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Prepared by Compaq
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Compaq Advanced Network Error Correction Support in a Microsoft® Windows NT® Server Environment

This document discusses the Compaq software-based solution designed to ensure network availability in a Microsoft Windows NT environment.

This software-based solution is supported on Windows NT 3.51 and 4.0.

This document also provides information on network configuration, network fault protection, and network monitoring. The intended audience for this White Paper is system engineers and network administrators who install, configure, and maintain Compaq server networks in a Microsoft Windows NT Server environment.

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Compaq Advanced Network Error Correction Support in a Microsoft Windows NT Server Environment

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OVERVIEW OF NETWORK AVAILABILITY SOLUTION FROM COMPAQ

Compaq has implemented a two-part, software-based solution to ensure network availability on Compaq server networks. The first part of the solution is provided by the Compaq NetFlex-3 device driver, which includes built-in network fault protection features, such as recovery from hardware failure events, network status events, and errors.

The second part of the solution is provided by the Compaq Advanced Network Control Utility. This utility allows you to designate a secondary controller that acts as a standby and assumes network responsibilities if the primary controller fails. This secondary controller is idle until a failure occurs with the primary controller.

Figure 1 illustrates how the NetFlex-3 driver and the Advanced Network Control Utility provide network fault protection in Windows NT.

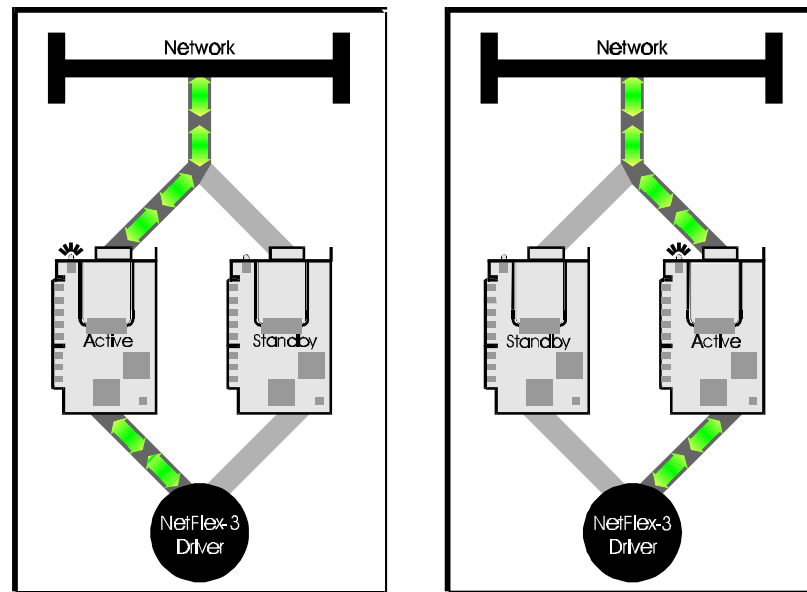


Figure 1. Controller pair illustration “active primary/idle standby” and “idle primary/active standby” after a NetFlex-3 switchover occurs.

Advanced Network Control Terminology

Table 1 lists the terms used to describe the main features of the Advanced Network Control Utility.

NOTE: This White Paper uses the words “controller” and “adapter” interchangeably.

TABLE 1
ADVANCED NETWORK CONTROL UTILITY
STANDARD TERM AND SCREEN DESCRIPTIONS

Standard Term	Description of Term
Controller Pair	Two Compaq ThunderLAN-based network controllers such as a Compaq NetFlex-3 Controller or a Compaq Netelligent Controller. The controllers are configured so that network connectivity is maintained, even if it loses a connection or a controller fails. The controller pair is installed with one NetFlex-3 driver instance, which means they are recognized by the network as only one controller.
Primary Controller	The network interface controller initially configured as the active network controller in a controller pair.
Secondary Controller	The network interface controller initially designated as the standby network controller in a controller pair.
Active Controller	The currently operational network interface controller in a controller pair.
Standby Controller	The non-active network interface controller in a controller pair.
Operating Modes	A controller pair can be in one of three operating modes: Manual Mode, Switch on Fail Mode, and Smart Switch Mode. These modes are described later in this document.
Statistics Tab	Provides controller information that is updated every three seconds once your installation and configuration are complete. This information is viewable under the Properties button.
Hardware Information Tab	Provides physical hardware information about the controller, such as Bus Number, Bus Type, Slot Number, and so on. This information is accessible under the Properties button.
Settings Tab	Provides information about the media speed, media connectors, network address, duplex setting, and so on – along with the ability to modify these settings. This tab also allows you to reset the adapter. This information is accessible under the Properties button.
Adapter States	Provides viewing capability of controllers in one of five states via the Advanced Network Control Utility. The appearance of the icon in the Advanced Network Control Utility indicates the current state of the controller. This information is accessible under the Properties button. Each adapter state is discussed in more detail in the “Advanced Network Control Utility” section.

Advanced Network Control Utility

The Advanced Network Control Utility extends and enhances the built-in recovery features of the Compaq NetFlex-3 device driver in a Windows NT 3.51 and later environment.

Network Fault Protection

When you configure a controller pair on a Compaq server, you are providing an added level of network fault tolerance protection. A single NetFlex-3 driver instance controls both the primary and secondary controllers when you install the Advance Network Control Utility. When the driver detects failures on the primary controller and the secondary controller has a valid link, network traffic is switched to the secondary controller. The default operating mode is *Switch on Fail*. The switch occurs without any interruption to the operating system or network services.

NOTE: The operating modes of the Advanced Network Control Utility are discussed in more detail on page 8 of this document.

The Windows NT operating system views the controller pair as a single controller. In a controller pair, if a primary network controller fails the Media Access Control (MAC) address of the primary controller transfers to the secondary controller. At that time, the driver switches the MAC address switches from the primary controller to the secondary controller. The MAC address is a unique address assigned to a particular network controller. The MAC address identifies that network controller on the network. The secondary controller automatically switches to the active controller and takes control of the traffic on the network. The entire process occurs without the intervention of network protocols or operating system applications.

You can further increase the network fault protection provided with the NetFlex-3 driver and the Advanced Network Control Utility by adding another hub to the configuration. You can accomplish this by connecting each controller in the controller pair to a separate hub as illustrated in Figure 2.

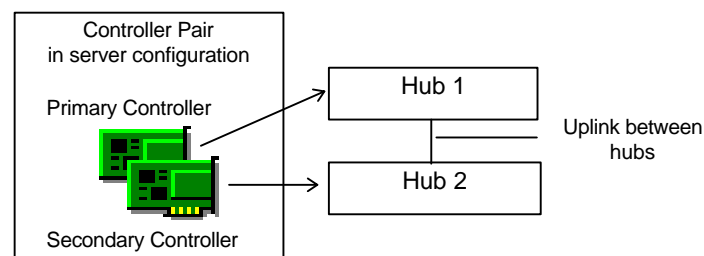


Figure 2. Primary controller and secondary controller connected to two separate network hubs with the hubs linked together.

The two hubs must be linked together for the Advanced Network Control Utility to provide switchover fault protection to the configuration. The controller pair can continue operation through hub power loss or hub failure of the primary controller.

The Advanced Network Control Utility detects, corrects, and reports failures from:

- A network controller failing or being unplugged from the hub
- Loose wire connections or frayed wires
- Most invalid settings or an incompatible controller and hub combinations

NOTE: Refer to the “Other Troubleshooting Tips” section at the end of this document for several mismatch and undetected connections.

When the NetFlex-3 driver detects a problem, it generates an event which is reported in the Windows NT System Event Log. The “Network Status Change and Error Reporting” section of this document provides more information regarding error reporting.

Compaq Insight Manager also receives alert messages under certain conditions. They are:

- During controller switch overs
- During controller failures
- Reporting network interface controller (NIC) “OK” status

When Insight Manger issues an alert condition about the controller, use the Windows NT Event Viewer to identify and resolve the issues that are reported.

Network Monitoring

The Advanced Network Control Utility gives you the ability to monitor your network controller configuration. If necessary, you can easily modify the software installation with this utility. The utility allows you to:

- Reconfigure the way the controller is installed
- Install and uninstall a controller pair
- Install and uninstall a stand-alone controller

The Advanced Network Control Utility also tracks and displays Adapter Statistics, Hardware Information, and Adapter Settings.

The Advanced Network Control Utility is accessible from the Windows NT Control Panel and provides functionality and monitoring information through the NetFlex-3 device driver. This means that it does not rely on any other applications and it is protocol independent.

The Advanced Network Control Utility allows you to install, uninstall, configure, and review status information for all monitored Compaq NICs on a network segment.

This utility allows you to:

- Set up controller pairs, as well as stand-alone NetFlex-3 and Netelligent Controllers listed in the “Hardware and Software Support Requirements” section
- Monitor status and configure (stand-alone and controller pair(s)) NetFlex-3 Controllers and Netelligent Controllers
- Reset a controller and switch a controller to an active controller setting instantaneously
- Change the controller pair(s) operating mode and primary controller settings instantaneously

Controller Pairing

Creating a controller pair with the Advanced Network Control Utility is easy and you can immediately view the results in the utility. A controller pair consists of two Compaq NetFlex-3 or Netelligent Controllers. The paired controller configuration provides connectivity over the network so that the network maintains operation even if a controller connection is lost or if one of the controllers fails.

Although a controller pair configuration is installed and monitored with one instance of the NetFlex-3 driver, the driver is always aware that there are two physical controllers. One controller is active and the other non-active controller is a backup (standby). The NetFlex-3 driver controls both controllers and can automatically switch traffic if one controller fails. The operating system views the controller pair as a single controller and the switch over from one physical controller to the other is completely transparent to the operating system and any application programs.

Each controller pair consists of a primary and a secondary physical controller. Only one of these controllers can be active at a time. When the system starts up the driver tries to direct network traffic over to the primary controller, so the primary controller is usually the *active* controller. Should the primary controller fail or lose connection, the secondary or *standby* controller can become active depending on the operating mode of the controller pair.

To create a controller pair you must use a combination of two of the following NetFlex-3 Controllers and/or Netelligent Controllers:

- Compaq NetFlex-3/E Controller
- Compaq NetFlex-3/P Controller
- Compaq Netelligent 10/100TX PCI UTP Controller
- Compaq Netelligent 10T PCI UTP Controller
- Compaq Netelligent Integrated 10/100 TX UTP Controller
- Compaq Netelligent Dual 10/100 TX PCI UTP Controller

NOTE: The pair *must* consist of two PCI or two EISA controllers in the same server. You *cannot* merge a PCI and EISA controller to form a controller pair.

Once you have physically installed the controllers in the server you can merge them to make a controller pair with the Advanced Network Control Utility. If you select the *Properties* button on the Advanced Network Control Utility screen, you can verify your settings on the Redundancy Control Tab by switching the settings.

NOTE: If you are pairing controllers with different media speeds, configure the controller with the *faster* speed as the primary (active) controller.

Figure 3 is an example of a configured controller pair.

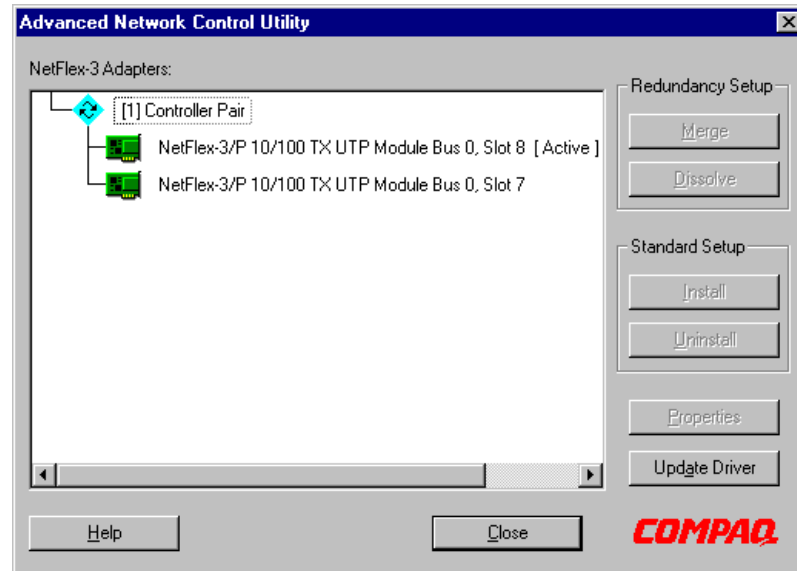


Figure 3. Illustration of a controller pair.

Notice that the controller pair icon has a [1] next to it. This number indicates the instance of the NetFlex-3 driver. If the screen showed more than one controller pair, each pair would have a different NetFlex-3 driver instance number.

Controller Pair Operating Modes

A controller pair can be in one of three operating modes:

In **Manual Mode** the driver does not switch controllers if the active controller fails. The only way to switch controllers is to do so manually using the Advanced Network Control Utility by selecting the *Switch Now* button.

In **Switch on Fail Mode** the driver switches controllers whenever the active controller fails or when there is cable fault.

In **Smart Switch Mode**, like Switch on Fail mode, the driver switches controllers whenever the active controller fails. However, if a previously failed primary controller becomes operational again, the NetFlex-3 driver switches control back. Compaq recommends this mode in a mixed-media speed environment

Figure 4 illustrates the operating mode options included under the *Properties* button. The Redundancy Controls screen is accessible once you have merged two controllers. You can modify this setting to meet your networking requirements. The *Switch on Fail* mode is set by default during installation.

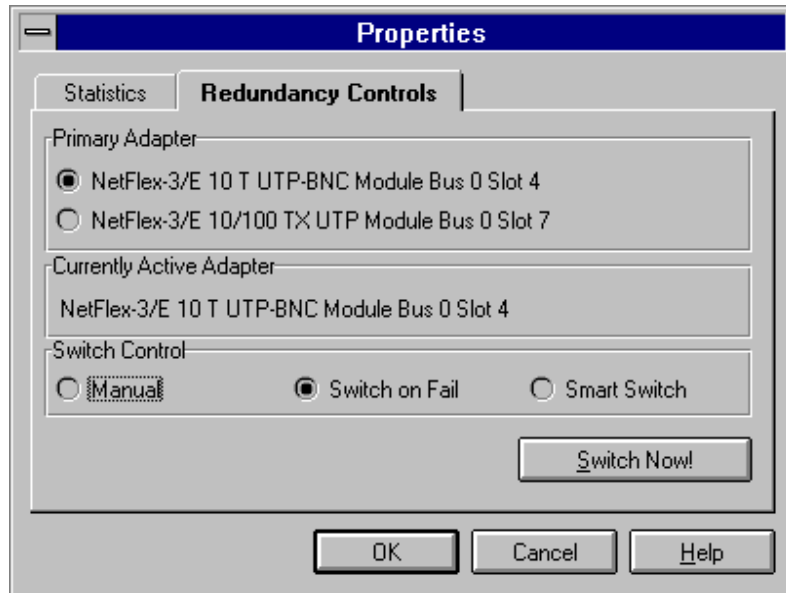


Figure 4. Illustration of the controller pair redundancy switch modes.

Stand-Alone Controllers

The Advanced Network Control Utility also includes install and uninstall features on stand-alone Compaq network controllers. The Advanced Network Control Utility allows you to install another instance of the NetFlex-3 driver for each uninstalled controller in a server. Once you install the driver and restart the server, the utility begins actively monitoring the controller. As with a controller pair, you can view the Windows NT Event Log Viewer and Compaq Insight Manager Alarms for error detection information. Paired controllers and stand-alone controllers appear in the same window view. The icon next to the controller indicates the current state of the controller.

Figure 5 illustrates a stand-alone controller and a controller pair in the Advanced Network Control Utility view window.

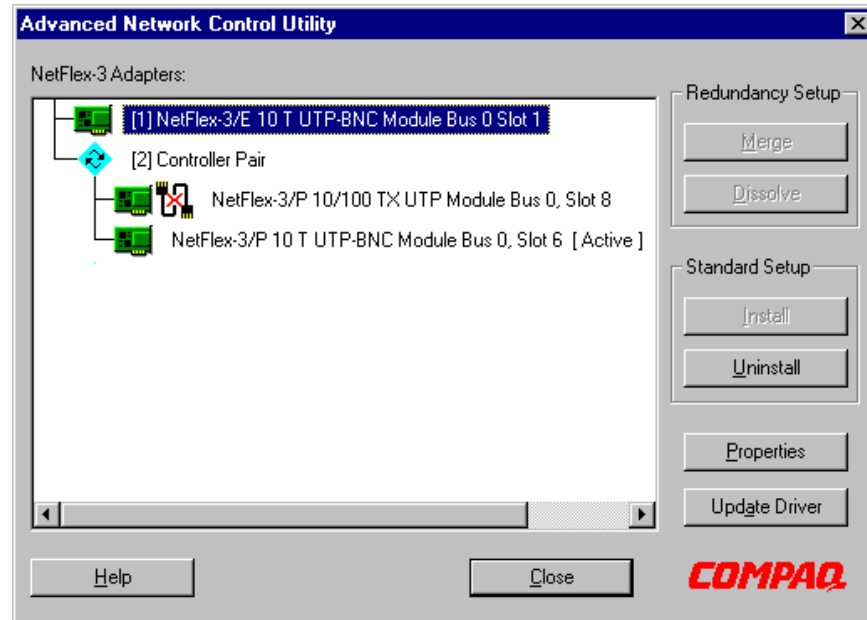


Figure 5. Illustration of an active stand-alone controller in slot 1 of the server.

Adapter States

You can determine the current state of an adapter by the appearance of the icon associated with a particular adapter. For example:



When the adapter appears green on the screen it indicates the adapter status is “OK.” The driver is installed and loaded. To uninstall the adapter, select the *Remove* button.



When the adapter appears gray on the screen it indicates the adapter is “Uninstalled” and the driver is not loaded. To install the driver, select the *Install* button.



Yellow indicates the adapter is “Unknown.” The adapter is installed, but the driver is not loaded. If you installed the adapter without installing the driver, the adapter remains in this state until the server is restarted. However, if the adapter is in this state after the system is restarted, the driver might not have loaded properly, or the Advanced Network Control Utility is unable to communicate with the driver.



A green adapter and broken cable indicates there is a “Wire Fault” detected. The adapter is installed in the registry and the driver is loaded, but the broken cable indicator means the cable might be unplugged, loose, broken, or the hub might be defective. If you see the broken cable icon next to the adapter, recheck the network connections and make sure the hub is working properly. Once the connection is restored the icon should disappear in a few seconds, but it can take up to one minute in some cases.



Red indicates the adapter has “Failed.” The adapter is installed and the driver is loaded. The driver is reporting a hardware problem with the adapter. This indicates a serious problem. Contact your service provider.

Information Tabs

Figure 6 illustrates one of the three information tabs that display statistical data, hardware information, and media settings.

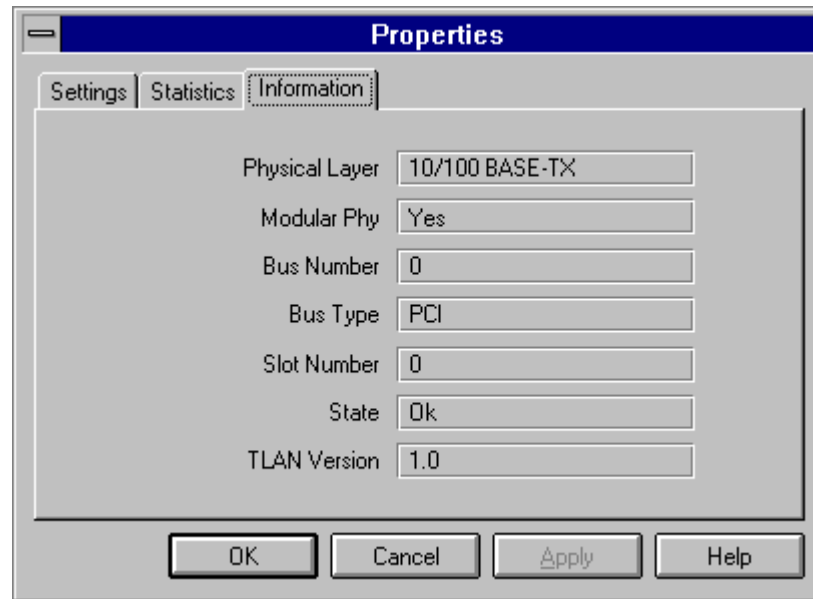


Figure 6. Example of the physical information available for a selected controller.

This screen is displayed by selecting a particular controller on the Advanced Network Control Utility screen and then selecting the *Properties* button.

Hardware and Software Support Requirements

The Advanced Network Control Utility provides support on Compaq servers in both EISA and PCI environments. However, the following hardware and software requirements must be met to use this utility:

Software Requirements

- Windows NT 3.51 or later
- Compaq Support Software for Microsoft Windows NT 3.51 (SSD), Version 1.18 or later to install:
 - NetFlex-3 device driver
 - Compaq Systems Management device driver
 - Advanced Network Control Utility

Hardware Requirements

- Compaq ProLiant or ProSignia Servers
- 10Base-T, 100Base-TX, 100Base-FX, or 100VG-AnyLAN topology with the following supported controllers:
 - Compaq NetFlex-3/P Controller
 - Compaq NetFlex-3/E Controller

These modular controllers may be configured with the following option modules:

- 10Base-T UTP/BNC Module
- 100VG-AnyLAN UTP Module
- 10/100Base-TX UTP Module
- 100Base-FX Module

Also includes support for the following Netelligent non-modular controllers:

- Compaq Netelligent 10/100TX PCI UTP Controller
 - Compaq Netelligent 10 T PCI UTP Controller
 - Compaq Netelligent Integrated 10/100 TX PCI UTP Controller
 - Compaq Netelligent Dual 10/100 TX PCI UTP Controller
- Controller pairs must be same architecture (EISA and EISA, or PCI and PCI)

Hardware and Software Support Limitations

The Advanced Network Control Utility can provide monitoring capabilities to more than one network segment in a Compaq server. However, each segment requires a separate instance of the NetFlex-3 driver for each controller pair or stand-alone controller.

The Advanced Network Control Utility does not provide support for:

- Compaq servers using NetFlex-2 Controllers
- Compaq ProSignia 300 and ProSignia 500 Servers using the Integrated NetFlex-L ENET NIC
- Token Ring networks

Examples of Configurations Monitored in the Advanced Network Control Utility

This section contains examples of several types of network configurations that can be monitored by the Advanced Network Configuration Utility. The examples demonstrate the fault tolerance capabilities built into the NetFlex-3 driver and the configuration and monitoring capabilities of the Advanced Network Configuration Utility.

The following types of configurations are illustrated:

- Controller pair configuration with one hub
- Controller pair configuration with two hubs
- Controller pair configuration with two stand-alone controllers on a network

Your network(s) configurations are not limited to these examples. You may include many combinations of controller pairs and stand-alone controllers, depending on the number of slots available on your system.

Controller Pair Configuration with One Hub

The Advanced Network Control Utility monitors the network, provides statistical data, and detects and transmits error information if a problem arises. The configuration illustrated in Figure 7 provides the security of a redundant secondary controller connected to the network with one hub.

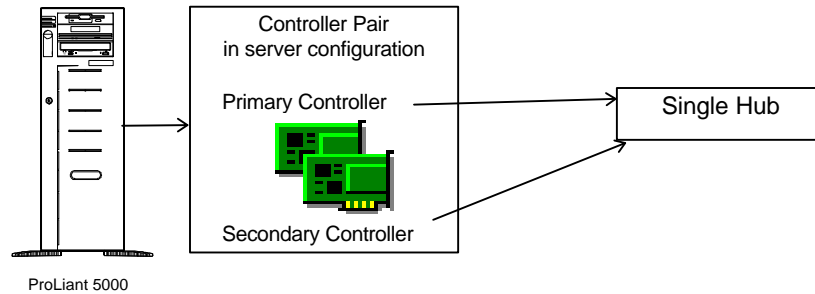


Figure 7. Controller pair configured with a single hub on a network segment.

If the primary controller fails or is disconnected, the NetFlex-3 driver with the support of the Advanced Network Control Utility switches the secondary controller to active status. The NetFlex-3 driver performs the switchover independent of network protocols and applications. The Advanced Network Control Utility shows status changes that occur to the controller pair. This is apparent when the controller pair icon changes to indicate a break in connectivity after a controller switchover occurs.

Next, the NetFlex-3 driver reports a status change in the Windows NT System Event Log and issues an alert to Insight Manager. The Windows NT Event Viewer displays a log listing all events which includes details reported by the driver.

The Redundant Controller Tab in the Advanced Network Control Utility allows you to change the Switch Controls. This feature of the utility is helpful when you are investigating a problem or verifying the controller pair connection on the network. Refer to the “Controller Pair Operating Mode” section of this document for an explanation of the Switch Controls and see the “Network Status and Error Reporting” section for help with troubleshooting.

Figure 8 illustrates the configuration as it appears in the Advanced Network Control Utility.

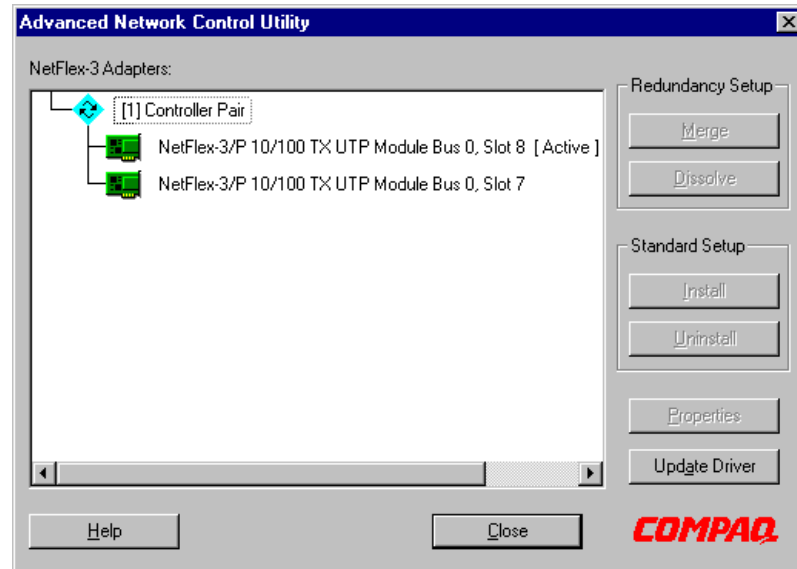


Figure 8. Controller pair with one active and one redundant controller as described in the configuration.

The other examples in this section build on the configuration in this example.

Controller Pair Configuration with Two Hubs

This configuration provides your network with the security of a redundant secondary controller and the support of two hubs.

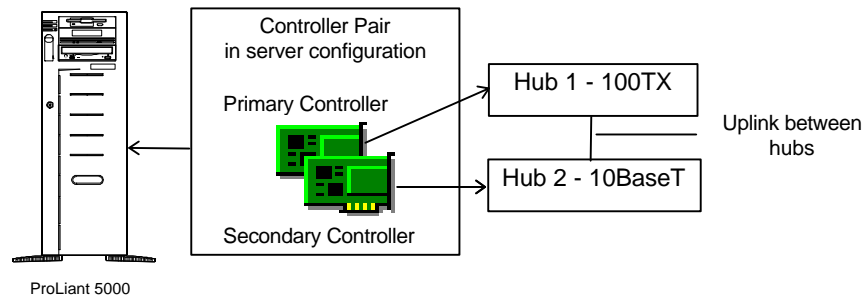


Figure 9. Controller pair connected and linked to two hubs on a network segment.

This configuration not only provides your network with the security of a secondary controller, but each controller is connected to a different hub. In this configuration both hubs must reside on the same network segment and must be linked together to provide redundant support. The second hub adds another level of fault tolerance. Should Hub 1 supporting the primary controller lose connection; the secondary controller on Hub 2 switches over to the active status. Notice that the configuration in Figure 9 includes hubs capable of different media speeds. This flexibility in the configuration allows you to provide protection without idling high-speed media devices.

The Windows NT operating system still views this controller pair as one controller. The system attempts to use the designated primary controller when it starts up; the secondary controller remains idle until the primary controller fails or is disconnected.

The next configuration adds more variation to the monitoring capabilities provided by the NetFlex-3 driver and the Advanced Network Control Utility.

Controller Pair Configuration and Two Stand-Alone Controllers on the Network

This server configuration provides connectivity to three separate networks. It includes a controller pair and also two independent network controllers. The Advanced Network Control Utility monitors all of these items.

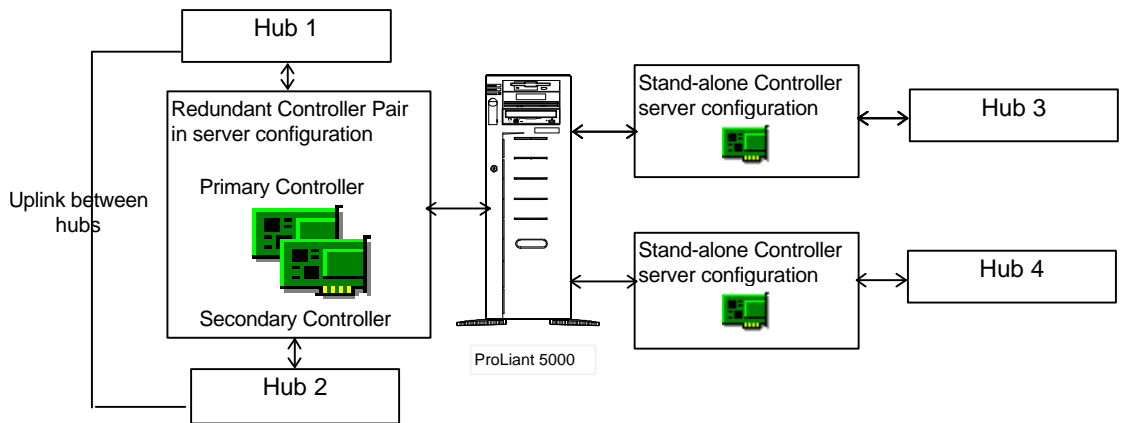


Figure 10. A redundant controller pair linked to two hubs on one network segment and two stand-alone controllers each supporting two different networks.

Figure 11 illustrates how this configuration appears in the Advanced Network Control Utility. Notice that the controller pair and the each stand-alone controller display a number bracketed [1], [2], or [3] before the controller name. Each number indicates a different instance of the NetFlex-3 device driver for the controller pair and each of the stand-alone controllers.

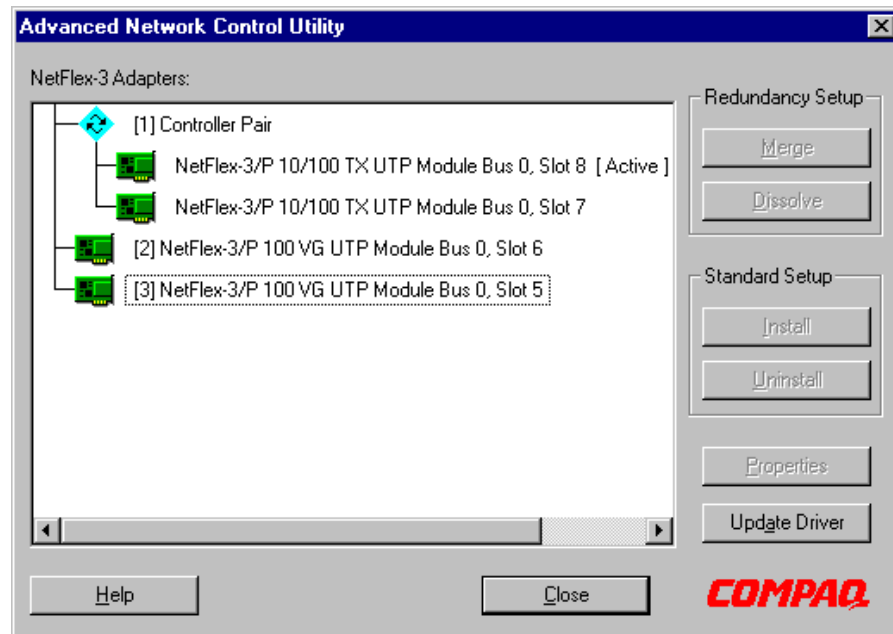


Figure 11. Controller pair and stand-alone controllers in a server configuration.

The controller pair on this server provides high availability fault protection to a designated network with redundant hubs and controllers. On this server, the network with the controller pair is performing a mission-critical operation and requires the added level of fault protection.

This server also provides connectivity for two other smaller less-critical network segments with stand-alone controllers. The Advanced Network Control Utility includes the ability to monitor stand-alone controllers in the server that do not require the protection of a controller pair.

Configuration Considerations

Consider the following items before configuring your Compaq server with the Advanced Network Control Utility:

- You cannot mix PCI and EISA controllers to make a controller pair.
- You do not have to comprise the controller pair with two controllers of the same media settings or network topologies. For example, a primary controller can be running in 100-TX full-duplex mode with a Compaq Netelligent Controller and the secondary controller can be set for 10Base-T half-duplex mode. However, the two controllers must be on the same network segment.
- You can include two linked hubs in your controller pair installation, which adds another level of fault tolerance to mission-critical network configurations.
- You can configure the server with many combination of controller pair(s) and stand-alone controller(s). You are only limited by the number of slots in the server.

Configuration Verification

After each configuration update that requires you to restart the server follow these steps to verify that the network controllers are active and functioning properly:

1. Select the *Manual Switch Mode*. Check the operation of each controller after installation.
2. Select the *Switch Now* button. Operation should switch to the secondary controller within a few seconds.
3. Select the *Switch Now* button to return operation to the primary controller. Operation should switch back to the primary controller within a few seconds.
4. Select the desired operation mode after you have verified the configuration.

Using the Advanced Network Control Utility

The information included in this section presumes that you have performed the following steps:

1. Physically installed the Compaq NetFlex-3 and/or Netelligent Controller in the server
2. Physically connected the controllers to a hub or hubs
3. Installed/updated the server with the Compaq SSD for Windows NT 3.51, Version 1.18 or later. To ensure that all the appropriate drivers are installed, Compaq recommends selecting the *Express Setup* option.

Once you complete the above steps, the Advanced Network Control Utility icon *Compaq Net* is loaded in the Windows NT Control Panel. The topics that follow outline the steps necessary to configure and monitor the network controllers.

Merging Two Controllers to Create a Controller Pair

Merging two controllers with the Advanced Network Control Utility creates a controller pair. The steps that follow outline how to merge network controllers into controller pairs.

1. Select the *Control Panel* icon from the Windows NT Main Program Group.
2. Select the *Compaq Net* icon to launch the Advanced Network Control Utility and view the installed controllers in the utility.

NOTE: If the two controllers that you want to merge into a pair are both currently installed, you must first remove a NetFlex-3 driver instance for one of them. Refer to "Uninstalling a Standard Controller as a Stand-Alone" procedures later in this section.

3. Highlight the two Compaq NetFlex-3 or Compaq Netelligent Controllers you want to merge as a pair.
4. Select the *Merge* button under the "Redundancy Setup" option.

NOTE: If this is the first installation occurrence of the NetFlex-3 driver or your current NetFlex-3 driver is outdated, you will be prompted for a new NetFlex-3 driver file.

To update the driver, insert Diskette 1 of the Compaq SSD for Windows NT, Version 1.18 and type the following path information:

A:\NETWETFLX3

When the files complete copying, a status box displays indicating that the merge request is complete. The configuration is immediately written to the registry. You must shutdown and restart the server for the controller pair to operate.

The two merged controllers are represented as a controller pair with the primary controller (listed first) as the active controller. Refer to the "Configuration Verification" section of this document to help you verify the installation.

Dissolving a Controller Pair

If you no longer want to pair two controllers together, you must uninstall the NetFlex-3 driver instance for the controller pair. The separation process is referred to as *Dissolving*. To dissolve network controllers that are currently configured as a controller pair, follow these steps:

1. Select the *Control Panel* icon from the Main Program Group of the Windows NT Program Manager.
2. Select the *Compaq Net* icon to launch the Advanced Network Control Utility.
3. Highlight the *Controller Pair* that you want to dissolve and select the *Dissolve* button.

A status box displays indicating the Dissolve request is complete. The changed configuration is immediately written to the registry. You must restart the server for the changes to take effect.

You can now install the secondary controller as a stand-alone controller. Refer to the procedures in the next section, "Installing and Uninstalling a Standard Controller as Stand-Alone."

Installing a Standard Controller as Stand-Alone

Each NetFlex-3 or Netelligent network controller that you install as stand-alone must have a separate NetFlex-3 driver instance. To install network controllers that are configured with a standard controller set up, follow these steps:

1. Select the *Control Panel* icon from the Main Program Group of the Windows NT Program Manager.
2. Select the *Compaq Net* icon to launch the Advanced Network Control Utility.
3. Highlight the controller that you want to install and select the *Install* button. A message status box displays indicating the request is complete.
4. Select the *Close* button when finished.

NOTE: Depending on the protocol you are using, Windows NT might ask you to enter protocol information. If necessary, enter the appropriate information and select *OK* to exit the Windows NT Network Information screen.

The changed configuration is immediately written to the registry. You must restart the server for the changes to take effect.

Uninstalling a Standard Controller as Stand-Alone

To uninstall network controllers that are configured as a standard controller set up, follow these steps:

1. Select the *Control Panel* icon from the Main Program Group of the Windows NT Program Manager.
2. Select the *Compaq Net* icon to launch the Advanced Network Control Utility.



IMPORTANT: When you uninstall a network controller, all protocol-related information for the controller you are disconnecting is lost.

If you plan on reinstalling the same controller at a later time, record all pertinent protocol information such as IP address, subnet mask, SNMP settings, and so on. You will be requested to enter the protocol information again at the time of a new install.

3. Highlight the controller that you want to uninstall and select the *Uninstall* button. A message status box displays indicating the request is complete.

The changed configuration is immediately written to the registry. You must restart the server for the changes to take effect.

Controller Switch-Over Events

The Compaq ThunderLAN (TLAN)-based network controllers (Compaq NetFlex-3 and Compaq Netelligent Controllers) and associated device driver (NETFLX3.SYS) have internal diagnostic and analysis capabilities that detect and report errors. These features provide a fault detection and recovery mechanism to increase network availability.

There are three known conditions which initiate a switch-over event: Cable Failure, Adapter Check - Hardware Problems (TLAN), and a User-Initiated Switch.

Cable Failure

This occurs when the network controller is unable to transmit data across the network. This may be due to the following conditions:

- Wire Fault/Link Failure - Cabling which is unplugged, a bad cable, or a non-functioning HUB
- Controller not transmitting - The controller is in a state where it does not send data

NOTE: This error condition may cause an Adapter Check (see, "Adapter Check - Hardware Problems (TLAN)", below).

If any of these conditions occur, the NetFlex-3 driver will fail the active controller and start the standby controller.

Cable failures cannot always be detected. See the section, "Failed or Invalid Configuration Conditions That Cannot Be Detected."

Adapter Check - Hardware Problems (TLAN)

If the network controller experiences a hardware error, the controller issues an interrupt to the NetFlex-3 driver to restart the controller. When a controller pair exists and a controller experiences an adapter check, the NetFlex-3 driver fails the active controller and switches over to the standby controller. The driver then tries to restart the controller. If the driver successfully restarts the controller and if the Switch Controller is set to Smart Switch, the NetFlex-3 driver switches back to make the primary controller active. If the Switch Controller is set to Switch on Fail, the NetFlex-3 driver will NOT switch over to the primary controller unless the standby controller fails.

User-Initiated Switch

An administrator can also initiate the switching of network traffic from the active controller to the standby controller.

Failed or Invalid Configuration Conditions That Cannot Be Detected

Duplex Mismatch

A Duplex Mismatch occurs when the switch is configured for full-duplex and the network controller is set to half-duplex, or visa versa. The network driver will not be able to detect this condition and may or may not be able to transmit data efficiently.

Link Failure Using 10Base-T Module at Full-Duplex

A Link Failure will not be reported when using the Compaq NetFlex-3 10Base-T module in full-duplex mode. This inability to detect a cabling problem only occurs with the 10Base-T module in full-duplex mode. The 100Base-TX module will detect a cable fault, even if it is configured for 10Base-T operation.

Network Status Change and Error Reporting

All Compaq network device drivers provide integrated error recovery that allows the device drivers to detect failure events and recover from them. The drivers can reset the NIC and continue running, usually without noticeable disturbance to normal operation. The drivers report status and recovery information to the Windows NT System Event Log and to Insight Manager.

The sections that follow provide troubleshooting information to help understand and correct, if necessary, network status changes reported by the NetFlex-3 driver and the Advanced Network Control Utility.

Insight Manager 3.0 Alarms

Insight Manager 3.0 reports status-related alarms if certain controller conditions arise. Insight Manager notifies you when a monitored item changes. For instance, when certain controller conditions occur a status change alarm is generated and stored in the Alarm Log. Insight Manager also generates a message or "trap" that describes the status change. Table 2 identifies the alarms generated, and trap descriptions.

TABLE 2
INSIGHT MANAGER 3.0 ALARMS AND TRAPS FOR
CONTROLLER PAIR ERRORS

Alarm Generated	Trap Description
Network Interface Card Failed	The status of a controller has changed to failed.
Network Interface Card OK	The status of the controller has changed to the OK condition.
NIC Switchover Occurred	The configured redundant controller became the active NIC.

If you receive any of these messages in Insight Manager, consult the Windows NT System Event Log and the Advanced Network Control Utility for additional information on the reported event.

Windows NT Event Viewer

The Windows NT Event Viewer, in the Administrative Tools Program Group, displays the Event log. This tool displays status information and errors detected by the NetFlex-3 driver. The description provided in the Event Detail screen can help you monitor and troubleshoot problems reported about NetFlex-3 controllers.

Figure 12 provides an example of the events reported in the Event Viewer.

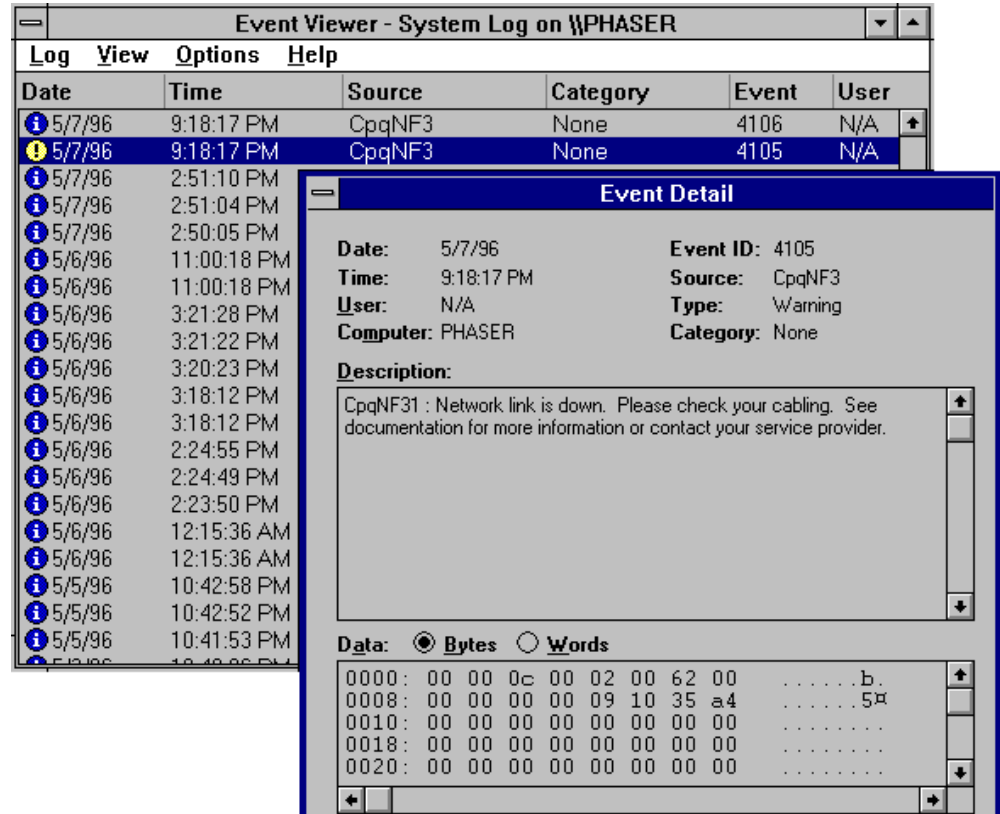


Figure 12. Example of the Windows NT Event Viewer displaying a NetFlex-3 event and the event detail.

Informational Event Reporting

The NetFlex-3 driver reports information events and descriptions of each event. Most of these events do not necessarily indicate a problem. However, if they are accompanied by other messages indicating a network problem, a further investigation is warranted. You can view controller status information in the Advanced Network Control Utility and status and error report information in the Windows NT System Event Log. These tools can help you monitor your network status and determine the operating state of the network.

The following table indicates where to look for information when specific events occur.

TABLE 3
INFORMATIONAL EVENTS

Event Viewer	Insight Manager	Advanced Network Control Utility	Description of Information Reported
✓	✓		<p><i>User Process Switchover</i></p> <p>Indicates a user request was generated.</p> <p>This event is reported after you select the <i>Switch Now</i> button to switch the controller from active to standby.</p>
✓	✓		<p><i>Switchover Auto Recover</i></p> <p>Indicates the NetFlex-3 driver has initiated a switchover from the secondary to the primary controller.</p> <p>This events is generated after a previously failed primary controller returns to the active state.</p>
		✓	<p><i>Interface Transmit Queue Depth</i></p> <p>The maximum number of transmits queued to the adapter at any one time.</p> <p>This is provided as informational only, no corrective action is necessary.</p>
		✓	<p><i>Transmit Underruns</i></p> <p>Frames aborted during transmission due to frame data not being available (due to host bus latencies).</p> <p>This is caused by the hardware being unable to connect to the bus. The system might be overloaded.</p>

Troubleshooting Hardware Failure Events

The table that follows identifies hardware-related failure events and provides possible reasons for the failures. It also provides possible corrective actions. The NetFlex-3 driver switches operation from the primary controller to the secondary controller based on certain events.

You can view controller status information in the Advanced Network Control Utility and status and error report information in the Windows NT System Event Log.

TABLE 4
HARDWARE FAILURE EVENTS

Event Viewer	Insight Manager	Advanced Network Control Utility	Description of Information Reported
✓		✓	<p><i>Adapter Check Interrupts</i></p> <p>The driver generates this event when a hardware problem is detected. The Advanced Network Control Utility logs the number of adapter check errors detected by the driver.</p> <p>The NetFlex-3 driver tries to automatically restart the controller; if the active controller fails the standby controller starts.</p> <p>Corrective Action:</p> <p>At the next scheduled maintenance, run the Compaq Systems Configuration Utility and/or Compaq Diagnostics on the controller experiencing the errors to determine if the board should be replaced. If the error persists, contact your service provider.</p>
✓		✓	<p><i>Switchover Media Failure</i></p> <p>The driver has initiated a switchover from the active to the standby adapter. A media failure initiated the switchover.</p> <p>Corrective Action:</p> <p>Check the connection to the hub. Verify that your hub has power.</p>
✓	✓	✓	<p><i>Switchover Adapter Check</i></p> <p>The driver has initiated a switchover from the active to the standby adapter. The switchover was initiated due to an adapter failure. The NetFlex-3 switched control of the network to the standby controller because it detected a hardware problem.</p> <p>Corrective Action:</p> <p>At the next scheduled maintenance, run the Compaq Systems Configuration Utility and/or Compaq Diagnostics on the controller experiencing the errors to determine if the board should be replaced. If the error persists, contact your service provider.</p>
		✓	<p><i>Heartbeat Error Interrupts</i></p> <p>This is the number of times a collision pulse was not detected during the interframe gap. A malfunction in collision circuitry.</p> <p>Corrective Action:</p> <p>Check your cable and hub connections.</p> <p>Possible causes include the cable is unplugged or the connector is explicitly set to UTP. The cabling could also be loose, frayed, or damaged.</p> <p>Verify that your hub has power.</p>

Network Status Change

Table 5 identifies network-related event failures and provides possible reasons for these failures. It also provides possible corrective actions. The NetFlex-3 driver switches operation from the primary controller to the secondary controller based on certain events.

You can view controller status information in the Advanced Network Control Utility and status and error report information in the Windows NT System Event Log.

**TABLE 5
NETWORK STATUS CHANGE**

Event Viewer	Insight Manager	Advanced Network Control Utility	Description of Information Reported
✓		✓	<p><i>Link Status Transition Interrupts</i></p> <p>The number of times the link status has changed.</p> <p>Link status changes can occur when a cable is unplugged or a hub problem occurs. If a link status change occurs on the primary controller, the secondary controller assumes control of network activity. If the secondary controller is attached to the same hub as the primary controller, the problem will be resolved if the cause was related to a cabling problem. However, if the hub is related to the problem, both controllers might be marked failed and the event will be logged in the Windows NT Event Viewer.</p> <p>Corrective Action:</p> <p>If you receive an alert indicating a link failure, first check the cable connections and the seating of the failed controller to ensure that everything is properly installed.</p> <p>If you still receive errors, replace the cables attached to the failed controller.</p> <p>At the next scheduled maintenance, run Compaq Diagnostics on the controller. It might require replacement.</p>
		✓	<p><i>Receive Overruns</i></p> <p>Frames that could not be received due to inadequate resources (receive First In-First-Out (FIFO) full), or because their frame size exceeded the maximum allowed frame size.</p> <p>This problem can be caused by too much bus traffic, which might indicate the system is too busy.</p> <p>Corrective Action:</p> <p>You might need to increase the number of receive buffers.</p>

Other Troubleshooting Tips

Here are other considerations when you are configuring a redundant controller pair:

- Install the same network segment as the primary controller. The secondary controller can be connected to a different hub. If the primary controller failure is related to a hub problem, the secondary controller will continue operation.
- When using a NetFlex-3 Controller with a 10 Base-T option module operating in full-duplex mode, wire fault conditions cannot be detected. This condition does not affect hardware failure detection and does not exist when operating in half-duplex mode.
- Configuring a 10Base-T controller and a 100 VG-AnyLAN controller to connect over a Hewlett Packard VG hub might cause switching problems. Compaq *does not* recommend this combination.
- Unbound Service

A set of registry entries for a controller does not bind to a physical piece of hardware. If any unbound services exist, the Advanced Network Control Utility detects them when the utility is started.

Here are some questions to ask yourself when trying to correct an unbound service problem and possible solutions:

- Did you physically remove a controller and not uninstall it first?
- Did you physically move an installed controller to another slot without uninstalling it first?

To correct the problem, bind the registry entries to an uninstalled controller or remove the entries. Binding the service to an available controller allows the driver to install the controller and load the next time the server is restarted. You can bind or remove services when you run the Advanced Network Control Utility.

- Did you install a bridged PCI controller without uninstalling other PCI network controllers first?

Some PCI controllers contain bridge chips which can cause the bus numbers of other PCI slots to shift; therefore, the NetFlex-3 driver might not load. To correct this problem, uninstall all network PCI controllers, add the bridged PCI device, and reinstall the network controllers .

- To achieve full-duplex, the network controllers and the network hub that you select must provide full-duplex capabilities. Check the documentation provided with the equipment.
- Under certain specific conditions a broken cable cannot be detected. This can happen when using a controller with a version 1.0 ThunderLAN chip and receiving data from a file copy operation.

To see what version of the ThunderLAN chip a controller has, check the Hardware Information Tab for that controller.

The solution is to add the following value to the registry:

WHITE PAPER *(cont.)*

Value Name	Value Type	Value	Location
MinFrameSize	REG_DWORD	64 decimal 40 hex	HKEY_LOCAL_MACHINE\System\CurrentControlSet\ Services\CpqNf3X\Parameters (where X is the instance #)

On-Line Resources from Compaq

Compaq maintains a library of technical documents on its World-Wide Web site. The Compaq Technical Information Library, located on the Compaq Web site, contains a collection of technical documentation that Compaq produced to support Windows NT on Compaq Servers.

You can download these and many other documents by accessing the Information Library on the Compaq Web site at:

http://www.compaq.com/solutions/frontline/winnt/info_lib/index.html