

# **IBM PCI Hot Plug Services**

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## **User Guide**

## **First Edition (July 1998)**

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## What is the IBM PCI Hot Plug Solution?

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The IBM PCI Hot Plug solution for Windows NT 4.0 ensures High Availability on PCI Hot Plug-compatible IBM servers. With IBM PCI Hot Plug, you can use:

- Hot Add to install and configure a new adapter while the server is running
- Hot Swap to replace a faulty standalone or redundant adapter while the system is running
- The IBM PCI Hot Plug Applet to monitor the status of Hot Plug PCI slots on your server

IBM PCI Hot Plug includes two wizards, IBM PCI Hot Plug and Play and IBM PCI Hot Swap. These wizards provide clear, step-by-step guidance while you are adding or swapping an adapter.

### Hardware Requirements

IBM PCI Hot Plug systems such as the IBM Netfinity 5500

### Software Requirements

- Microsoft Windows NT 4.0 SP3 or later
- IBM PCI Hot Plug Package which includes:
  - IBM Fault Tolerant DMI agent  
This agent automatically installs DMI services on your system.
  - IBM Hot Plug Solutions
    - IBM PCI Hot Plug Applet
    - IBM PCI Hot Plug and Play Wizard
    - IBM PCI Hot Swap Wizard
  - Hot Plug Adapters Software
    - IBM Netfinity 10/100 Fault Tolerant device driver
    - IBM Token Ring device driver
    - IBM Fault Tolerant ServeRAID II device driver

You can download IBM PCI Hot Plug software from [www.ibm.com/pc/support/netfinity](http://www.ibm.com/pc/support/netfinity).

### Hardware Supported for Hot Plug

	<b>Hot Add</b>	<b>Hot Swap</b>	<b>Fault Tolerant Pair Hot Swap</b>
IBM Netfinity 10/100 Fault Tolerant	X		X
IBM Token Ring	X		
IBM Fault Tolerant ServeRAID II	X	X	X

Please ask your IBM representative for other supported adapters.

## Installing IBM PCI Hot Plug

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You must use the following software to provide IBM PCI Hot Plug support for hot plug-capable IBM Netfinity systems. You can download this software from [www.ibm.com/pc/support/netfinity](http://www.ibm.com/pc/support/netfinity).

- IBM Fault Tolerant DMI Agent
- IBM PCI Hot Plug Services
- IBM Fault Tolerant Device Drivers

### Installing IBM Fault Tolerant DMI agent

This software will install DMI version 1.1 on your system. You must install the DMI agent before you can install the IBM PCI Hot Plug Services.

If DMI is already installed on your system, proceed to Installing IBM PCI Hot Plug Services.

1. Download the DMI .exe file from the web page and extract the files onto a diskette.
2. Insert the diskette into the floppy drive.
3. From the Start menu, select Run.
4. Type A:\SETUP.EXE in the Open box.
5. Click OK. The Setup wizard opens.
6. Follow the instructions on the setup wizard until the program is installed.
7. Reboot.

### Installing IBM PCI Hot Plug Services

1. Download the IBM PCI Hot Plug Services .exe file from the web page and extract the files onto a diskette.
2. Log in to Windows NT as a user in the Administrator group.
3. Insert the diskette into the floppy drive.
4. From the Start menu, Select Run.
5. Type A:\SETUP.EXE in the Open box.
6. Click OK. The Setup wizard opens.
7. Follow the instructions on the setup wizard until the program is installed.

#### Notes:

- If you have an older version of IBM PCI Hot Plug Services on your system a message box will prompt you to upgrade. Click Yes and the Setup wizard will guide you through the rest of the installation.
- Installation error messages are listed in winerror.h.

### Installing Hot Plug Adapters Software

In order to support any of the Hot Plug features, you must install the Fault Tolerant drivers. If you already have an IBM Netfinity 10/100 Fault Tolerant or IBM Fault Tolerant ServeRAID II adapter configured on your system those drivers must be removed and replaced with the latest Fault Tolerant drivers. A reboot will be required.

1. Download the fault tolerant driver .exe file from the web page and extract the files onto a diskette.

2. Place the diskette into the floppy drive.
3. Proceed with the normal upgrade of the adapter drivers. See your Windows NT documentation for information about upgrading drivers.

### **Tips to know before using PCI Hot Plug features**

#### **1. Hot Plug Drivers**

In order to support any of the Hot Plug features, you must install the Fault Tolerant drivers. If you already have an IBM Netfinity 10/100 Fault Tolerant or IBM Fault Tolerant ServeRAID II adapter configured on your system, those drivers must be removed and replaced with the latest Fault Tolerant drivers. A reboot will be required.

#### **2. Hot Add of an Adapter previously removed**

When an administrator attempts to Hot-Add a Raid or SCSI adapter on a Hot Plug system which has already had the adapter installed on it and then removed, the Hot Add will fail.

The administrator is strongly advised to mark all SCSI drivers which have no device as "DISABLED" via the Devices Control Applet. This will prevent the driver from being started and allow the Hot Add to proceed normally.

#### **3. MAC address incorrect (all zeros) for Hot Added card**

After a Hot Add of a NIC Card, the MAC addresses are being returned as all zeros (000000000000). This does not affect the abilities of the adapter.

#### **4. Hot Remove**

This feature is NOT supported.

#### **5. Best Time to perform PCI Hot Plug action**

It is highly recommended to perform any of the PCI Hot Plug features during low traffic.

#### **6. Reboot Message**

After a Hot Add of an adapters, the Windows NT applications (Network Applet and SCSI Applet) will ask the user for a Reboot. **DO NOT REBOOT**

#### **7. Hot Swap of ServeRAID II**

During a Hot Swap of a stand alone ServeRAID II adapter, any I/O performed on the adapter during this operations will be failed. Error messages might appear.

#### **8. Can't open both IBM PCI Hot Plug Applet and IBM PCI Hot Swap Wizard at the same time.**

## Hot Adding a New Adapter

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Hot Add allows you to install and configure an adapter while the server is running. To Hot Add a new adapter:

1. Log on to Windows NT as a user within the Administrator group.
2. Open the server cabinet carefully in order to access the PCI Hot Plug slots.
3. Locate an empty PCI Hot Plug slot. (Make sure the power to the slot is Off.)
4. Open the adapter retention latch.
5. Lift the black tab.
6. Remove the expansion slot cover.
7. Insert the adapter firmly into the slot. Use the plastic guides to ensure the adapter is properly seated.
8. Connect any applicable adapter cables.
9. Lower the tab and close the adapter retention latch.
10. The power LED next to the slot turns ON and the Hot Plug and Play Wizard starts.
11. Follow the instructions on the Hot Plug and Play Wizard. Before the wizard completes, you may have to configure the adapter. For configuration instructions, refer to the documentation for your adapter.
12. Click Finish to close the wizard and complete the installation.

**DO NOT REBOOT!** (Even if prompted, you do not need to reboot.)

If a problem occurs during installation, refer to the Event Viewer (System Log) for information about the install session.

### Warnings:

- Do NOT Hot Add two adapters simultaneously as it may cause device configuration problems.
- Do NOT perform a Hot Add during peak hours—current connections may be interrupted.

<p><b>Helpful Tip:</b> You can Hot Add a Logic Analyzer card and a PCI Bus Analyzer card to the PCI Bus without impacting existing adapters. When finished, simply power off the slot using the IBM PCI Hot Plug Applet and remove the analyzer from the system. These procedures may be useful in gathering data for I/O performance analysis.</p>
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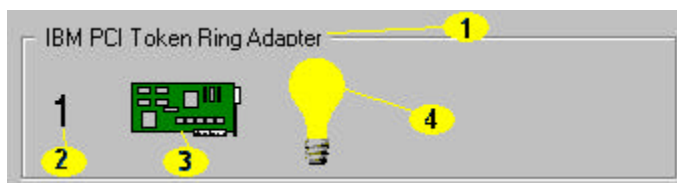
## The IBM PCI Hot Plug Applet

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This applet helps you monitor and control the status of Hot Plug slots on your server.

### Checking the Power Status of a Slot:

1. Open the applet by right-clicking the Hot Plug Icon in the Taskbar notification area on the right side of the Taskbar. (You can also open the applet by selecting Hot Plug Controls from the Control Panel.)
2. Select the tab designating the slot you want to check status on. The following portion of the property page is displayed:



- 1 Displays the name of the adapter in the slot.
- 2 Displays the Logical Slot Number. This number matches the slot in the back panel of the server.
- 3 Indicates whether there is an adapter in the slot. If an adapter is present, the card is green. If an adapter is not present, the card is gray.
- 4 Indicates whether the slot has power. If the light bulb is yellow, the power is on. If the light bulb is gray, the power is off.

### Changing the Power Status of a Slot

1. Open the applet by right-clicking the Hot Plug Icon in the Taskbar notification area on the right side of the Taskbar. (You can also open the applet by selecting Hot Plug Controls from the Control Panel.)
2. Select the tab designating the slot you want to modify.
3. If you want to turn on the power for the selected slot, click On. If you want to turn off the power for the selected slot, click Off.
4. Click Apply. The power status of the slot is changed.

**Warning:** Do not remove power from a slot with an adapter being used by the server—it may hang your machine. To ensure the slot is Off, open the IBM PCI Hot Plug Applet. If the light bulb is gray, the power is off. You can also check the Power LED in back of the server. If the Power LED is not lit, the power to the slot is Off.

## The IBM PCI Hot Plug Systray

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The Hot Plug Systray gives you quick access to information about the PCI Hot Plug slots on the server.

To access the Hot Plug Systray, click the Hot Plug icon (🔥) in the Taskbar “systray,” located on the right side of the Taskbar. The menu appears as follows and contains the labeled characteristics:



- 1** Slot contains an adapter that is pending installation—adapters with this status are marked by a black dot next to the adapter name. A pending adapter is not fully configured and requires user interaction to finish the installation. To complete configuration for this adapter, click the adapter name to start the IBM Hot Plug and Play wizard.
- 2** Empty slot
- 3** Slot contains a fully configured, supported adapter.

## **The IBM PCI Hot Plug and Play Wizard**

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The IBM PCI Hot Plug and Play Wizard automatically starts after the insertion of a new adapter. This wizard will guide you through the configuration and startup of the adapter.

If you choose to cancel the adapter configuration, you can restart this wizard with the IBM PCI Hot Plug Systray.

See [Hot Adding a New Adapter](#) for information about adding an adapter.

## Hot Swapping an Adapter

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IBM PCI Hot Plug allows you to Hot Swap standalone and redundant adapters. You must swap the adapter with an adapter of the same hardware level; in other words you cannot upgrade the existing adapter in the swap.

### Hot Swapping a Standalone ServeRAID II Adapter

Use this procedure to replace a standalone IBM Fault Tolerant ServeRAID II adapter. (Note that you cannot Hot Swap a standalone IBM Fault Tolerant Fast Ethernet adapter.)

1. Log on to Windows NT as a user within the Administrator group.
2. Open the Hot Swap Wizard. (From the Start menu, select IBM Hot Plug PCI Applications, then IBM Hot Swap PCI.)
3. When the wizard prompts you to swap the adapter, open the server cabinet carefully in order to access the PCI Hot Plug slots. Refer to your server's user guide for details about PCI Hot Plug Slots.
4. Locate the slot with the adapter needing to be swapped. The Attention LED for this slot will be flashing.
5. Open the adapter retention latch.
6. Lift the black tab.
7. Remove the adapter.
8. Insert the adapter firmly into the slot. Use the plastic guides to ensure the adapter is properly seated.
9. Do NOT connect the cable at this moment.
10. Lower the tab and close the adapter retention latch. The wizard will keep running until the preliminary adapter configuration is complete.

**Note** The IBM PCI Hot Swap wizard will not allow you to proceed if the swapped adapters are not the same hardware version.

11. Connect any applicable adapters cables.
12. Lift the black tab
13. Lower the tab and close the adapter retention latch. The wizard will keep running until the preliminary adapter configuration is complete.
12. Click Finish to close the wizard and complete the installation.

### Hot Swapping an Adapter in a Fault Tolerant Pair

This feature is supported for IBM Netfinity 10/100 Fault Tolerant and IBM Fault Tolerant ServeRAID II adapters. Note that you can Hot Swap an IBM Netfinity 10/100 Fault Tolerant adapter only if it is the passive adapter in a fault tolerant pair.

### IBM Fault Tolerant Fast Ethernet

If the primary adapter has failed, please do the following:

1. Log on to Windows NT as a user within the Administrator group.
2. Open the Hot Swap Wizard. (From the Start menu, select IBM Hot Plug PCI Applications, then IBM Hot Swap PCI.)
3. When the wizard prompts you to swap the adapter, open the server cabinet carefully in order to access the PCI Hot Plug slots. Refer to your server's user guide for details about PCI Hot Plug Slots.
4. Locate the slot with the adapter needing to be swapped. The Attention LED for this slot will be flashing.

5. Open the adapter retention latch.
6. Lift the black tab.
7. Remove the adapter.
8. Insert the adapter firmly into the slot. Use the plastic guides to ensure the adapter is properly seated.
9. Connect any applicable adapter cables.
10. Lower the tab and close the adapter retention latch. The wizard will keep running until the adapter configuration is complete.

**Note:** The IBM PCI Hot Swap wizard will not allow you to proceed if the swapped adapters are not the same hardware version.

11. Click Finish to close the wizard and complete the installation. The wizard will prompt you to fail back.
12. Click Yes.

**Note:** If you click No, you cannot fail back to the primary adapter without rebooting or using the DMI Explorer control.

### IBM Fault Tolerant ServeRAID II

1. Log on to Windows NT as a user within the Administrator group.
2. Open the Hot Swap Wizard. (From the Start menu, select IBM Hot Plug PCI Applications, then IBM Hot Swap PCI.)
3. When the wizard prompts you to swap the adapter, open the server cabinet carefully in order to access the PCI Hot Plug slots. Refer to your server's user guide for details about PCI Hot Plug Slots.
4. Locate the slot with the adapter needing to be swapped. The Attention LED for this slot will be flashing.
5. Open the adapter retention latch.
6. Lift the black tab.
7. Remove the adapter.
8. Insert the adapter firmly into the slot. Use the plastic guides to ensure the adapter is properly seated.
9. Do NOT connect the cable at this moment.
10. Lower the tab and close the adapter retention latch. The wizard will keep running until the preliminary adapter configuration is complete.

**Note** The IBM PCI Hot Swap wizard will not allow you to proceed if the swapped adapters are not the same hardware version.

11. Connect any applicables adapters cables.
12. Lift the black tab
13. Lower the tab and close the adapter retention latch. The wizard will keep running until the preliminary adapter configuration is complete.
14. Click Finish to close the wizard and complete the installation.
15. Use the IBM ServeRAID Fault Tolerant applet to switch to the primary adapter. Open this utility by clicking its icon in the Control Panel.



IBM ServeRAID Fault Tolerant applet icon

**Note:** You can force a failure on the primary adapter using the IBM ServeRAID Fault Tolerant Management applet. This can be useful if the performance of the adapter is not normal (that is, there might be some problem related to the hardware).

## Hot Swap Wizard

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Use this wizard when swapping an adapter. It will guide you through the Hot Swap process. To start the Hot Swap Wizard, select IBM Hot Plug PCI Applications, then IBM Hot Swap PCI from the Start menu. See Hot Swapping an Adapter for more information about Hot Swap.

**Note:** In future releases, this Wizard will be part of the Failover Management Utility, which will manage all fault tolerant adapter pairs in the network. (For more information, please contact your IBM representative).

## Configuring the IBM Fault Tolerant ServeRAID II Adapter in a Fault Tolerant Pair

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The latest version of the Server RAID II driver includes *fault tolerant* technology. With fault tolerance, two adapters can be paired and connected to the same enclosure in order to provide access to the disk, even after an adapter fails.

### Hardware Requirements

In order to perform fault tolerance with ServeRAID II, you need to use one of the following enclosures:

- 3518 – PC Server Enterprise Expansion Enclosure using IBM SCSI-2 F/W Enhanced Repeater Card
- 3519 – Rack Drawer Enclosure using IBM SCSI-2 F/W Enhanced Repeater Card
- IBM Netfinity EXP10 Rack Storage Enclosure using Netfinity EXP10 3m External Auto-Sensing Cable

### Guidelines and Restrictions

- A fault tolerant pair cannot be part of a Wolfpack shared cluster.
- It is not possible to use the on board adapter to create a fault tolerant pair.
- All logical drives must have unique shared logical disk IDs.
- Only the active adapter in a fault tolerant pair appears in the NT administration tool.
- If both adapters have logical drives configured, they will not be configured as a fault tolerant pair.
- Configuring a fault tolerant pair requires a reboot.
- A backup adapter cannot be added using the Hot Add utility.
- The adapter must be configured as write-through.
- When using multiple fault tolerant pairs in a system, each set of adapters must have a unique set of names.
- An on-board ServeRAID adapter cannot be disabled, even if it is not used.

To configure a fault tolerant pair:

- Both cards in the pair must have non-conflicting SCSI IDs
- Both cards in the pair must have their host names and partner names configured correctly
- All logical drives must have a shared Merge ID defined

### Configuring the First Adapter in a Fault Tolerant Pair

Do not connect cable to the SCSI bus of the two adapters in the fault tolerant pair at this time.

1. Insert the IBM PCI ServeRAID II Configuration Utility diskette into the floppy drive.
2. Boot the system. The IBM ServeRAID Adapter Disk Array Configuration menu appears.
3. From the Select Adapter menu, select the first adapter to be included in the fault tolerant pair.
4. Choose Advance Functions (option 7).
5. Choose Init/View/Synchronize Config (option 7).

### **Important—Read before moving to the next step!**

The IBM Fault Tolerant ServeRAID II adapter should only be initialized once—when the adapter is initially installed. Initializing the adapter removes all configuration information from the NVRAM. This information includes the SCSI IDs, the cluster and cluster partner name, and the array information. This point is especially important if, after initial installation, the NT system boot drive is located on the IBM Fault

Tolerant ServeRAID II adapter. If initialization occurs after the boot drive array has been created, this array information will be removed and the server will be unable to boot into Windows NT.

If you need to change the configuration of the IBM Fault Tolerant ServeRAID II adapter, or delete a disk array, perform these actions individually. It is your responsibility to ensure that you know where arrays, which you do not want to delete, are located.

6. Choose Initialize Configuration (option 2).
7. Choose Change Raid Parameters (Option 5) and Turn On the Unattended Mode Option.
8. Press Escape key and save the configuration by selecting Yes.
9. Choose Display/Change Adapter Params (Option 8).
10. Make sure the SCSI IDs of the adapters are unique on all channels.
11. Enter a name for the Host Configuration ID (for example, cuha\_0000001).
12. Enter a unique name for Cluster Partner ID (for example, cuha\_0000002).

**Important:** The Host Configuration ID and Cluster Partner ID are case-sensitive. These names will be used in setting up the second adapter of the fault tolerant pair.

13. Press F10 to apply the changes.
14. Press the Escape key repeatedly until you return to the Select Adapter Menu.

#### **Configuring the Second Adapter in a Fault Tolerant Pair**

1. From the Select Adapter menu, select the second adapter of the fault tolerant pair.
2. Choose Advanced Functions (option 7).
4. Choose Initialize Configuration (option 2).
5. Choose Change Raid Parameters (Option 5) and Turn On the Unattended Mode Option.
6. Press Escape key and save the configuration by selecting Yes.
7. Choose Display/Change Adapter Params (Option 5).
8. Make sure the SCSI IDs of the adapters are unique on all channels.
9. Enter a name for the Host Configuration ID. Use the name assigned to the Cluster Partner ID of the first adapter in the pair.
10. Enter a name for Cluster Partner ID. Use the name assigned to the Host Configuration ID of the first adapter in the pair.

**Important:** Remember that the Host Configuration ID and Cluster Partner ID are case-sensitive and must match the names assigned to the first adapter in the pair.

11. Press F10 to apply the changes.
12. Turn off the system.
13. Connect the SCSI cables to the adapters in the pair, and to the SCSI Bus of the two adapters.

#### **Configuring the Logical Drives**

Once the adapters are configured and the cables are connected, boot the system with the IBM ServeRAID II Configuration Utility diskette.

1. From the Select Adapter menu, select one of the adapters in the fault tolerant pair.
2. Choose Create/Delete/Copy Log drives (option 4).
3. Choose Create Disk Array (option 3).
4. The first drive marked RDY (ready) is highlighted.
5. Press Enter to include other drives marked as RDY in the array. After an array has been created, it



will be designated as ONL (on-line) A (the current array).

**Note:** You must have two or more drives for RAID level 1 and three or more drives for RAID level 5 within the same array.

6. Choose Define Logical Drives (option 4). The array is shown in the order created on the left side of the screen.
7. Select an array and press Enter.
8. Specify the size of the logical drive.
9. Press any key to initialize the logical drive (see on screen prompt).
10. Confirm your choice.

### **Assigning a Merge ID to the Shared Logical Drives**

After creating your logical drives you must assign a Merge ID to the shared drives. To do so:

1. Return to the IBM ServeRAID Adapter Disk Array Configuration menu.
2. Choose Advanced Functions (option 7).
3. Choose Merge Group Management (option 9).
4. For all shared drives residing on the same SCSI Bus, choose Create Shared Logical Drive ID (option 2). All logical drives are displayed on screen.
5. Press the space bar to define the group ID of the highlighted drive.
6. Assign any group ID between 1 and 8. IBM Fault Tolerant ServeRAID II supports up to 8 Logical Drive Units (LDU).
7. Define unique IDs for all logical drives on the shared SCSI Bus.
8. Press F10 after each assignment to apply the changes.
9. Press Escape repeatedly until you reach the Select Adapter Menu.
10. Select the second adapter of the Fault Tolerant pair.
11. Exit the IBM ServeRAID Adapter Disk Array Configuration Utility.
12. Reboot the system for the changes to take effect.

### **NT Installation**

When you have successfully configured the fault tolerant pair, you must install the IBM Fault Tolerant ServeRAID II driver. Refer to your NT documentation for information about installing drivers.

### **IBM ServeRAID Fault Tolerant Applet**

You must also install the IBM ServeRAID Fault Tolerant Control Panel Applet. Use this applet to:

- View the current status of the Fault Tolerant pair
- Force the primary adapter to fail, thereby transferring functionality to the secondary adapter.

You can download this applet from [www.ibm.com/pc/support/netfinity](http://www.ibm.com/pc/support/netfinity).

### **Definition of failure**

The driver attempts to fail over to the secondary adapter whenever it is unable to send a command to the primary adapter, and the primary adapter does not respond to a reset command. Loose cables or bad disks will not cause a fail over to occur.

### **Replacing a non-Hot Plug Adapter in a Fault Tolerant Pair**

If the failed adapter is not in a Hot Plug PCI slot:

1. Turn off the system.
2. Replace the failed adapter.
3. Follow the steps in *Configuring the Second Adapter in a Fault Tolerant Pair* earlier in this topic.

If the failed adapter is in a Hot Plug slot, refer to Hot Swapping an Adapter.

## **Fault Tolerant Network Adapters**

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The IBM Netfinity 10/100 Fault Tolerant adapter supports fault tolerance. Review the documentation that comes with the driver for installation information. Note that you cannot create a fault tolerant pair using Hot Add—a reboot is necessary.

### **Replacing a Failed Adapter in a Fault Tolerant Pair**

When a primary adapter fails, you can Hot Swap the failed adapter. To do this, open the Hot Swap Wizard, choose that adapter and follow the instructions. The adapter must be swapped with an adapter of the same hardware level. See Hot Swapping an Adapter for more information.

### **Recommended Configuration on the Netfinity 5500**

We suggest that you place the primary adapter in the PCI Hot Plug slot and use the on-board adapter as the secondary adapter.

## Glossary

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### **adapter retention latch**

This latch rests on top of the adapter slot. It rotates clockwise and counterclockwise, allowing you to fasten or release the tab over the slot.

### **Attention LED**

Each hot plug PCI slot has an Attention LED that is visible from the rear of the server and one that is visible from the inside of the server. When the Attention LED is flashing, it signifies that the adapter requires some sort of user intervention.

### **expansion slot cover**

The metal bar covering an empty slot.

### **fault tolerance**

This technology allows you to configure two adapters into a fault tolerant pair. Once installed and configured the fault tolerant pair will provide access to data (disk and network) even after an adapter failure.

### **fault tolerant pair**

Two adapters logically grouped together in order to provide continual access to data, even after an adapter failure. In the pair, one adapter is active and the other is passive.

### **Hot Add**

This IBM PCI Hot Plug feature allows you to add and configure an adapter to a Hot Plug-compatible server while the server is running.

### **Hot Removal**

Allows you to remove a faulty adapter while the server is running. This feature is NOT supported for this release of IBM PCI Hot Plug.

### **Hot Swap**

This IBM PCI Hot Plug feature allows you to replace a faulty adapter while the server is running.

### **IBM PCI Hot Plug and Play Wizard**

This wizard guides you through the configuration of a new Hot Plug adapter.

### **IBM PCI Hot Plug Applet**

This applet allows you to monitor and control PCI Hot Plug slots on your server.

### **IBM PCI Hot Swap Wizard**

This wizard helps you replace a faulty Hot Plug adapter.

### **Power LED**

This LED is on when the hot plug slot has power. When this LED is off, the slot has no power. Do not add or remove an adapter from the slot when the Power LED is on.

### **primary adapter**

The active adapter in a fault tolerant pair

### **secondary adapter**

The passive adapter in a fault tolerant pair.

**tab**

The black plastic piece on top of the slot. If you open the adapter retention latch, you can lift the tab to add or remove an adapter or an expansion slot cover.