main functions of DAAD are to collect all possible information about the array controllers in the system and to offer a list of all detected problems.

DAAD comes standard with COMPAQ PCs containing the IDA-2 Controller and with the IDA-2 Controller option kit.

DAAD works by issuing multiple commands to the array controllers to determine if a problem exists. This data can then be saved to a file and, for severe situations, can be sent to an Authorized COMPAQ Service Provider or directly to Compaq for analysis. In most cases, DAAD will provide enough information to initiate problem resolution immediately.

DAAD does not write to the drives or destroy data. It neither changes nor removes configuration information.

Data gathered by DAAD includes:

- Controller information
- ROM versions (controller and drives)
- System data (ASCII date of current system ROM, current time, microprocessor type, extended memory size, EISA IDs for each controller)
- Locations of all physical drives
- Failed drive information
- Spare drive information
- Monitor and performance data

Run DAAD from the DOS prompt.

Conclusion

Effective fault prevention and management requires both intelligent hardware and the appropriate server management tools. The IDA-2 Controller incorporates many intelligent self-diagnostic features to collect operational and fault information. It monitors 15 different parameters and is capable of conveying the information it collects to COMPAQ INSIGHT Manager and COMPAQ Server Manager/R server management tools.

COMPAQ INSIGHT Manager provides configuration management and alerting for multiple drive parameters. It operates on the network and can monitor multiple servers simultaneously. COMPAQ Server Manager/R also provides similar alerting and management for the IDA-2 Controller . Unlike INSIGHT Manager, however, Server Manager/R operates remotely via an asynchronous communications link. In addition, it provides remote diagnostics and remote console operations.