

Turbo 16/4 Token-Ring PC Card

Installation Instructions

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Note

Before using this information and the product it supports, be sure to read the general information under Appendix I, "Notices and Warranty" on page I-1.

Seventh Edition (May 1997)

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Danger: Before you begin to install this product, read the safety information in *Caution: Safety Information—Read This First*, SD21-0030. This booklet describes safe procedures for cabling and plugging in electrical equipment.



Varning — livsfara: Innan du börjar installera den här produkten bör du läsa säkerhetsinformationen i dokumentet *Varning: Säkerhetsföreskrifter— Läs detta först*, SD21-0030. Där beskrivs hur du på ett säkert sätt ansluter elektrisk utrustning.



Fare: Før du begynner å installere dette produktet, må du lese sikkerhetsinformasjonen i *Advarsel: Sikkerhetsinformasjon — Les dette først*, SD21-0030 som beskriver sikkerhetsrutinene for kabling og tilkobling av elektrisk utstyr.



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Gevaar: Voordat u begint met de installatie van dit product, moet u eerst de veiligheidsinstructies lezen in de brochure *PAS OP! Veiligheidsinstructies—Lees dit eerst*, SD21-0030. Hierin wordt beschreven hoe u elektrische apparatuur op een veilige manier moet bekabelen en aansluiten.



Gevaar Voordat u begint met het installeren van dit product, dient u eerst de veiligheidsrichtlijnen te lezen die zijn vermeld in de publikatie *Caution: Safety Information - Read This First*, SD21-0030. In dit boekje vindt u veilige procedures voor het aansluiten van elektrische apparatuur.



Vorsicht: Bevor mit der Installation des Produktes begonnen wird, die Sicherheitshinweise in *Achtung: Sicherheitsinformationen—Bitte zuerst lesen*, IBM Form SD21-0030. Diese Veröffentlichung beschreibt die Sicherheitsvorkehrungen für das Verkabeln und Anschließen elektrischer Geräte.



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Danger : Avant d'installer le présent produit, consultez le livret *Attention : Informations pour la sécurité — Lisez-moi d'abord*, SD21-0030, qui décrit les procédures à respecter pour effectuer les opérations de câblage et brancher les équipements électriques en toute sécurité.



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Pericolo: prima di iniziare l'installazione di questo prodotto, leggere le informazioni relative alla sicurezza riportate nell'opuscolo *Attenzione: Informazioni di sicurezza — Prime informazioni da leggere* in cui sono descritte le procedure per il cablaggio ed il collegamento di apparecchiature elettriche.



Perigo: Antes de iniciar a instalação deste produto, leia as informações de segurança *Cuidado: Informações de Segurança — Leia Primeiro*, SD21-0030. Este documento descreve como efectuar, de um modo seguro, as ligações eléctricas dos equipamentos.



Peligro: Antes de empezar a instalar este producto, lea la información de seguridad en *Atención: Información de Seguridad — Lea Esto Primero*, SD21-0030. Este documento describe los procedimientos de seguridad para cablear y enchufar equipos eléctricos.



Perigo: Antes de começar a instalar este produto, leia as informações de segurança contidas em *Cuidado: Informações Sobre Segurança—Leia Isto Primeiro*, SD21-0030. Esse folheto descreve procedimentos de segurança para a instalação de cabos e conexões em equipamentos eléctricos.



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Related Publications

Refer to these publications for additional information:

- *BOF for LAN Technical Reference Adapter Interfaces* , SBOF-6221
- *IBM Token-Ring Network Architecture Reference* , SC30-3374
- *LAN Technical Reference IEEE 802.2 and NETBIOS* , SC30-3587
- *Credit Card Adapter Technical Reference* , SC30-3585
- *NTS/2 LAN Adapter and Protocol Support Configuration Guide* , S96F-8489
- *LAN Technical Reference: Token-Ring Network Shared-RAM* , SC30-3588
- You will need the manuals that were shipped with your network operating system.

Note: SBOF-6221 and SC30-3587 replace *Local Area Network Technical Reference* , SC30-3383.

Chapter 1. Introduction

The IBM Turbo 16/4 Token-Ring PC Card (referred to as *PC Card*) is a credit-card-sized adapter that provides an interface between computers and Token-Ring networks. The PC Card is designed to operate in computers with PC Card slots that comply with the standards for the Personal Computer Memory Card International Association (PCMCIA) Release 2.1, Type II slots.

Special features include:

- Fully compatible and up to 90% faster than the IBM Auto 16/4 Credit Card Adapter.
- Includes Remote Program Load (RPL).
- Full-duplex ready.
- Supports the Desktop Management Interface (DMI).
- Easy to install — variable interrupt levels and I/O address choices.
- Choice of Plug and Play automated configuration or software configurable, with included graphical or command line tool, for fast and easy installation.
- Includes RJ-45 cable and STP media access adapter for easy connection to either UTP or STP cabling. Optionally available cable terminated with 9-pin female D-shell connector for attachment to existing Token-Ring shielded cable such as IBM P/N 6339098.
- The cable must be connected to the PC Card in order to be recognized by the computer. This allows mobile computing because the PC Card does not have to be removed; simply disconnect the cable.
- Compliance with PCMCIA and IEEE 802.5 standards, Revision 2. This allows the PC Card to be used with a variety of application programs.
- Auto Ring Speed, a configurable option that permits the PC Card device driver to detect and operate at the data rate of the ring. This function avoids problems due to manual

configuration of an incorrect data rate and eliminates the need to reconfigure the PC Card if the data rate of the ring is changed.

You should not select Auto Ring Speed if you might be the first one to attach to your ring. The PC Card will not allow you to connect in this case. You will have to try to connect again after another Token-Ring user is on the ring.

When using the PC Card in Auto Ring Speed mode, it is important to be aware of transmit buffer limitations that may cause problems. A 16-Mbps Token Ring can support transmit buffer sizes up to 17 960 bytes. A 4-Mbps Token Ring can support transmit buffer sizes up to 4464 bytes. This is a restriction due to the speed of the media. This might affect your application.

If your PC Card software is configured to try 16-Mbps ring operation first and you plan to utilize Auto Ring Speed, be sure to use a transmit buffer size less than or equal to 4464 bytes. This will ensure that you will not have any open PC Card errors due to improper transmit buffer size if your PC Card must change ring speed.

- Support for a variety of network operating systems and network applications.

Overview of Point Enablers, Socket Services, Card Services, and Super Client Drivers

Computers that support PC Cards have one or more PC Card slots, known as A, B, C... or 1, 2, 3.... The slots are controlled by an integrated circuit chip; in many computers, this is an Intel 82365SL, but some use other types.

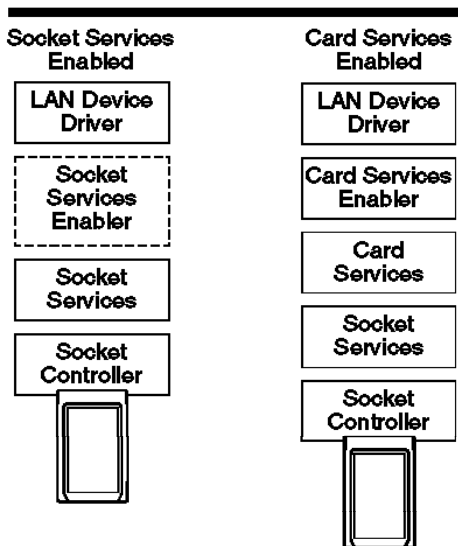
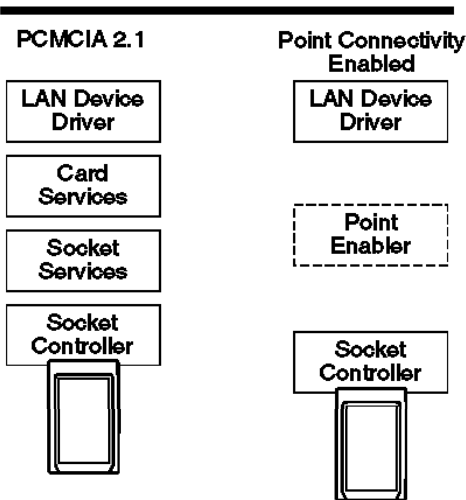
In order for communications programs to use a PC Card, interface software of some sort is needed. At present, several interfaces are available and each has its advantages and disadvantages. The two most important interfaces are those provided by Point Connectivity Enablers and Card Services; both are available under DOS, but OS/2 requires you to use Card Services.

If you decide to use Card Services, you must install and enable it before running LANAIID.

A third type of interface is Socket Services. A Socket Services 1.01 enabler, TOKENRNG.EXE, for use under DOS, is on *Diskette 2, Drivers* (included in this kit).

Relationship between the Interfaces: The following diagram shows how the interfaces relate to each other:

Credit Card Software Configurations



Point Connectivity Enablers

These are small programs that provide an interface directly to the PC Card controller; therefore, they must be written to support a particular type of controller. For the IBM Turbo 16/4 Token-Ring PC Card, there are point enablers for the Intel chip and for the chip installed in the Toshiba 3300SL.

In the DOS environment only, you have the option of using these point connectivity enablers *instead* of Card and Socket Services.

Two point enablers are supplied for this PC Card:

POINTTR.EXE For computers with Intel PCMCIA controllers. These include the IBM ThinkPad, Toshiba 4500 and later, and many other makes.

TOSHTR.EXE For the Toshiba T3300SL.

Notes:

1. When using the point connectivity enabler, it is vitally important that you make certain that the system resources used by the PC Card are different from and do not conflict with the system resources and any other PC Cards installed in your computer.
2. Windows NT currently uses a point enabler called PCMCIA.SYS, which currently ships with Windows NT.

Advantages

- Enablers consume no memory — they remove themselves after configuring the PC Card.

Disadvantages

- You must specify the slot number; the point enabler will enable only that slot. Therefore, the PC Card must always be in a specific slot.
- In some computers, the slot may not be switched off when the computer is in suspend mode, so the PC Card will continue to consume power.
- When configuring two or more PC Cards, you must allocate memory and interrupt resources manually.

Socket Services

This is a BIOS-type interface that provides a way to gain access to the PC Card sockets (slots) of a computer. It identifies how many sockets your computer has and detects the insertion or removal of a PC Card while the computer is switched on. It has an interface to Card Services. Socket Services is part of the PCMCIA Specification.

The Socket Services device driver is usually provided by the manufacturer of the computer, because the driver must understand the computer's BIOS and PCMCIA controller.

The Socket Services interface enabler shipped on *Diskette 2, Drivers* is TOKENRNG.EXE. It will not work with Socket Services 2.0 or higher.

TOKENRNG.EXE DOS Socket Services 1.01 interface enabler. It uses the Socket Services that is included in some computers to configure the socket and PC Card. It is used on machines with DATABOOK PC Card controllers that support the Socket Services 1.01 interface and not Card Services.

Card Services

This is a software management interface that allows system resources (such as memory, interrupts, slots, and I/O ports) to be allocated automatically when Socket Services has detected that a PC Card has been inserted.

Client drivers call Card Services to allocate and de-allocate system resources. When Socket Services detects an insertion or removal of a PC Card, it sends notification to Card Services. Card Services then notifies its registered client drivers, such as IBMTOKCS.OS2, that they should allocate or de-allocate resources.

If the installation program detects Card and Socket Services in your computer, it will default to Autoset mode. Autoset mode allows your LAN driver to negotiate with Card Services for memory space and interrupts. This helps to prevent conflicts with other PC Cards that are installed in your computer; however, you will not know exactly what memory addresses and interrupts have been given to you. It will default to Autoset mode if the driver supports it.

Card Services requires Socket Services. The Card Services interface will usually be provided with the operating system.

Advantages

- Ability to insert and remove PC Cards without computer reconfiguration and without damaging the electrical contacts.

- Automatic allocation of system resources.
- When used with your Token-Ring software in Autoset mode, automatic configuration of your PC Card occurs.

Disadvantage

Stay-resident program that uses system memory. The amount varies according to the type of PC Card support and the drivers used.

The DOS Card Services 2.00 interface enabler shipped on *Diskette 2, Drivers* is CS20TOK.EXE.

CS20TOK.EXE DOS Card Services 2.00 interface enabler. It uses the Card Services interface to configure the socket and the PC Card. It is used when the Token-Ring device driver is not a Card Services client driver and a Card Services environment is desired. It works with DOS Card Services 2.00 and higher.

Super Client Drivers

Many vendors are providing customers with super client drivers; these are drivers that will enable many different PC Cards. PC-DOS 6.1 includes one called PCMSCD.EXE, for example.

They are best used for modems and other PC Cards that do not have a Card Services client driver of their own. If you use a super client driver, try to disable support for the PC Card and use our client driver. Our drivers have been written to take advantage of Card Services. Look at the documentation for your super client driver to find out whether you can disable Token-Ring support.

Card Services Enabler

If you want to use a Token-Ring device driver that does not have built-in Card Services support on a system that uses Card Services, CS20TOK.EXE is supplied. This program is a Card Services Enabler that uses Card and Socket Services to configure the IBM Turbo 16/4 Token-Ring PC Card. As with other enablers, you must specify the resources desired for the PC Card, and they must agree with the settings of the Token-Ring device driver for the system to work correctly.

Card and Socket Services versus Point Enablers

There is much debate about this. In principle, Card and Socket Services is the better method of connection because it allows you to insert or remove PC Cards from any slot as you want, even while the computer is switched on; and it automatically allocates resources like memory, I/O ports, interrupt levels, and slots.

Point Enablers, of which two are provided with the PC Card, are popular because they remove themselves from memory after having been loaded—as opposed to the 30-40 KB needed for Card and Socket Services.

For point enablers, you have to specify the slot in which a particular PC Card will be used and you have to specify memory locations, interrupt levels, and other parameters. This is not difficult unless you use several PC Cards at different times, in which case you need to make certain that what you specify does not conflict with any other PC Cards installed in your computer.

Autoset Mode: Card and Socket Services turns out to be most helpful when you have a number of PC Cards installed in your computer. If the installation program detects Card and Socket Services in your computer, it will default to Autoset mode. Autoset mode allows your LAN driver to negotiate with Card and Socket Services for memory space and interrupts every time you switch on your computer. This helps to prevent conflicts with other PC Cards that are installed in your computer; however, you will not know exactly what memory addresses and interrupts you are using.

Chapter 2. Installation

Checklist

The PC Card cannot be installed without a network operating system on the computer. Ensure that a network operating system is installed, or use LAN AID to install IBM LAN Client as described in this checklist.

To install this PC Card, complete the following steps in order.

- ___ 1. Read the information in Chapter 1, "Introduction."
- ___ 2. Check the shipping package contents list and tips beginning on page 2-2.
- ___ 3. Insert the PC Card; see page 3-1.
- ___ 4. Connect the cable to the PC Card and to the network. The cable must be connected to the PC Card or the system will not recognize the PC Card.
- ___ 5. Install the software according to the operating system on your computer:
 - If you have Windows 95, go to page 4-3.
 - If you have Windows NT 3.51, go to page 4-5.
 - If you have Windows NT 4.0, go to page 4-7.
 - All other operating systems, go to Chapter 4, "Software Installation."
- ___ 6. Installation is now complete. You must reboot your system for the changes to take effect. If you have not inserted the PC Card already, insert it before rebooting the system. Appendix F, "Hot-Pluggability and Suspend/Resume Issues" on page F-1 gives information about hot-plugging the PC Card.

Kit Contents

In addition to this manual, your kit contains the following items:

- IBM Turbo 16/4 Token-Ring PC Card (also called *PC Card*)
- Token-Ring PC Card cable, P/N 38H7044. (The standard cable uses an RJ-45 connector for use with UTP network wiring.)
- Token-Ring PC Card cable with D-shell connector, P/N 38H7046 (in some kits).
- Five IBM Turbo 16/4 Token-Ring PC Card diskettes (3-1/2 inch).
- An STP connector for connection to STP network wiring, P/N 73G8314. See Chapter 3, "Inserting and Removing the PC Card" for information on installing the PC Card, the cable, and, if needed, the STP connector.

Note: The Token-Ring PC Card cable can be purchased separately. If you want additional cables, contact your IBM marketing representative or your place of purchase. See Appendix E, "Parts Information" for part numbers.

- Adapter Support Information card.
- Registration card.

Installation Tips

This section provides references to other sections of this book, phone numbers, and tips about the PC Card.

1. You might want to download the latest version of the PC Card installation software from the IBM PC Company Bulletin Board System or the World Wide Web. See "IBM Product Support" on page A-3.
2. If you have problems with your computer or PC Card or need assistance, contact your IBM representative or call the IBM Help Center. See "IBM Product Support" on page A-3.
3. If you plan to use Card and Socket Services software, Version 2.0 or higher, install it and reboot your computer. The software may be provided with your computer or operating system. See page 1-5 for a description of these services.

4. The READ.ME file on *Diskette 1, Installation* contains information to help you configure and customize the PC Card.

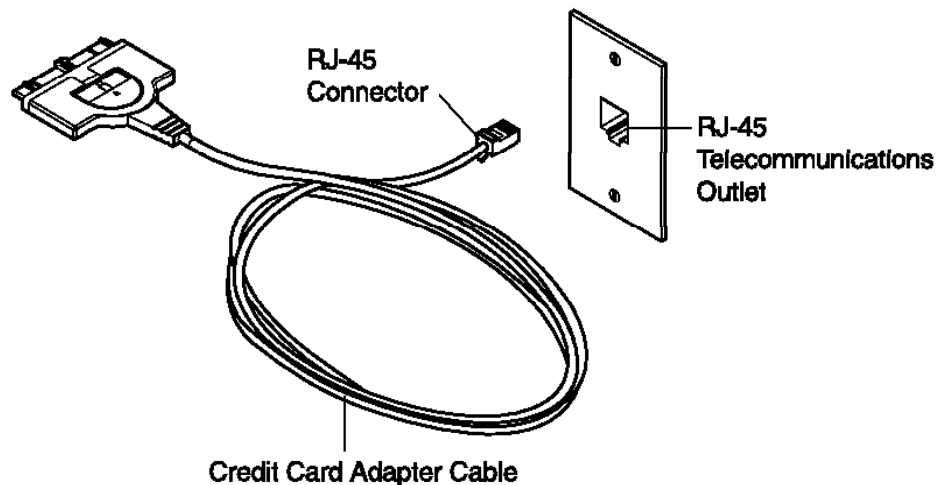
Return to page 2-1 to continue. Step 2 of the Installation Checklist is now complete.

Chapter 3. Inserting and Removing the PC Card

Inserting the PC Card

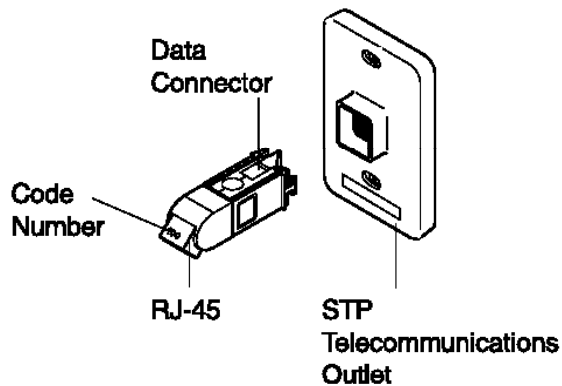
Note: If you are using Card and Socket Services, you may be able to use *hot-pluggability* features with your PC Card. See Appendix F, “Hot-Pluggability and Suspend/Resume Issues.”

- 1 Switch OFF (O) the power to the computer.
- 2 Determine which type of network cabling you will be using as shown in the following figures, and connect the PC Card cable to the network as described.
 - If your network uses UTP cabling, attach the RJ-45 (8-pin modular) connector on the PC Card cable (P/N 38H7044) to the RJ-45 telecommunications outlet.



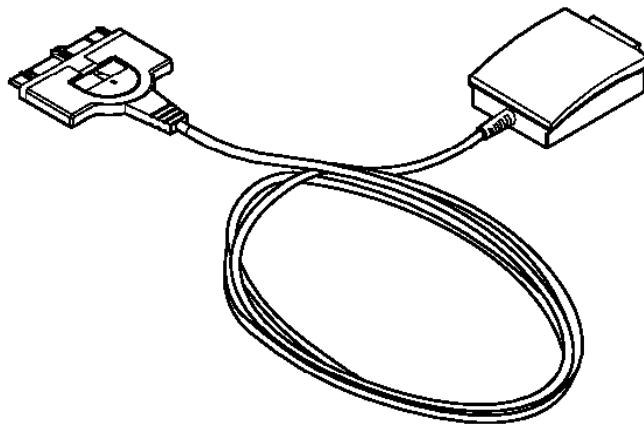
- If your network uses STP cabling, attach the RJ-45 connector on the PC Card cable (P/N 38H7044) to the RJ-45 end of the STP connector (P/N 73G8314). Attach the STP connector to the STP telecommunications outlet.

The STP connector has been specifically designed to work with the IBM Turbo 16/4 Token-Ring PC Card.



STP Connector for Data Connector

- If you are connecting to a standard Token-Ring cable that uses a D-shell connector (P/N 6339098), use PC Card cable P/N 38H7046.

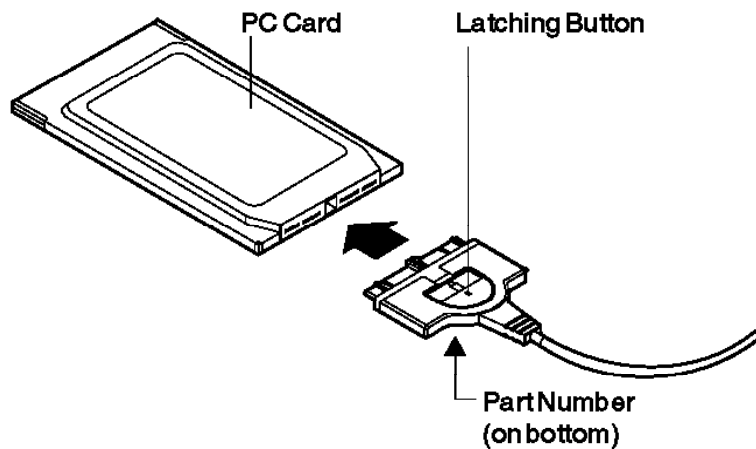


Note: Verify that you are using the correct STP connector. The correct STP connector and PC Card cable have the code number 100 on the connectors that attach to each other.

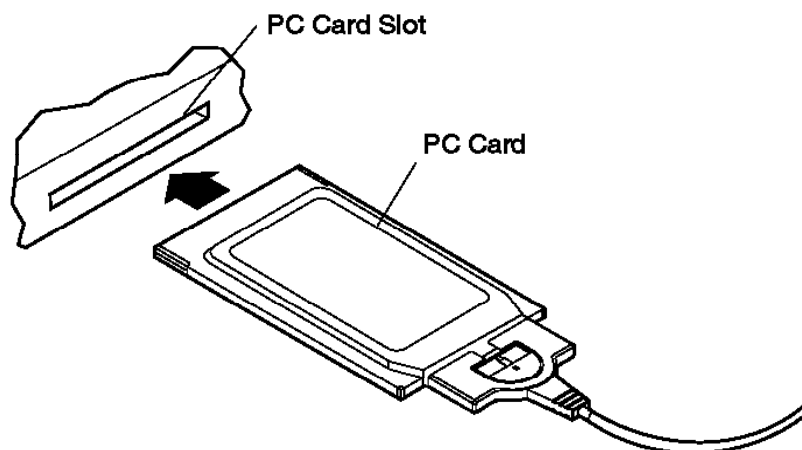
- 3** To attach the cable to the PC Card, move the latching button (the half-circle in the center of the PC Card connector) toward the cable. The cable cannot be connected or disconnected unless the latch is retracted.

Attach the cable to the PC Card with the part number on the bottom.

The connector is keyed to attach to the PC Card only one way. If you feel any resistance, remove the connector, turn it over, and reattach it.



- 4** To lock the cable securely, move the latching button in toward the PC Card. In some cases, you may want to leave the PC Card cable latch retracted. If the PC Card cable is pulled, it will disconnect from the PC Card, possibly saving your computer from being pulled off a table.
- 5** Insert the PC Card in the slot. If you are using a point enabler, note which slot you use.



The PC Card is keyed to go in only one way. If you feel resistance before the PC Card is fully inserted, remove the PC Card, turn it over, and reinsert it.

- 6** Switch ON (I) the power to the computer.
- 7** Return to page 2-1 to continue. Step 3 of the Installation Checklist is now complete.

Removing the PC Card

Note: If you are using Card and Socket Services, you may be able to use *hot-pluggability* features with your PC Card. See Appendix F, “Hot-Pluggability and Suspend/Resume Issues” for more information.

Follow these steps to remove the PC Card:

- 1** Switch OFF (O) the power to the computer.
- 2** With the cable still attached to the PC Card, pull the PC Card from the computer.
- 3** To detach the cable from the PC Card, retract the latching button (the half-circle in the center of the connector) by moving it toward the cable.
- 4** Grasp the connector and unplug it from the PC Card.
- 5** Store the PC Card.

Note: When the cable is removed from the PC Card, the PC Card, appears to the system as if it has been physically removed from the socket.

Chapter 4. Software Installation

This chapter describes how to install a supported network operating system other than IBM LAN Client and how to run LANAID to configure the PC Card to work with the system.

If you are using one of the environments listed in Table 4-1, you will not use LANAID.

If you are using one of the environments listed in Table 4-2, you will use LANAID to configure your machine. Even though the network operating system appears to fully install and configure the device driver, it is highly recommended that you run LANAID to ensure that the PC Card is appropriately configured.

Where to Find the Installation Instructions for Your Environment

Table 4-1. Do not use LANAID to configure your machine

Windows 95	page 4-3
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Windows 95 — Installation

You will need your Windows 95 diskettes or CD-ROM during installation unless you have copied the .CAB files to your hard disk.

Diskette 2, Drivers contains the device driver for Windows 95 (IBMTOK.VXD). It is recommended that you use the Windows 95 PC Card support software.

There are two versions of Windows 95. One is the original version shipped in August 1995. The other is called the OEM Sales Release 2 (OSR2). The driver installation instructions are slightly different in the two versions.

To determine if you have OSR2, click **Start, Settings, Control Panel,** and **System**. If the system version number is 4.00.950 B, you are using OSR2. If it is 4.00.950 A or just 4.00.950, you are using the original version of Windows 95.

If you are running OSR2, use the instructions in “Windows 95 OSR2 Installation” on page 4-4. Otherwise, follow the instructions here.

- 1** If you have not already inserted the PC Card, insert it now. The cable *must* be connected to the PC Card.
- 2** If PCMCIA support has been started on your machine, the system will prompt you for a diskette. If not, click **Start, Settings,** and **Control Panel**. Then click **PC Card (PCMCIA)** to start PCMCIA support, and follow the instructions given.
- 3** Insert *Diskette 2, Drivers* and press **Enter**.
- 4** Type **a:\win95** and press **Enter**.
- 5** Set the parameters. The system will list acceptable default values.
- 6** Follow the instructions given to copy the files.
- 7** Installation is now complete.

Windows 95 OSR2 Installation

- 1** If you have not already inserted the PC Card, insert it now. The cable *must* be connected to the PC Card.
- 2** If PCMCIA support has not been started on your machine, click **Start**, **Settings**, and **Control Panel**. Then, click **PC Card (PCMCIA)** to start PCMCIA support, and follow the instructions on the screen.
- 3** When the Update Device Driver Wizard appears, insert *Diskette 2, Drivers* and press **Next** to search the diskette for the driver.
- 4** If the driver is not found on the diskette, click **Other Locations** and type **a:\win95**. When the driver is found, press **Finish**.
- 5** Set the parameters. The system will list acceptable default values.
- 6** Follow the instructions on the Windows panels to copy the files.
- 7** Installation is now complete.

Windows NT 3.51 — Installation

IBMTKPCM.SYS is an NDIS 3.0 device driver for Windows NT 3.51 or higher. This driver requires that Service Pack 2 or higher has been applied to your Windows NT system. It will function only in a computer with an Intel 82365SL or compatible socket controller. Windows NT does not support the Databook socket controllers at this time.

- 1** On the Windows NT desktop, select **Main**.
- 2** In the Main Window, select **Control Panel**.
- 3** In the Control Panel Window, select **Network**.
- 4** Select **Add Adapter**. The computer will generate a list of available adapters. When this window comes up, scroll to the bottom of the list. Select **Other - Requires disk from manufacturer**. Then, select **Continue**.
- 5** Insert *Diskette 2, Drivers* in drive A. In the Insert Disk dialog box, type **a:\nt** and select **OK**.
- 6** In the Select OEM Option dialog box, you should see Token Ring PC Card in the highlighted box. Click **OK**. The driver and its associated files will be copied from the diskette to the system.
- 7** In the Turbo 16/4 PC Card dialog box, click **Configure**.
- 8** You can choose either Enhanced Mode or Compatibility Mode. Enhanced Mode uses less memory for the hardware operation of the PC Card. Compatibility Mode allows the configuration to be used by earlier Token-Ring PC Cards such as the Auto 16/4 Credit Card Adapter. Select the mode desired and click **OK**.
- 9** Set the parameters. The system will list acceptable defaults. Select **OK** when you have finished.
- 10** Select **Save** to accept the configuration.

11 Select **Close**.

12 Restart the computer.

Windows NT 4.0 — Installation

- 1** Right-click the Network Neighborhood icon.
- 2** Select **Properties**.
- 3** Click the **Adapters** tab.
- 4** Click **Add**. The computer will generate a list of available adapters.
- 5** Click **Have Disk**, type **a:\nt**, insert *Diskette 2, Drivers* in the A drive, and select **OK**.
- 6** In the Select OEM Option dialog box, you should see Token Ring PC Card in the highlighted box. Click **OK**. The driver and its associated files will be copied from the diskette to the system.
- 7** In the Turbo 16/4 Token-Ring PC Card dialog box, click **Configure**.
- 8** You can choose either Enhanced Mode or Compatibility Mode. Enhanced Mode uses less memory for the hardware operation of the PC Card. Compatibility Mode allows the configuration to be used by earlier Token-Ring PC Cards such as the Auto 16/4 Credit Card Adapter. Select the mode desired and click **OK**.
- 9** Set the parameters. The system will list acceptable defaults. Select **OK** when you have finished.
- 10** Select **Save** to accept the configuration.
- 11** Select **Close**.
- 12** Restart the computer.

OS/2 NDIS 2 Device Driver Using LAPS

If your OS/2 network operating system has not yet been installed on your computer, install it now and follow its instructions for installing device drivers. If an OS/2 network operating system has previously been installed, follow the instructions here for using LAPS to install device drivers.

- 1** Insert *Diskette 2, Drivers* in drive A.
- 2** Enter **laps** at the OS/2 prompt. LAPS is usually located in the `\ibmcom` subdirectory on the boot drive.
- 3** Select **Install**. You will be prompted for the source of the .NIF file. Enter **a:**. Select **OK** once the Installation Complete message appears. You will return to the main menu.
- 4** Select **Configure** and then, on the Select a Configuration option menu, make sure that **Configure LAN Transport** is highlighted. Select **Continue**. You will now be in the Configuration Workstation panel.
- 5** From the Network Adapters group box, select **IBM Turbo 16/4 Token-Ring PC Card**. Then, select **Add**.

Note: You can edit parameter settings for this adapter. Select this adapter in the Current Configuration box and select **Edit**.

- 6** In the Protocols list box, select the protocols used by your network application. Highlight each protocol and select **ADD**. If you are not sure which ones to use, select **IBM IEEE 802.2** and **IBM OS/2 NetBIOS** protocol drivers or ask your network administrator.

The protocol drivers you have selected will appear under the adapter driver name in the Current Configuration list box.

Note: You can edit parameter settings for the protocols. Highlight a protocol and select **Edit**.

- 7** Select **OK** when you have completed your selections for the adapter. You will now return to the main menu. Select **Exit** for the changes to take effect.
- 8** Select **Exit** on the IBM logo panel.
- 9** You will see messages regarding updates to the CONFIG.SYS file. Make sure that the correct drive and directory for the CONFIG.SYS file are specified, and click **Continue**.
- 10** Exit the program. Select **OK** when asked if you want CONFIG.SYS, STARTUP.CMD, and PROTOCOL.INI updated.
- 11** Select **Exit** on the Exiting LAPS window.
- 12** Installation is now complete. Shut down and restart your computer for all changes to take effect.
- 13** Check for the following conditions to determine whether the adapter is working correctly and whether installation has been completed successfully:
 - The device driver files are loading successfully. There are no error messages.
 - You are able to log on and communicate with the network.If you experience problems, go to Appendix A, "Problem Determination."

OS/2 NDIS 2 Device Driver Using MPTS

If your OS/2 network operating system has not yet been installed on your computer, install it now and follow its instructions for installing device drivers. If an OS/2 network operating system has previously been installed, follow the instructions here for using MPTS to install device drivers.

- 1** Start MPTS by performing either of the following actions:
 - From the OS/2 desktop, double-click the MPTS icon.
 - From an OS/2 window, go into the IBMCOM subdirectory and enter **mpts** at the OS/2 prompt.
- 2** Select **OK** on the MPTS logo panel.
- 3** Select **Install**. You will be prompted for the source of the .NIF file. Put *Diskette 2, Drivers* in drive A. Enter **a:.** Select **OK** once the Installation Complete message appears. You will return to the main menu.
- 4** Select **Configure** in the MPTS dialog box.
- 5** On the Configure panel, make sure that **LAN adapters and protocols** is preselected and then select **Configure** at the bottom of the panel.
- 6** In the Configuration panel, in the Network Adapters group box, select **IBM IBM Turbo 16/4 Token-Ring PC Card** and select **ADD**.

Note: You can edit parameter settings for this PC Card. Highlight this adapter in the Current Configuration list box and select **Edit**. When you have finished with the parameter settings, select **OK**.
- 7** In the Protocols list box, select the protocols used by your network application. Highlight each protocol and select **ADD**. If you are not sure which ones to use, select **IBM IEEE 802.2** and **IBM OS/2 NetBIOS** protocol drivers or ask your network administrator.

The protocol drivers you have selected will appear under the adapter driver name in the Current Configuration list box.

Note: You can edit parameter settings for the protocols. Highlight a protocol and select **Edit**.

- 8** Select **OK** when you have finished selecting and editing protocols in the Configuration panel.
- 9** Select **Close** on the Configure panel.
- 10** Select **Exit** in the MPTS dialog box.
- 11** Select **Exit** on the Update CONFIG.SYS panel to update the CONFIG.SYS file.
- 12** Select **OK** when you get the message that the CONFIG.SYS has been successfully updated.
- 13** Select **Exit** on the Exiting MPTS panel.
- 14** Shut down OS/2 and restart your computer to let the changes take effect. Installation is now complete.
- 15** At system startup, check for the following conditions to determine whether the adapter is working correctly and whether installation has been completed successfully:
 - The device driver files loaded successfully. There are no error messages.
 - You are able to log on and communicate with the network.If you experience problems go to Appendix A, "Problem Determination."

OS/2 NDIS 2 Device Driver Using Other Installation Programs

IBM TCP/IP for OS/2 is an example of products that provide driver installation programs.

- 1** Insert *Diskette 2, Drivers* in drive A.
- 2** Use your product documentation to install the driver (IBMTOKCS.OS2).
- 3** Modify the parameters if needed.
- 4** Installation is now complete. Shut down and restart your computer for all changes to take effect.
- 5** Check for the following conditions to determine whether the adapter is working correctly and whether installation has been completed successfully:
 - The device driver files load successfully.
 - There are no error messages.

If you experience problems go to Appendix A, "Problem Determination."

Novell NetWare Client32 for Windows 95 — Installation

- 1** Select **Remove PC Cards** from the Network Control Panel for any PC Cards that are no longer in the system or that you are removing.
- 2** In a DOS window, change to the `\windows\inf` directory.
- 3** Remove the TOKENCS.INF file.
- 4** Create a temporary directory and copy all of the files from the `\windows\inf` directory to this new directory.
- 5** Delete all of the files (*.inf) from the `\windows\inf` directory.
- 6** Copy the new .INF file for your driver from the *Diskette 2, Drivers \novell\netware* directory into the `\windows\inf` directory.
- 7** Copy all of the files back from the temporary directory to the `\windows\inf` directory.
- 8** Your new .INF file should now be the first one Windows sees in the loading process, and should be loaded before any others for the same PC Card.
- 9** Shut down the machine, remove the old PC Card, install the IBM Turbo 16/4 Token-Ring PC Card, and switch on the machine.
- 10** Windows 95 will detect the new hardware and find the new driver to be installed. If not, you can use the *Have Disk* for installation. The file is on *Diskette 2, Drivers* in the `\novell\netware` directory.
- 11** Complete the Client32 installation.
- 12** Reboot the machine to effect the changes and load the new driver.

IBM LAN Support Program/Native — Installation

The LAN Support Program/Native (LSP Native) does not support the NDIS environment and should not be used for the installation of NDIS drivers.

The *LSP Custom Version 1.01 Installation Guide* is available on the Web for users who need more information (filename TRIAU4.EXE). It might be useful as a reference during installation.

Perform the following installation steps for the PC Card when using DOS and LSP Native:

1 Run the program to install the drivers.

- a** Insert *Diskette 2, Drivers* in drive A and enter **a:\lspnativ\dxmaid.**

Note: The default configuration will install both the IBM Turbo 16/4 Token-Ring PC Card driver for Native mode (DXMCSMOD.SYS) and the NetBIOS interface (DXMT0MOD.SYS). DXMCSMOD is a card-services-aware version of DXMC0MOD, the native Token-Ring driver that comes with the LAN Support Program (LSP). A Card Services enabler is no longer necessary to use LSP. DXMCSMOD.SYS supports Card Services 2.1 and utilizes a parameter initialization file called LSP.INI to read in configuration options. The LSP.INI file is similar to the PROTOCOL.INI file that is used in the NDIS environment.

- b** Make a note of the name of the directory where the LSP is installed. The default directory name is LSP. You will have to specify this name when LANAIID asks for the directory containing your LSP.INI file. This is done during step 2 of these instructions. Also, if you are using a locally administered address, edit the LSP.INI file and add

```
netaddress=yyyyyyyyyyyyyy
```

where yyyyyyyyyyyy is the 12-digit hexadecimal address.

2 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAIID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
 - If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
 - If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAIID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).
- a** If LANAIID is not already installed, install it as described in “Installing LANAIID” on page 5-3.
- b** After LANAIID is installed, continue with “Using LANAIID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **IBM LSP/Native**.

3 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

ARTISOFT LANtastic Versions 6.0 and 7.0 — Installation

- 1** Install the ARTISOFT LANtastic Version 6.0 software using the installation instructions provided with it (**a:install**). You will need the following information as you go through the panels.
 - Make a note of the subdirectory name where you install the LANtastic software. The default name is LANTASTI.
Note: You might have to create a directory (**md c:\lantasti**) for the installation to proceed.
 - When prompted for an adapter, select **NDIS Support for Network Adapters**.
 - When prompted to insert the manufacturer's driver diskette, insert *Diskette 2, Drivers*.
 - Set up your printers and disk drives according to the LANtastic installation instructions. Contact your network administrator if you need more information.
 - The program will then begin the installation. Follow the instructions on the panel.

- 2** After the installation has been completed, *do not reboot* your computer. Press **Esc** to exit to DOS.

- 3** Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
- If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).

- If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).
 - a** If LANAID is not already installed, install it as described in “Installing LANAID” on page 5-3.
 - b** After LANAID is installed, continue with “Using LANAID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Artisoft LANtastic**.

4 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

Note: If you installed the PC Card into a LANtastic system that was already configured for other adapters, it might be necessary to merge two PROTOCOL.INI files. Compare PROTOCOL.INI with the most recent PROTOCOL.00x and copy any necessary information back into PROTOCOL.INI.

Banyan VINES/NDIS — Installation

Perform the following installation steps for the PC Card when using DOS and a Banyan VINES environment with NDIS drivers:

- 1** If there is already one computer attached to your Banyan server, follow the instructions below. Otherwise, go to step 1a to install your PC Card.
 - Format a high-density diskette.
 - From a computer that is already logged in to the server, type **pccopy**.
 - On successive panels, select:
 - **Copy PC Configuration Software** and/or **LAN Driver**
 - **NDIS Token Ring** and **PCCONFIG**
 - **REDIRALL**
 - **A:**
 - Insert the formatted diskette in drive A and press **Enter**.
 - This will make one installation diskette with all the required Banyan files on it.
 - Back at your computer, make a \vines subdirectory on your hard disk.
 - Copy the contents of the new diskette into your \vines subdirectory.
 - Go to step 2 on page 4-19.
- a** Make a \vines subdirectory on your hard disk.
- b** Copy the contents of the Banyan installation diskette to your \vines subdirectory.
- c** If you used a directory name other than \vines, make a note of it. You will need the directory name when you perform the installation procedures in step 2 on page 4-19.
- d** Locate the subdirectory \ndis on one of the two Banyan VINES LAN software diskettes and copy the contents of

this subdirectory to the subdirectory on your hard disk containing the other Banyan software.

2 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
- If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
- If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).

a If LANAID is not already installed, install it as described in “Installing LANAID” on page 5-3.

b After LANAID is installed, continue with “Using LANAID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Banyan VINES**.

3 Run the PCCONFIG program that was supplied with the Banyan software.

a Type `cd vines`.

b Type `pconfig` to run the configuration program.

c Select **Login Environment Settings**.

- d** Select **Default Communications Driver**.
 - e** Select **NDIS Token Ring**.
 - f** Press **Enter**.
 - g** Press **Esc** to return to the main menu.
 - h** Select **Network Card Settings**.
 - i** Select **NDIS Token Ring**.
 - j** Type **ibmtokcs_nif** in the PROTOCOL.INI bindings blank.
 - k** Make sure that the other settings are the same as those chosen when you ran LAN Aid (those specified in your PROTOCOL.INI).
 - l** Press **F10, Esc, and F10** to save your changes.
- 4** If you installed the PC Card in a VINES system that was already configured for other adapters, it might be necessary to merge the two PROTOCOL.INI files. Compare PROTOCOL.INI with the most recent PROTOCOL.00x and copy any necessary information back into PROTOCOL.INI.
- 5** After you install the PC Card and reboot your computer, type **cd vines**, and then **ban** to get to the Banyan login panel.
- 6** Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

Microsoft LAN Manager/NDIS — Installation

Perform the following installation steps for the PC Card when using DOS and the Microsoft LAN Manager environment:

1 If Microsoft LAN Manager is not already installed, refer to the *Microsoft LAN Manager Installation and Configuration Guide* and follow these instructions to install the program. If it is already installed, go to step 3 on page 4-22.

2 Make a note of the directory in which you are installing your LAN Manager software because you will be asked for it in step 4 on page 4-24. The default name is LANMAN.DOS.

a Insert your SETUP diskette and type **a:setup**.

b Insert the DOS Driver 1 Diskette when prompted.

c On the bottom of the Network Adapter Drivers window, select the **Other Driver** option.

d When prompted, insert *Diskette 2, Drivers* in the diskette drive. Do *not* enter a path name on the prompt window.

e Press **Enter** when IBMTOKCS.DOS is displayed.

A message will be displayed to indicate when the NDIS driver (IBMTOKCS.DOS) has been copied.

f On the Network Protocols window, select the NetBEUI driver.

g Follow the instructions on the panels to complete the configuration. However, *do not reboot* your computer at this time. Throughout the rest of the installation, pressing Enter will advance the panels.

Note: You will get a note saying *Setup has detected extended memory in your system. Do you want setup to maximize application memory?* Answer no.

h Go to step 4 on page 4-24.

3 If Microsoft LAN Manager is already installed:

a Make a note of the directory in which LAN Manager resides because you will be asked for it in step 4 on page 4-24.

b Start the Microsoft LAN Manager Setup program.

c If Microsoft LAN Manager has been configured to support other PC Cards in the computer, the Workstation Configuration window will be displayed. Select the **Add New Configuration** option on that window.

d On the Network Adapter Drivers window, select the **Other Driver** option.

e When prompted, insert *Diskette 2, Drivers* in the diskette drive. Do *not* enter a path name on the prompt window.

f Press **Enter** when IBMTOKCS.DOS is displayed.

A message will be displayed to indicate when the NDIS driver (IBMTOKCS.DOS) has been copied.

g On the Network Protocols window, select the NetBEUI driver.

h Follow the instructions on the panels to complete the configuration. However, *do not reboot* your computer at this time. Throughout the rest of the installation, pressing Enter will advance the panels.

Note: You will get a note saying *Setup has detected extended memory in your system. Do you want setup to maximize application memory?* Answer no.

- i** After the configuration has been completed, return to step 3c if you need to configure LAN Manager for a second IBM Turbo 16/4 Token-Ring PC Card.

4 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
 - If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
 - If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).
- a** If LANAID is not already installed, install it as described in “Installing LANAID” on page 5-3.
- b** After LANAID is installed, continue with “Using LANAID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Microsoft LAN Manager**.

5 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

Microsoft Windows for Workgroups/NDIS 2 — Installation

Perform the following installation steps for the PC Card to install a real mode driver when using Microsoft Windows for Workgroups:

- 1** Follow the setup instructions included with Windows for Workgroups.

If Windows for Workgroups is not already installed, you will be prompted to install a network PC Card during the Windows for Workgroups installation process.

If you are installing the PC Card in a computer that already has Windows for Workgroups installed, refer to the *Microsoft Windows for Workgroups User's Guide* for instructions on how to install and configure a third-party device driver.

Note: If you have Windows for Workgroups Version 3.11, perform the following steps before proceeding with step 1a.

- When you get to the Network Setup window, select **Networks**, and then **Install Microsoft Windows Network**.
- Change any other items for your environment, and select **OK** and **Continue**.

a When prompted to install a new PC Card, select **Unlisted or updated network adapter**. You will be asked to insert a diskette that contains the network driver. Insert *Diskette 2, Drivers* and select **OK**.

b Follow the instructions as they appear on the window to install the IBMTOKCS.DOS device driver.

c Accept the defaults for Interrupt, MMIO, and SRAM. You will be given a chance to update these later, if necessary.

d Exit the Windows for Workgroups setup. *Do not* reboot your computer at this time. Exit to the DOS prompt.

2 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
 - If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
 - If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).
- a** If LANAID is not already installed, install it as described in “Installing LANAID” on page 5-3.
- b** After LANAID is installed, continue with “Using LANAID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Microsoft Windows for Workgroups**.

3 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

DOS Client-16 for Novell NetWare lower than 3.12— Installation

- 1 Create a directory that will hold the NetWare files. The default directory name is NWCLIENT.
- 2 In your AUTOEXEC.BAT:
 - Add the directory to the PATH= command. For example,

```
PATH=C:\;C:\DOS;C:\NWCLIENT;
```

- Add the following commands to the end:

```
LSL  
NESL  
TOKENCS  
ROUTE  
IPXODI  
NETX
```

These represent:

NetWare Link Support Layer program
NetWare Event Service Layer program
IBM Token-Ring driver
Routing module, only if routing is required
NetWare ODI Network driver
NetWare workstation shell for NetWare 3.11.

- 3 Insert your NetWare diskette in drive A.
- 4 Copy LSL.COM, IPXODI.COM, ROUTE.COM, NESL.COM, and NETX.EXE to your NetWare directory.

Note: Make a note of the directory name to which the NetWare files are copied. You will need the directory name when you perform the installation procedures in step 5.

- 5 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available

resources. LANAIID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.

- If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
- If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAIID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).

a If LANAIID is not already installed, install it as described in “Installing LANAIID” on page 5-3.

b After LANAIID is installed, continue with “Using LANAIID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Novell NetWare 16-bit Client**.

6 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

DOS Client-16 for Novell NetWare 3.12 and 4.0— Installation

- 1** Create a directory that will hold the NetWare files. The default directory name is NWCLIENT.
- 2** In your AUTOEXEC.BAT:
 - Add the directory to the PATH= command. For example,

```
PATH=C:\;C:\DOS;C:\NWCLIENT;
```

- Add the following commands to the end:

```
LSL  
NESL  
TOKENCS  
ROUTE  
IPXODI  
VLM
```

These represent:

NetWare Link Support Layer program
NetWare Event Service Layer program
IBM Token-Ring driver
Routing module, only if routing is required
NetWare ODI Network driver
NetWare workstation shell for NetWare 4.0x.

- 3** Insert your NetWare diskette in drive A.
- 4** Copy LSL.COM, IPXODI.COM, NESL.COM, and ROUTE.COM to your NetWare directory.
- 5** Copy all files with the extension .VLM to your NetWare directory.
- 6** Copy VLM.EXE to your NetWare directory.
- 7** Add LASTDRIVE=Z to the end of your CONFIG.SYS.

8 Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAIID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
 - If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).
 - If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAIID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).
- a** If LANAIID is not already installed, install it as described in “Installing LANAIID” on page 5-3.
- b** After LANAIID is installed, continue with “Using LANAIID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Novell NetWare 16-bit Client**.

9 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

DOS Client-16 for Novell NetWare 4.01 and higher— Installation

- 1** Insert the Novell 4.01 Diskette in drive A, and type **a:**, press **Enter** and then type **install**, and press **Enter**. Follow the steps on the panels as they appear.
- 2** At *step 1* record the client directory name in order to do a client installation. The default directory name is C:\NWCLIENT.
- 3** At *step 5* press **Enter** and *Other drivers*.
- 4** At the *Insert the driver disk* window, insert *Diskette 2, Drivers*, type **a:\novell\dos**, and press **Enter**.
- 5** Choose **IBM Turbo 16/4 Token-Ring PC Card**.
- 6** At the *Settings for IBM Turbo 16/4 Token-Ring PC Card* window, press **Esc**.
- 7** At *step 5*, press **Enter** to finish installing NetWare.
- 8** Press **Enter** to exit the installation tool.
- 9** Configure the PC Card.

Memory management notes

- If you are using Card and Socket Services, the program will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. LANAIID will allow you to select values for resources to be used by your PC Card such as Interrupt, memory, and I/O Base Address.
- If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt, MMIO, and SRAM do not conflict with those for other PC Cards and resources installed in your computer (such as video, sound, COM port).

- If you are using EMM386, in most cases the memory exclusions will be automatically handled by LANAID. If you are using a memory manager, you must exclude the memory ranges being used by your PC Card (8-KB default).

10 If LANAID is not already installed, install it as described in “Installing LANAID” on page 5-3.

11 After LANAID is installed, continue with “Using LANAID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **Novell NetWare 16-bit Client**.

12 Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

OS/2 NetWare Client — Installation

- 1** Before performing the installation procedures, determine which adapter address (local or universal) you will be using.
 - If you are using the locally administered adapter address (an adapter address that you can assign that overrides the universally administered address), continue with the procedures in step 2.
 - If you are using the universally administered adapter address (an adapter address that is permanently encoded in the adapter at the time of manufacture and that is unique to the adapter), you must run the PC Card diagnostics to display the universal address.

To see the adapter address, run the diagnostics. For more information, see “Running the Diagnostics Program” on page A-15.

Record the universal address here. _____

- 2** Use the Novell NetWare instructions (shipped with your Novell software) to install the NetWare files on your computer’s hard disk.

Warning: *Do not reboot* your computer during the NetWare installation. Your specific environment variables will not be set until you perform the PC Card installation procedures (in step 6).
- 3** Verify that you are installing the NetWare Requester for OS/2. From the installation menu, select **Requester on workstation**.
- 4** When requested to select the ODI LAN driver, type **tokencs.sys**.
- 5** When the system requests the WSDRV_1 driver disk or third-party device driver diskette, insert *Diskette 2, Drivers*.
- 6** Configure the PC Card.
 - a** If LANAIID is not already installed, install it as described in “Installing LANAIID” on page 5-3.

- b** After LANAIID is installed, continue with “Using LANAIID to Configure the PC Card” on page 5-7. When you get to the panel that asks for the existing network operating system, select **OS/2 Novell Requester**.

- c** Step 5 of the Installation Checklist is now complete. Continue with the next step on page 2-1.

Chapter 5. LANAID and IBM LAN Client

After you have inserted the PC Card, you must configure the PC Card software to operate with your computer and network operating system. You will need the manuals that were shipped with your network operating system.

If your computer does not have a hard disk, contact your network administrator.

About LANAID

LANAID is a software tool shipped on the IBM Turbo 16/4 Token-Ring PC Card diskettes. Use LANAID to configure the IBM Turbo 16/4 Token-Ring PC Card to work with any of the network operating systems listed below. It will also install the IBM LAN Client network operating system.

LANAID requires that Card Services or an Intel socket controller that is compatible with the point enabler be installed.

LANAID detects the following network operating systems and configures the PC Card to work with them:

- IBM LAN Client
- DOS Novell NetWare Client-16
- OS/2 Novell NetWare Client
- Artisoft LANtastic 6.0, 7.0
- Banyan VINES 6.x
- Microsoft LAN Manager
- Windows for Workgroups\NDIS 2
- Other DOS NDIS environments

For all other environments, you will use your network operating system to change parameters in the PC Card configuration.

The Net Address

LANAID identifies the PC Card to be configured by its universally administered address, which was assigned at the factory. The universally administered address, or net address, of the IBM Turbo 16/4 Token-Ring PC Card is shown on the back of the card. Ensure that the address shown by LANAID is the same as the address on the PC Card. It may be necessary to remove one or more PC Cards to allow LANAID to find the PC Card to be configured.

About IBM LAN Client

IBM LAN Client prevents excessive consumption of DOS conventional memory in DOS-based computers by drivers and protocol stacks. The LAN drivers and protocol stacks no longer require large amounts of DOS memory below 1 MB.

In addition, IBM LAN Client provides support using one PC Card-specific LAN device driver instead of two different kinds of drivers for your clients and servers. You select the appropriate device drivers and protocol stacks for your computer. The correct modules are automatically loaded based on the options you select.

Protocols and Clients Supported by IBM LAN Client

IBM LAN Client provides support for the following protocols and clients:

- For DOS 5.0 or higher:
 - NetWare Client-32 (IPX**/SPX)
 - IEEE 802.2
 - NetBIOS
 - DOS LAN Services

- For Windows 3.1:
 - NetWare Client-32 (IPX/SPX)
 - IEEE 802.2
 - NetBIOS
 - TCP/IP
 - DOS LAN Services

- For Windows for Workgroups 3.11:
 - NetWare Client-32 (IPX/SPX)
 - IEEE 802.2
 - NetBIOS
 - TCP/IP
 - DOS LAN Services

IBM LAN Client Features

- As little as 2 KB conventional memory required.
- Protocol NetWare Loadable Modules (NLM)s: these are dynamically loadable and unloadable modules that operate in 32-bit protect mode and implement the various protocol functions. Supported protocols include 802.2, IPX/SPX, TCP/IP, and NetBIOS.
- New Novell NetWare Client-32 for DOS/Windows
 - 32-bit, protect-mode client
 - Automatically reconnects an entire network environment, including open files
 - Enhanced cache (large, configurable network cache)
 - Enhanced native installation and configuration utilities.
- Provides backwards compatibility for existing DOS 802.2 and NetBIOS applications.
- Uses NET.CFG file, consistent with other products.
- Concurrent multiple frame types and protocols.
- Winsock 1.1 support for TCP/IP.

Note: DOS conventional memory consumption does not increase when you combine multiple protocols. The DOS LAN Services (DLS) Client can require significant amounts of DOS memory.

Installing LAN AID

The LAN AID graphical user interface operates under DOS or in a *full-screen* DOS session of OS/2. (A DOS *window* of OS/2 will not work correctly.) You need at least 1.5 MB of free, extended memory and 300 KB of conventional memory to run the program. At a DOS prompt, enter **mem** to find out about the memory availability on your system.

LANAID options can be selected in several ways. You can click with a mouse or other pointing device, or you can make selections by tabbing to your selection and pressing Enter. (If you will be using a mouse with LANAID, make sure that you have a mouse driver installed.) Push buttons can also be selected with *hot keys*. The hot keys are the letters that correspond to the underlined characters on the push button. Press **Alt** plus the hot-key letter.

You can get help on each LANAID panel by selecting the Help button at the bottom of the panel. You can get context-sensitive help by placing your mouse pointer on any part of the panel and pressing **F1**.

1 Install LANAID on your hard disk:

At the DOS prompt, insert *Diskette 1, Installation* in drive A and enter **a:install**.

2 Type the drive, path, and directory you want to use for LANAID.

You can let it default to C: for the drive and LANAID for the directory or you can enter new values. Press **Enter** for each entry.

The files are automatically decompressed and copied to the target directory. When this is completed, the LANAID program is automatically invoked.

Using LANAID to Install IBM LAN Client

1 Start LANAID from the directory where you installed it. If it has not been installed, install LANAID from *Diskette 1, Installation* by entering **a:install**.

LANAID should be run from DOS.

2 Select the **Network Software** push button.

Follow the instructions on the panels to specify how your CONFIG.SYS is to be upgraded.

3 If you are using an operating system that works with IBM LAN Client, a list of software options is presented in the

center of the Network Operating System Choices panel. Select **Install IBM LAN Client**. Choose **Express Install** to have the LANAIID program install IBM LAN Client using the default protocols provided for your PC Card type and operating system. NetWare Client-32 and 802.2 will be loaded. Then, continue with the instructions in step 5. Choose **Custom** to customize the protocols and parameters.

4 After choosing Custom, select **Install IBM LAN Client**. Then, choose **Custom Install** and select from the following clients and protocols:

- **NetWare Client-32 (IPX/SPX)**

NetWare Client is Novell's version of client software.

You cannot select both NetWare Client and DOS LAN Services.

- **DOS LAN Services (DLS)**

DLS is the DOS client software for IBM LAN and Warp servers. When you select DLS, you are asked for the following information:

- User Name
- Machine ID
- Domain Name

When you select DLS, NetBIOS is automatically selected as well.

You cannot select both DLS and NetWare Client.

- **NetBIOS**

When you select NetBIOS, parameters cannot be set in LANAIID.

You can find up-to-date information about the NetBIOS device driver parameters in LNCLIENT.TXT in the LNCLIENT subdirectory.

- **802.2**

Choose 802.2 when you are using the IEEE 802.2 protocol on your LAN.

When you select 802.2, parameters cannot be set in LANAIID.

- **TCP/IP**

This option is presented under Windows or Windows for Workgroups only.

Choose **TCP/IP** when you are using the TCP/IP protocol on your network.

When you select TCP/IP, you are required to select a Local IP Address and Default Gateway. The Local Subnet Mask is set to 255.255.240.0 by default. You can change it by typing in a new value and selecting OK.

You cannot select *both* DLS and NetWare Client; however, all other combinations are accepted. Some options are selected automatically, based on your other choice. If you choose DLS, then NetBIOS is selected automatically.

5 On the IBM LAN Client Configuration panel, there are two or more folders. The Install Options folder allows you to specify directory names and backup parameters. The Network Options folder allows you to set parameters for this PC Card. Other folders, such as NWCL32, TCP/IP, or DLS allow you to set parameters for each chosen network operating system or protocol.

6 When you have finished, press the **Install** push button. You will be prompted to insert diskettes. The options that you have selected will be installed automatically.

On the View Adapter Configuration panel, there are two folders. The Configurable folder shows all the parameters you can set along with their current values. Parameters that are in conflict with other settings are noted. Use the **Suggest** push button to have LANAIID suggest non-conflicting values. Use the **Change** push button to select from the allowable values yourself. The Hardware folder shows parameters of the computer system that you cannot set, but that might be useful.

Select the **Store** push button to save the settings. You will be prompted to insert diskettes at the proper time, and the values that you have chosen will be configured automatically.

When you finish with the panels, press the **Done** button and you will be returned to the main panel. Installation is then complete.

7 Reboot your computer.

Using LANAID to Configure the PC Card

This section explains how to run LANAID to configure the PC Card for operation with a previously installed network operating system and device driver. See Chapter 4, "Software Installation" for information on installing network operating systems and device drivers.

If you are using Card and Socket Services, LANAID will default to Autoset mode, which allows the LAN driver to negotiate with Card and Socket Services for available resources. If you do not use Autoset mode, LANAID will allow you to select values for resources to be used by your PC Card such as Interrupt and I/O Address.

- 1** From the LANAID main panel, select **Network Software**. On the Network Operating System Choices panel, select **Identify Existing Network Operating System**.
- 2** On the Network Operating System Selection panel, LANAID identifies a network operating system and the directory in which the network operating system is installed. It is important to confirm these choices or manually identify the actual installed operating system and directory. When the information is correct, press the **Continue** push button.
- 3** From the LANAID main panel, select **View Adapter Configuration**. On the next panel, there are two folders. The Configurable folder shows all the parameters you can set along with their current values. Parameters that are in conflict with other settings are noted. Use the **Suggest** push button to have LANAID suggest non-conflicting values.

If you are not using Card and Socket Services in Autoset mode, you must ensure that the values that you select for Interrupt and I/O address do not conflict with those for other PC Cards installed in your computer. Use the **Change** push button to select from the allowable values yourself. The Hardware folder shows parameters of the computer system that you cannot set, but that might be useful.

Select the **Store** push button. You will be prompted to insert diskettes at the correct time, and the values that you have chosen will be configured automatically.

When you finish with the panels, press the **Done** button and you will be returned to the main panel. Installation is then complete. See "Running the Diagnostics Program" on page A-15 if you want to use the diagnostics.

4 Reboot your computer.

Command Line Invocation of LANAID

Note to LAN administrators: If you want to do automated installations of LAN Client, use the LANAIDC tool. Enter **lanaidc /h. Diskette 1, Installation** will boot to a menu that allows you to select either Diagnostics or LANAIDC. See Appendix H, "LANAIDC Parameter Information" for more information.

Appendix A. Problem Determination

Check this list of possible error conditions if problems occur.

1. Make sure that the PC Card is in the socket and that the cable is connected to the PC Card.
2. You are using EMM386.EXE or another memory manager.

EMM386 is the source of many problems with PC Cards. The problem occurs when EMM386.EXE and the LAN device driver are using the same memory. This is called *memory contention*. The PC Card will not function correctly if this contention occurs. If you are using Card Services, check to be sure that the memory that Card Services controls is excluded by the memory manager. If you are using a point enabler, be sure that the memory that you use is excluded by the memory manager. As a quick test, you may want to comment out EMM386.EXE in your CONFIG.SYS, reboot, and try the PC Card again.

If the PC Card functions, you will have to edit the EMM386.EXE command to exclude some memory. The PC Card uses 8 KB of memory in two separate areas. These memory areas may be consecutive. See Appendix C, "Using a Memory Manager" for more information.

3. You are using Card Services.

During reboot, you hear four alternating tones. This indicates that Card Services was unable to give you one or more resources that your program requested. Resources are I/O ports, interrupt level, and memory locations.

Note: The items in the following paragraph are performed by the installation program.

If you are using the NDIS driver (IBMTOKCS.DOS), edit the PROTOCOL.INI file and see whether you have specified a particular value for the interrupt level or memory locations. This would be indicated by the keywords INTERRUPT=X, MMIO=0xXXXX, or RAM=0xXXXX. If you are using the ODI driver (TOKENCS.COM), edit the NET.CFG file and see whether you have specified a particular value for the interrupt level or

memory locations. This would be indicated by the keywords INT X, MEM #1 XXXXX, or MEM #2 XXXXX.

These keywords specify a particular value for these parameters. If you find one or more of these keywords, comment them out by placing a semicolon in front of the keyword. Save the file and reboot your computer. If all three are commented out or are not in PROTOCOL.INI or NET.CFG, the driver is in Autoset mode and lets Card Services determine what values are used by the driver. If you reboot and still receive the alternating beep alarm, there is a problem with Card Services. Check your level of Card Services and ensure that it is the latest available.

4. You are using a point enabler.

When you use a point enabler, it is essential that the I/O ports, interrupt, memory areas, and slot number that are chosen by the enabler agree with what the LAN device driver is expecting. Problems occur when the enabler has set up certain resources and the LAN device driver is expecting others. Typically, the LAN driver will not initialize. Look at the default values for the interrupt, whether the PC Card is a primary or secondary PC Card (this affects the I/O ports), and where the MMIO memory and the SRAM memory are located. Be sure that the enabler settings and the settings of the LAN driver coincide. By the use of parameters on the command line of the enabler and the parameters for the LAN device driver (in PROTOCOL.INI, NET.CFG, or LSP.INI), you should be able to configure your PC Card to function.

5. If you believe that you have a hardware problem with the PC Card, run the PC Card diagnostics. See “Running the Diagnostics Program” on page A-15.

6. Check “Troubleshooting and Error Codes” on page A-3 if your computer displays an error code. If you do not find your error code, use the following information to contact IBM.

IBM Product Support

1-800-772-2227 IBM USA General Help
1-800-237-5511 IBM USA Software Help
1-800-426-7299 IBM PC Company USA General Help
1-800-565-3344 IBM and OBI Canada General Help

For new or updated version of the installation code or the drivers, call the IBM PC Company BBS:

United States (919) 517-0001 (directory 32)
Vancouver (604) 664-6464
Toronto (416) 956-7877
Montreal (514) 938-3022
Winnipeg (204) 934-2735
Markham (905) 316-4255

You can download the code from the BBS or the Internet. If you are outside the United States or Canada, contact your IBM marketing representative.

World Wide Web

Anonymous ftp to [lansupport.raleigh.ibm.com](ftp://lansupport.raleigh.ibm.com)

On a Web browser:

<http://www.networking.ibm.com/nes/neshome.html>
or <http://www.pc.ibm.com/>

Unattended Install

On a Web browser:

<http://www.networking.ibm.com/nes/nespcmci.htm>

See the files named W95PCCRD.EXE and NTPCCRD.EXE.

Troubleshooting and Error Codes

The following sections provide messages that can be received from the NDIS driver function. The messages are logged to a file. The NDIS driver signals the user when a Card Services call fails; the error signal is an alternating beep. If you hear this sound, and you are running OS/2, a problem is occurring during configuration of the PC Card and you must review the LANTRAN.LOG file in your

\IBMCOM subdirectory to determine what is wrong. Depending on the error, you may see one or more of the following error codes.

OS/2 NDIS Error Codes

OS/2 message information can be displayed with the OS/2 help facility. For example, enter **help xxxx** where xxxx is the message number.

DOS NDIS Error Codes

Error Code	Explanation and Action
LTG0022E	<p>A failure during initialization of the IBMTOKCS device driver has occurred. This is a generic initialization failure message. If the IBMTOKCS device driver encounters any errors during initialization, the specific message related to the error will accompany this generic message.</p> <p>Resolve the specific error message that accompanies this message. In addition, ensure that the Protocol Manager device driver, PROTMAN.DOS, exists, and that a DEVICE statement for it exists in the CONFIG.SYS file.</p>

OS/2 ODI Error Codes

Error	Explanation and Action
<p>Token Ring Primary Adapter De-Registered due to Adapter Check</p> <p>Token Ring Alternate Adapter De-registered due to Adapter Check</p>	<p>The indicated PC Card (primary/alternate) has discontinued participating in the ODI communications subsystem because the PC Card detected an internal or device driver problem. Check the parameters from the net.cfg file for validity. Restart the system and if the problem persists, contact technical support for help.</p>
<p>Token Ring Primary Adapter closed, Driver De-Registered</p> <p>Token Ring Alternate Adapter closed, Driver De-Registered</p>	<p>The indicated PC Card (primary/alternate) encountered an error as part of a normal driver shutdown procedure and de-registered from ODI. Reboot the computer and contact technical support if the problem persists.</p>

Error	Explanation and Action
Token Ring Primary Adapter reset failed Token Ring Alternate Adapter reset failed	The indicated PC Card (primary/alternate) was not brought back online as a result of a normal driver reset procedure. This may indicate cabling problems, ring problems or PC Card missing or hardware failure.
Token Ring Primary Adapter reset due to Cable disconnected at Card Token Ring Alternate Adapter reset due to Cable disconnected at Card	Reconnect the cable to the PC Card. If this fails, check the condition of the cable and replace it if needed.
Token Ring Primary Adapter reset due to Cable disconnected at MAU Token Ring Alternate Adapter reset due to Cable disconnected at MAU	Reconnect the cable to the MAU/CAU/concentrator. If this fails, check the condition of the cable and replace it if needed.
Buffer memory failure. Token Ring Buffer memory failure.	A test of the interface to the host system found a memory failure in the PC Card/device driver communication area. This indicates that the PC Card is either not present at the given location or there is a hardware failure.
Token-Ring: Device driver cannot find Card Services Token-Ring: AttachDD to Card Services failed	Ensure that a card services driver is loaded. The device driver could not find a card services driver interface.
Token-Ring: Device driver cannot find PCMCIA sockets	The computer has no PCMCIA sockets for Card Services to support. PC Card will not work on this computer without additional hardware.
Token-Ring: RegisterClient failed	Either Card Services is out of resources to register another client or is unable to work with this version of client. Either reduce other users of Card Services or update the Card Services version in the computer.

Error	Explanation and Action
Token-Ring: RequestWindow for MMIO (MEM1) failed Token-Ring: RequestWindow for SRAM (MEM2) failed	The given net.cfg parameter (mem1 or mem2) specifies a memory location that cannot be allocated to the driver because it is either owned by another entity in the computer or the value requested was incorrect. Change the requested value or, if one is not specified in the net.cfg file, specify one other than the default.
Token-Ring: RequestI/O failed Token-Ring: RequestIRQ failed	Similar to the previous mem1/mem2 problems, but are linked to the net.cfg keywords PORT and INT. The same remedy to the mem1/mem2 applies here with the appropriate keyword.
Token-Ring: Map MMIO window to system failed Token-Ring: Map SRAM window to system failed Token-Ring: RequestConfiguration failed	Indicates a resource conflict between the drivers' need and card services' ability to configure the requested socket that did not appear on allocation of the original value for IRQ, I/O, and memory resources. Change the requested values for these resources.
Token-Ring: Registered but card not in slot	A PC Card was registered for the given slot but was not in the slot. When the PC Card is inserted, it will be processed and opened.
Token-Ring: Hardware incapable of enhanced mode	EnhancedMode was requested on a PC Card that is not capable of enhanced mode operation. Remove the enhanced mode keyword, recheck system resources, and retry.
The LSL is not loaded.	The LSL.SYS driver is not loaded. In addition, check that the NetWare OS/2 requester is installed and loaded.

Error	Explanation and Action
An interrupt failed to occur during initialization	The driver found and reset a PC Card that did not post an initialization complete interrupt in the expected time. Check that the resource values requested are the correct values for the PC Card. If so, this message might indicate a hardware problem
The board cannot be found.	No board could be located at the values requested. Check that the card is installed and the resource requests match those allocated to the hardware.
This interrupt is already used and cannot be shared.	The requested interrupt is in use by another entity in the system and cannot be shared with the PC Card. Select a different interrupt for the PC Card.
Either the board was not found or the bus is unrecognizable	The driver could not find a PC Card that matches the given parameters that it can support. Might indicate a hardware problem with the PC Card or a configuration problem. Might require the PCMCIA keyword in the net.cfg if the PC Card is PCMCIA.
The shared RAM is on an incorrect boundary or MMIO and ROM overlap.	Mem1 and mem2 parameters are incorrect. Change these parameters and restart.
NIC Data Rate/Ring Speed Mismatch...	The requested ring speed does not match the speed at which the attached ring is operating. Change the requested ring speed via the DATA RATE keyword or, where appropriate, add the AUTORINGSPEED keyword to allow the PC Card to handle this automatically.

Error	Explanation and Action
NIC Data Rate/Ring Speed Mismatch, Changing NIC Data Rate...	Initial ring speed requested was different from the one that the attached ring is operating at. The PC Card and driver are now attempting to switch to the other speed (4 or 16 Mbps) automatically.
AutoSense And/Or RPL Enabled; No Other Adapters Present On The Ring NIC Data Rate Change Unsuccessful...	An automatic ring speed change failed. If you know the ring speed, use the "data rate 4" or "data rate 16" without the AUTORINGSPEED keyword. Automatically determined ring speed is impossible if the PC Card is opened as a single station on the ring. The first station must know what speed to open the ring at and subsequent stations can use auto-determination. Likewise, a station using RPL to load its operating system from a host on the network will fail if it is the only station on the network.
NET.CFG Custom Keyword NIC UAA in error	The NIC UAA keyword parameter in the net.cfg file is in error.
The Adapter is operating in Full Duplex Mode.	The PC Card successfully opened in full-duplex mode. This mode is only on switched token-ring networks. Information only.
NET.CFG Error: A Node Address is required to complete startup.	A node address must be specified in the net.cfg file via the "node xxxxxxxxxxxx" format and could not be found. Add one to the net.cfg file.
Invalid Node Override, Group Address bit was set now reset NET.CFG Error: The Node Address specified matches a multicast address.	The node address in the net.cfg file is an invalid address for a single station. Change the address to a valid local or globally administered address.
NET.CFG Error: Slots must be specified for PCMCIA Token-Ring adapters.	A slot number is required for the PC Card in the net.cfg.

Error	Explanation and Action
Node Override assumed to be a valid Universally Administered address	On the IBM Turbo Token-Ring 16/4, the universally administered address can be used in the net.cfg as the node address. This message is a warning that the given address is not of the format "4000xxxxxx" and is assumed to be a valid, non-group, universally administered address. The code did not check the address for validity.
Port selected is not valid for PCMCIA adapter in non-enhanced mode. Interrupt selected not valid for PCMCIA adapter in non-enhanced mode.	A resource was selected that cannot be supported on a non-enhanced PC Card. Select a value that is supported for the PC Card in use or, if the PC Card is being set up in enhanced mode, ensure that the ENHANCEDMODE keyword is in the net.cfg.
The RECEIVEBUFFERSIZE in NET.CFG file is too small (Min=192). The RECEIVEBUFFERSIZE in NET.CFG file is too large (Max=2048). The RECEIVEBUFFERSIZE in NET.CFG is not a multiple of 8.	The value for receive buffers size in the net.cfg does not conform to the required parameters. Change the value as needed.

DOS ODI Error Codes

Error Code	Explanation and Action
TOKENCS-DOS-50	The board cannot be found or the cable is not attached. The PC Card has not been inserted in the PCMCIA socket. Insert your PC Card in the socket and try again.
TOKENCS-DOS-204	The shared RAM is on incorrect boundary. Change the Shared RAM base address and place it on a 16-KB boundary (C0000, C4000, C8000, CC000, D0000, D4000, D8000, DC000).

Error Code	Explanation and Action
TOKENCS-DOS-205	<p>The PC Card did not reset during initialization.</p> <p>During initialization, no interrupt occurred.</p> <p>This can happen if you are using an enabler and it is setting an interrupt level that is different from the interrupt level TOKENCS.COM is using. Check to make sure that both interrupts are the same.</p>
TOKENCS-DOS-206	<p>An interrupt failed to occur during initialization.</p> <p>During initialization, no interrupt occurred.</p> <p>This can happen if you are using an enabler and it is setting an interrupt level that is different from the interrupt level TOKENCS.COM is using. Check to make sure that both interrupts are the same.</p>
TOKENCS-DOS-226	<p>The ROM and shared RAM address ranges overlap.</p> <p>The ROM and RAM memory areas are overlapping.</p> <p>Check the settings in NET.CFG for MEM #1 and MEM #2. MEM #1 determines the ROM (MMIO) base address. MEM #2 determines the Shared RAM base address. If you are using an enabler, check where it is placing the ROM (MMIO) and the RAM address. ROM is 8 KB in size. RAM is usually 16 KB in size.</p>
TOKENCS-DOS-228	<p>The MAX FRAME SIZE in NET.CFG file is too large (Max=17 960).</p> <p>The maximum frame size has been exceeded.</p> <p>Change the maximum frame size to a valid value.</p>

Error Code	Explanation and Action
TOKENCS-DOS-229	<p>The MAX FRAME SIZE in NET.CFG file is too small (Min=632).</p> <p>The maximum frame size is too small.</p> <p>Increase the maximum frame size to a valid value.</p>
TOKENCS-DOS-230	<p>The specified MAX FRAME SIZE in NET.CFG is not a multiple of 8.</p> <p>The maximum frame size has been set to a value that is not valid.</p> <p>Change the MAX FRAME SIZE to a multiple of 8.</p>
TOKENCS-DOS-231	<p>The MAX FRAME SIZE in NET.CFG is too big for this PC Card.</p> <p>The maximum value at this speed for this PC Card is xx.</p> <p>Change the MAX FRAME SIZE to a valid value.</p>
TOKENCS-DOS-233	<p>Card Services could not be found.</p> <p>TOKENCS.COM could not find Card Services.</p> <p>Check your CONFIG.SYS and ensure that Card Services is loading. If Card Services support is not wanted, take the PCMCIA keyword out of NET.CFG.</p>
TOKENCS-DOS-235	<p>A Card Services error has occurred.</p> <p>You have heard an alternating tone and this message is posted to the panel. This indicates that Card Services was unable to provide the resources requested.</p> <p>Check your NET.CFG parameters INT, MEM #1, MEM #2. If they are not in NET.CFG, Card Services has a problem. If they are specified in NET.CFG, comment (REM) them out and try again.</p>

Error Code	Explanation and Action
TOKENCS-DOS-246	<p>The DATA RATE specified in NET.CFG must be either 4 or 16 Mbps.</p> <p>You have specified an incorrect ring speed. It must be either 4 or 16 Mbps. The DATA RATE keyword is used to set the speed.</p>
(no message)	<p>Please insert an IBM Turbo 16/4 Token-Ring PC Card or press Esc to avoid loading the driver.</p> <p>This message occurs when you have not inserted an IBM Turbo 16/4 Token-Ring PC Card in the machine and have started TOKENCS.COM.</p> <p>Insert an IBM Turbo 16/4 Token-Ring PC Card at this time or press Esc to leave.</p>

DXMCSMOD Error Codes

Error Code	Explanation and Action
DXMCS 18I	<p>The Token-Ring Credit Card is ready to attach to the ring. It is configured for a ring speed of xx Mbps. Enter Y if this is correct. If you would like to change the configured ring speed to xx Mbps, enter C to change.</p> <p>The PC Card will allow the user to select the ring speed it will use.</p> <p>The user can respond to the question or may prevent the question from being asked by removing the PROMPT keyword in LSP.INI.</p>
DXMCS 19I	<p>Changing the ring speed configuration to xx Mbps.</p> <p>This message is displayed in response to the user input from message DXMCS 18II.</p> <p>None</p>
DXMCS 20I	<p>Ring speed will REMAIN at xx Mbps.</p> <p>This message is displayed in response to the user input from message DXMCS1 8II.</p> <p>None</p>

Error Code	Explanation and Action
DXMCS 21E	<p>An error occurred during configuration.</p> <p>An error prevented DXMCSMOD from configuring the PC Card using the parameters entered in LSP.INI.</p> <p>Verify that the parameters entered in LSP.INI do not conflict with other settings in the computer. The possible conflicts are memory and interrupt settings.</p>
DXMCS 22I	<p>No Card Services present.</p> <p>DXMCSMOD cannot locate Card Services.</p> <p>Ensure that the Card Services drivers have been loaded before DXMCSMOD loads.</p>
DXMCS 23I	<p>An error occurred when accessing the LSP.INI file.</p> <p>The LSP.INI file could not be read. The file may either be corrupted or not be present in the same directory as DXMCSMOD.</p> <p>Verify that the file LSP.INI exists. Reinstall DXMCSMOD using the installation aid.</p>
DXMCS 24E	<p>An error occurred when the program was accessing PARSEINI.COM.</p> <p>The PARSEINI.COM file could not be read. The file may either be corrupted or not be present in the same directory as DXMCSMOD.</p> <p>Check that the file PARSEINI.COM exists in the same directory as DXMCSMOD.</p>

Troubleshooting Windows 95 (NDIS 3)

Windows 95 sometimes has trouble selecting available resources for the PC Card, causing the PC Card not to function. If you find that your PC Card is not functioning, follow this procedure.

1. Click **Start**.
2. Go to the Settings menu selection and click **Control Panel**.
3. Click **System**.
4. Click the **Device Manager** tab.
5. Go to the icon for Network Adapters. You might see a yellow or red circle with an exclamation point inside beside an entry for the IBM Turbo 16/4 Token-Ring PC Card. If you see this,

click the entry. This will take you to the properties dialog for the PC Card.

6. Click the **Resources** tab of the dialog box. There are three resources that must be correct before the IBM Turbo 16/4 Token-Ring PC Card will function correctly. Acceptable values for the input/output range include any four consecutive values beginning at 0300. The interrupt request value should be a value between 3 and 15 that does not conflict with any other devices. The memory range is often set incorrectly by Windows 95. It is recommended that the memory range be set in the 000D0000 to 000DC000 in a non-conflicting memory region. The memory range 000C0000 to 000CFFFF is often used for video caches and Windows 95 does not always exclude memory regions that are already in use.
7. If EMM386.EXE is in your CONFIG.SYS, comment it out.

Troubleshooting Windows NT (NDIS 3)

Windows NT 3.51 and 4.0 use a point enabler called PCMCIA.SYS that is supplied with Windows NT. PCMCIA.SYS configures the Intel compatible socket controller with settings gleaned from the registry entry for the PC Card. Windows NT will indicate resource conflicts only after an attempt is made to configure a device. As when using a DOS enabler, you must manually choose your PC Card resources. By looking at the event viewer in the administrative tools, you might find that there is an I/O, IRQ, or memory conflict. A program called WINMSD is included with Windows NT which allows you to see the resources of your machine and determine if there are any conflicts. Make a note of your configured resources and compare them to the settings indicated by WINMSD. Make corrections to your configuration as needed. This is done by the following procedure:

1. Right-click **Network Neighborhood**.
2. Select **Properties**.
3. Select the **Adapter** tab.
4. Select **IBM Turbo 16/4 Token-Ring PC Card** and click **Properties**.

You can now change your configuration as needed.

Running the Diagnostics Program

Use the diagnostics program on *Diskette 1, Installation* to test the hardware components of the PC Card.

The diagnostics program performs a series of tests and displays the results of each one by showing success or failure. An error during any test will end the test in progress and display an error message and error code. See the following tables for a description of error codes and recommended actions.

Note: The testing process might run as long as 3 minutes and can be exited at any time by pressing Enter or by removing the diskette and pressing Esc. Pressing Esc will cause the computer to reboot. Pressing Enter will end the test in progress and allow the user to select another test option.

- 1** Insert *Diskette 1, Installation*.
- 2** Switch ON the power to the computer.
- 3** At the DOS Menu, select **2, IBM Turbo 16/4 Token-Ring PC Card Extended Diagnostics**.
- 4** Follow the instructions as they appear. You will be prompted to select a test option. See "Test Options" for descriptions.

Test Options

There are two test options: the wrap test and the on-ring test.

The wrap test ensures that the adapter and cable hardware are functioning properly. For this test, connect the adapter and cable to the network to perform a wrap test through the hub or concentrator, or insert a wrap plug (no wrap plug is required if you have an STP cable connection) to help isolate a failure to the adapter, the cable, or the wiring to the hub or concentrator.

The on-ring test verifies communication between the adapter and the LAN. This test requires that the adapter is connected to a network with other adapters, so the ring speed of the network can be automatically sensed. If the adapter under test is the only one

on the network, the on-ring test will fail. Continue testing the adapter using the wrap test, or connect the adapter to a network that has at least one other station connected and open.

Diagnostics Error Codes and Suggested Actions

Initialization Error Codes

Failure during adapter initialization usually indicates a hardware error on the card. Reboot your computer using the diagnostic diskette (*Diskette 1, Installation*), and run the diagnostic program again. If the card continues to fail, replace the card and cable.

One of the following codes will be shown to indicate the results of the initialization test. The error codes are displayed in hexadecimal format and represent the BRING_UP_CODE set by the adapter.

0000	Initialization success
0020	Diagnostics could not be executed
0022	ROM diagnostics failed
0024	Shared RAM diagnostics failed
0026	Processor instruction test failed
0028	Processor interrupt test failed
002A	Shared RAM interface register diagnostics failed
002C	Protocol-handler diagnostics failed
0040	PC Card's programmable timer for the computer failed (set by the microcode)
0042	Cannot write to shared RAM (set by microcode)
0044	Reading from shared RAM read-only area caused an incorrect error indication (interrupt)
0046	Writing into shared RAM read-only area did not cause an error indication (interrupt)
0048	Initialization timed out

Open Errors

Failure during the adapter open test might indicate that the adapter is not properly configured to run on the network it is trying to open onto or that the adapter is not properly configured for the system. The open test provides a return code and an open error code. If the return code is 07, then see "Open Error Codes" on page A-17 for a more accurate description of the failure and

suggested actions. If the return code is a value other than 00 or 07, problem determination of the PC Card and the diagnostics is necessary. Record the error and contact your network administrator.

00	Open completed successfully
01	Incorrect command code
03	Adapter open, should be closed
05	Required parameters not provided
07	Command cancelled, unrecoverable failure (see open error codes to isolate problem)
30	Inadequate receive buffers
32	Incorrect MAC address
33	Incorrect adapter receive buffer length
34	Incorrect adapter transmit buffer length

Open Error Codes

If the open provides a return code of 7, there will be a corresponding error code. The open errors are returned in 2 bytes. The high-order byte is always 0 and the low-order byte contains the following information:

1. The phase of testing in which the error was encountered is in the high-order nibble (half-byte) of the low-order byte.
2. The error condition is in the low order nibble of the low-order byte.

Phases

Value	Meaning
1n	Lobe media test
2n	Physical insertion
3n	Address verification
4n	Roll call poll (neighbor notification)
5n	Request parameters

Errors

Value	Meaning
n1	Function failure

Value	Meaning
n2	Signal loss
n3	Reserved
n4	Frequency error (see note)
n5	Time-out
n6	Ring failure
n7	Ring beaconing
n8	Duplicate node address
n9	Parameter request—retry count exceeded
nA	Remove received
nB	IMPL force received
nC	Duplicate modifier
nD	No monitor detected
nE	Monitor contention failed for RPL

Suggested Actions in Response to Open Errors: When the following phase-error combination values are presented, they are the result of certain specific occurrences. Explanation of the occurrences follows with recommended actions listed. Table A-1 on page A-22 lists the recommended actions for both the application program and the computer operator.

Error Code	Explanation	Action
11	Lobe Media, Function Failure: The testing of the lobe between the PC Card and the access unit has been unsuccessful because the lobe has a bit-error rate that is too high, or the PC Card cannot receive successfully.	1, 3, and 5
24	Physical Insertion, Frequency Error: The PC Card has detected that the ring is operating at a speed other than the speed at which it was inserting.	2

Error Code	Explanation	Action
26	Physical Insertion, Ring Failure: The PC Card, acting as an active monitor, was unable to complete the ring purge function successfully. This indicates that an error condition has occurred since the successful completion of monitor contention (claim token), when this PC Card became the active monitor.	1 and 2a
27	Physical Insertion, Ring Beacons: The PC Card has detected one of the following conditions: <ul style="list-style-type: none"> • The PC Card tried to insert on a ring that was operating at a different data rate. • A monitor contention (claim token) failure occurred. • The PC Card received a beacon MAC frame from the ring. 	1, 2, and 2b
2A	Physical Insertion, Remove Received: The PC Card has received a remove ring station MAC frame, indicating that a network management function has directed this PC Card to get off the ring.	2a and 4
2D	Physical Insertion, No Monitor Detected: RPL station is the first station attempting to insert onto the ring.	1 and 2a
2E	Physical Insertion, Monitor Contention Failed for RPL: Physical insertion failure of RPL station.	2
32	Address Verification, Signal Loss: The PC Card has detected a 250-ms signal loss (receiver cannot recognize signal), indicating that an error condition has occurred since the PC Card successfully completed the ring signal recognition phase of the open operation.	1 and 2a

Error Code	Explanation	Action
35	Address Verification, Time-out: The insertion timer expired before this function was completed, indicating that the ring can be congested, experiencing a high bit-error rate, or losing an abnormally high number of tokens or frames, thus preventing successful Address Verification MAC frame transmissions.	1 and 2a
36	Address Verification, Ring Failure: The PC Card, acting as an active monitor, was unable to complete the ring purge function successfully. This indicates that an error condition has occurred since the successful completion of monitor contention (claim token), when this PC Card became the active monitor.	1 and 2a
37	Address Verification, Ring Beaconing: The PC Card has either detected a monitor contention (claim token) failure or received a beacon MAC frame from the ring.	1 and 2b
38	Address Verification, Duplicate Node Address: The PC Card has detected that another station on the ring has a PC Card address that is the same as the PC card address being tested.	4
3A	Address Verification, Remove Received: The PC Card has received a remove ring station MAC frame, indicating that a network management function has directed this specific address to get off the ring.	2a and 4
42	Ring Poll, Signal Loss: The PC Card has detected a 250-ms signal loss (receiver cannot recognize signal) indicating that an error condition has occurred since the PC Card successfully completed the ring signal recognition phase of the open operation.	1 and 2a

Error Code	Explanation	Action
45	Ring Poll, Time-out: The insertion timer expired before this function was completed, indicating that the ring can be congested, experiencing a high bit-error rate, or losing an abnormally high number of tokens or frames. This prevents the PC Card's successful reception of either the ring poll request or response MAC frame, or transmission of the required ring poll response MAC frame.	1 and 2a
46	Ring Poll, Ring Failure: The PC Card, acting as an active monitor, was unable to complete the ring purge function successfully. This indicates that an error condition has occurred since the successful completion of monitor contention (claim token), when this PC Card became the active monitor.	1 and 2a
47	Ring Poll, Ring Beaconing: The PC Card has either detected a monitor contention (claim token) failure or received a beacon MAC frame from the ring.	1 and 2b
4A	Ring Poll, Remove Received: The PC Card has received a remove ring station MAC frame, indicating that a network management function has directed this PC Card to get off the ring.	2a and 4
55	Request Parameters, Time-out: The insertion timer expired before this function was completed, indicating that the ring can be congested, experiencing a high bit-error rate, or losing an abnormally high number of tokens or frames. This prevents successful transmission of the request parameter MAC frame or reception of either the set parameter 1 or set parameter 2 MAC frame (required response to the PC Card's request).	1 and 2a

Error Code	Explanation	Action
56	Request Parameters, Ring Failure: The PC Card, acting as an active monitor, was unable to complete the ring purge function successfully. This indicates that an error condition has occurred since the successful completion of monitor contention (when this PC Card became the active monitor).	1 and 2a
57	Request Parameters, Ring Beacons: The PC Card has received a beacon MAC frame from the ring.	1 and 2b
59	Request Parameters, Parameter Request - Retry Count Exceeded: The PC Card has detected that the ring parameter server is present on the ring but that the required response (set parameter 1 or set parameter 2 MAC frame) was not received in the allotted time. This indicates that the ring can be congested, experiencing a high bit-error rate, or losing an abnormally high number of tokens or frames.	1 and 2a
5A	Request Parameters, Remove Received: The PC Card has received a remove ring station MAC frame, indicating that a network management function has directed this PC Card to get off the ring.	2a and 4

Recommended Actions Table

Table A-1 (Page 1 of 2). Recommended Actions

Number	Description
1	After delaying at least 30 seconds, retry the open two times, inserting the same delay between each try.
2	After delaying at least 30 seconds, check the PC Card configuration (especially the PC Card data rate) and retry the open.
2a	If this error persists, direct the computer operator to contact the network administrator for assistance and provide Open Error information.

Table A-1 (Page 2 of 2). Recommended Actions

Number	Description
2b	If this error persists, direct the computer operator to contact the network administrator for assistance.
3	Direct the computer operator to contact the network administrator for assistance and provide Open Error information.
4	Direct the computer operator to contact the network administrator for assistance and provide Node Address information, and try attaching to the ring after 6 minutes.
5	If this error persists, problem determination of the PC Card or lobe is necessary. Contact your network administrator for problem determination assistance.

Transmit Error Codes

If you experience time-out errors during the on-ring test, try running the wrap test in the diagnostics. If the wrap test is completed successfully, but the on-ring test fails, it might indicate problems on the Token-Ring network that the adapter is opening onto during the on-ring test.

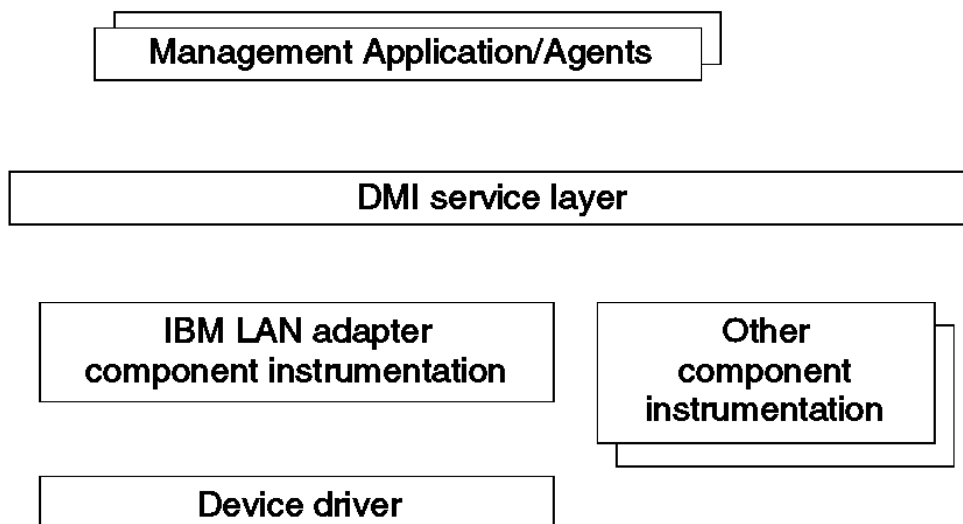
For any other errors, ensure that the adapter and cabling are properly connected, and retry the test. If the adapter continues to fail, record the error and contact your network administrator.

01	Unrecognized command code
08	Unauthorized access priority
22	Error on frame transmission, examine STRIPPED_FS
23	Error on frame transmit or strip process
24	Unauthorized MAC frame
25	Maximum commands exceeded
26	Correlator not acceptable
27	Link not transmitting I frames, status changed from link open
28	Transmit frame length not acceptable
29	Link retransmission in process, buffers free
40	Station ID not acceptable
41	Protocol error, link not in acceptable state for command

Appendix B. Desktop Management Interface

The Desktop Management Interface (DMI) is a standard framework for managing the information provided by the components of PC systems. DMI was created by the Desktop Management Task Force (DMTF). The DMTF is a cooperative, industry-wide effort formed to bring management, ease of use, and control to PC systems.

The DMI architecture utilizes a service layer, a local program that collects information from the components of the PC system and passes the information to management applications. The IBM LAN adapter instrumentation couples the adapter's device driver to the service layer.



For additional information about the DMTF or DMI, refer to URL <http://www.dmtf.org>.

LAN Adapter Instrumentation for OS/2

The IBM LAN adapter instrumentation is implemented as a protocol stack in OS/2. Currently, the protocol stack supports NDIS 2 device drivers. The protocol stack implementation allows the instrumentation to get and set attributes for any IBM NDIS 2 device driver without requiring changes to the device driver. The IBM LAN adapter instrumentation for OS/2 is on *Diskette 2, Drivers*.

For OS/2 Warp, Version 4, the DMI service layer and its associated browser and agent applications are contained in the base OS. For earlier versions of OS/2, the DMI service layer can be installed separately. Information about acquiring the DMI service layer and its browser and agent applications can be found at URL <http://www.raleigh.ibm.com/sha/shahome.html>.

Automatic Installation

The IBM LAN adapter instrumentation can be installed like any other protocol stack by using MPTS. Follow these steps.

1. Start MPTS (double-click the MPTS icon).
2. Select **Configure**.
3. Select **Configure** again.
4. Select **Other protocols....**
5. When prompted for an installation diskette, insert *Diskette 2, Drivers*. Change from the default directory of A: to A: DMI OS2, and then press **Enter**. The files will be copied to the system.
6. Bind the IBM LAN adapter instrumentation protocol for the adapters you want managed via DMI, by selecting **Add**. Select **OK** when you have finished.
7. Exit the MPTS installation process.

Note: The installation procedure copies MACDMI2.EXE and MACDMI.MIF to the IBMCOM PROTOCOL directory, which is not usually in the PATH statement. You must ensure that these files reside in a directory that is in your PATH statement.

Manual Installation

The IBM LAN adapter instrumentation can be also be installed manually by following these steps.

1. Install the executable (MACDMI2.EXE) and its files: Copy MACDMI2.EXE and MACDMI.MIF to a directory included in your PATH statement.
2. Install the protocol driver (MACDMI.OS2) and its files. The following example uses <install_dir> to represent the install directory.

- a. Copy MACDMI.OS2, MACDMI.NIF, MDM.MSG and MDMH.MSG to <install_dir>.
- b. Ensure that <install_dir> is in your DPATH statement.
- c. Update your CONFIG.SYS file to contain the entry:

```
DEVICE=C:<install_dir> MACDMI.OS2
```

- d. Add a section to your system's PROTOCOL.INI file for the IBM LAN adapter instrumentation:

```
[MACDMI]
DRIVERNAME = MACDMI$
```

- e. Add a bindings entry to the system's PROTOCOL.INI file to indicate which NDIS 2 drivers you want to be managed by DMI. An example of a complete PROTOCOL.INI entry would be:

```
[MACDMI]
DRIVERNAME = MACDMI$
Bindings = IBMTCS_nif, IBMTCS2_nif
```

Starting the IBM LAN Adapter Instrumentation

The IBM LAN adapter instrumentation, MACDMI2.EXE, can be started at an OS/2 command prompt, with the RUN command in CONFIG.SYS or with the START command. The OS/2 DMI service layer must be started before the instrumentation.

The first time the instrumentation runs, it will install the IBM LAN adapter components into the OS/2 service layer's database. The instrumentation displays messages indicating the status of the procedure.

If you want to change the LAN adapter that is to be managed, just go into MPTS and bind the IBM LAN adapter instrumentation protocol to the adapters you want managed. The next time the instrumentation is started, it will install (if necessary) additional LAN adapter components into the OS/2 service layer's database.

IBM LAN Adapter Instrumentation Messages

Look in LANTRAN.LOG for error messages from MACDMI.OS2. Use the OS/2 Help Facility to get additional information on any MDMxxxxx error messages reported by MACDMI2.EXE or MACDMI.OS2. For example: enter **help MDM0041**.

Managing IBM LAN Adapters Locally

Once the OS/2 DMI service layer and the IBM LAN adapter instrumentation have been started, the management information file (MIF) browser can be used to view and set LAN adapter attributes. The MIF browser icon is located in the IBM SystemView Agent folder along with SystemView Agent documentation. The MIF browser provides a hierarchical representation of the groups and attributes of each manageable component in the system.

LAN Adapter Instrumentation for NT

The IBM LAN adapter instrumentation is implemented as a ring-3 executable program in NT. The executable program supports NDIS 3 device drivers. The instrumentation allows users to retrieve attributes for any IBM NDIS 3 device driver without requiring changes to the device driver. The IBM LAN adapter instrumentation for NT is on *Diskette 2, Drivers*.

Information about acquiring the Win32 DMI service layer and its browser and agent applications can be found at URL <http://www.raleigh.ibm.com/sha/shahome.html>.

Installation

Copy all the files from A: DMI NT to the desired directory on your system.

Starting the IBM LAN Adapter Instrumentation

The IBM LAN adapter instrumentation for NT, MACDMINT.EXE, can be started like any other executable file. The NT DMI service layer must be started before the instrumentation.

The first time the instrumentation runs, it will install the IBM LAN adapter components into the NT service layer's database. The instrumentation displays messages indicating the status of the procedure.

The instrumentation will manage all the LAN adapters in the system.

IBM LAN Adapter Instrumentation Messages

The IBM LAN adapter instrumentation will display messages.

Managing IBM LAN Adapters Locally

Once the Win32 DMI service layer and the IBM LAN adapter instrumentation have been started, the MIF browser can be used to view LAN adapter attributes. The MIF browser icon is located in the IBM SystemView Agent folder along with SystemView Agent documentation. The MIF browser provides a hierarchical representation of the groups and attributes of each manageable component in the system.

SNMP Management of IBM LAN Adapters

The IBM LAN adapters can be managed by any application using standard SNMP operations. SNMP management is accomplished by utilizing the SNMP agent and DMI subagent supplied with the IBM SystemView Agent. The DMI subagent translates a MIB variable into the corresponding DMI MIF attribute. In order to manage the IBM LAN adapters using SNMP, follow the steps outlined below for the end station and the manager's station.

These are the files necessary to use SNMP to manage IBM LAN adapters. The files are all located on *Diskette 2, Drivers* in the DMI SNMPMGRS directory.

- MACDMI.MAP—mapping file fragment, correlates SNMP object identifier (OID) to DMI component. Used in the end station.
- MACDMI.MIB—SNMP MIB file that describes the manageable attributes of the IBM LAN adapters. Used by most SNMP manager platforms.
- MACDMI.DEF—MIB definition file that describes attributes of IBM LAN adapters. Used by NetView for Windows.

End Station Setup

Add the contents of the MACDMI.MAP file to the existing entries in the DMISA.MAP mapping file. The mapping file provides the correlation between the SNMP OIDs and the DMI components. The mapping file is located in the directory <sva_path> BIN AGENT, where <sva_path> is an environment variable defined during installation.

Note: Some earlier versions of the SystemView Agent defined the <netview_path> environment variable for installation.

Start these programs for an **OS/2 end station**: SNMP agent (SNMPD.EXE), DMI subagent (DMISA.EXE), and the LAN adapter instrumentation (MACDMI2.EXE).

Start these programs for an **NT end station**: SNMP agent (SNMPD.EXE), DMI subagent (DMISA32.EXE), and the LAN adapter instrumentation (MACDMINT.EXE).

Manager Station Setup

The general steps to set up any SNMP management platform are:

1. Copy the MIB/DEF file to the appropriate directory (where all the other MIB/DEF files are located).
2. Load the MIB/DEF file into the manager's database.

The specific setup instructions for two SNMP management platforms are described below.

- NetView for AIX

The MIB Browser operates directly on the MIB file (MACDMI.MIB). Copy MACDMI.MIB to the usr OV snmp_mibs directory. To load the MIB: start NetView for AIX, select **OPTIONS** and then the **LOAD/UNLOAD MIB** option.

To view the LAN adapter attributes, select **TOOLS** and then the **MIB Browser** option. Use the **Down Tree** option to traverse the MIB tree and locate the LAN adapter attributes. The path through the MIB tree is:

```
internet->private->enterprises->ibm->  
  ibmArchitecture->ibmDmi->mibsFromMifs->  
    ibmLanAdapter->dmtfGroups
```

Click on **Start Query** to obtain the value of a MIB attribute.

- NetView for Windows

The MIB Browser operates on the MIB definition file (MACDMI.DEF) that defines the structure of the MIB. The default path for this file is the <install_dir> BIN DEF_FILE directory. The default <install_dir> is NVWIN.

Copy MACDMI.DEF to the <install_dir> BIN DEF_FILE directory and copy MACDMI.MIB to the <install_dir> BIN MIBS directory.

To view the LAN adapter attributes, use the MIB Browser function and the **Load MIB Tree** option to load the MIB definition file (MACDMI.DEF). This will display the tree of MIB attributes that represent the LAN adapter. Double-click any MIB attribute to obtain its value. Double-click a second time to graph the value; this would be useful for an attribute such as Ring Utilization.

Appendix C. Using a Memory Manager

If your computer comes with a memory manager preinstalled, or if you would like to use one, you must configure your computer so that the memory manager does not use the same memory as your PC Card. If you have more than one PC Card, you must reserve the memory needed for all of them. One PC Card cannot use the same memory ranges as another.

To determine whether or not your computer has a memory manager, edit your CONFIG.SYS file and look for the memory manager driver name. For example, when using EMM386, look for:

```
DEVICE=C:\DOS\EMM386.EXE . . . . .
```

When using a memory manager, considerations for your PC Card environment (Point Enabler or Card and Socket Services) are required. Listed here are explanations for handling these environments with a memory manager. It is not intended to be all-inclusive. To understand completely your memory manager and your configuration files, refer to your computer's operating system manual.

Memory Managers with Point Enablers

- To prevent duplicate use of a memory location, the area used by your PC Card must be excluded from the memory manager. To do this, you must edit your CONFIG.SYS file. In certain environments, LANAIID will add the exclude statement automatically.

If you are using enhanced mode, 8 KB of memory must be excluded. If you are using compatibility mode, 24 KB of memory must be excluded.

- For the point enabler, the required exclusions are shown in the example below (using EMM386, this is done using the X= parameter):

For enhanced mode:

```
DEVICE=C:\POINTTR.EXE SA RS=4 MMIO=D000 IRQ=9 SRAM=D000,4 WS=0
.
.
DEVICE=C:\DOS\HIMEM.SYS
.
.
DEVICE=C:\DOS\EMM386.EXE 1024 RAM X=D000-D1FF
```

For compatibility mode:

```
DEVICE=C:\POINTTR.EXE SA RS=4 MMIO=D000 IRQ=9 SRAM=D800,16 WS=0
.
.
DEVICE=C:\DOS\HIMEM.SYS
.
.
DEVICE=C:\DOS\EMM386.EXE 1024 RAM X=D000-D1FF X=D800-DBFF
```

Notice that the EMM386 line excludes the ranges that the POINTTR.EXE enabler uses.

Memory Managers with Card and Socket Services

1. To prevent duplicate use of a memory location, the area used by your PC Card must be excluded from the memory manager. To do this, you must edit your CONFIG.SYS file. In certain environments, the installation program will add the exclude statement automatically.

If you are in enhanced mode, 8 KB of the MMIO range must be excluded.

If you are in compatibility mode, 8 KB of the MMIO range (MMIO base address default of D000) and 16 KB of the Shared RAM (SRAM) range (SRAM base address default of D800) must be excluded.

In addition, Card Services needs at least 4 KB excluded for its use. Remember, if you are using more than one PC Card, the

memory locations for the other PC Cards must also be excluded.

2. Card Services and memory managers typically do not talk to each other. You must tell them what areas can be used. For example, with IBM Card Services the /MA option is used to tell Card Services what memory range it can use for PC Cards. It also uses some of this area for itself. That same /MA range must be excluded from the memory manager line. This will prohibit the memory manager from also using that same space.

For IBM CS, the /MA is used to specify the range of memory the PC Cards and Card Services use. The parameter is added to the Resource Map Utility line in your CONFIG.SYS. For example:

- Using IBM Card Services:

On a computer using memory range C0000-CFFFF

```
DEVICE=C:\DOS\EMM386.EXE NOEMS X=C000-CFFF
```

```
.
```

```
DEVICE=C:\DOS\DICRMU02.SYS /MA=C000-CFFF
```

The Resource Map Utility driver name may be slightly different for the various computers. Consult your operating manual.

- Using Phoenix Card Services with the /ADDR option:

For some versions of Phoenix Card Services, the /ADDR parameter is used to specify the 4-KB memory range used by Card Services. The memory range chosen for the PC Cards must not conflict with this range. The /ADDR parameter is placed on the Phoenix device driver line in the CONFIG.SYS file. Consult your operation manual as to the version you have and whether the /ADDR option is needed.

Note: The /ADDR needs only the starting address of the Card Services memory area.

On a computer using memory range D0000-DFFFF

```
DEVICE=C:\DOS\EMM386.EXE NOEMS X=D000-DFFF
```

```
.  
.
```

```
DEVICE=C:\PCPLUS\PCMCS.EXE /WAIT=12 /ADDR=D0 /IRQ=9
```

3. General Rules:

IBM Card Services

- a. The memory area used by PC Cards must fall within the range specified by /MA.
- b. The memory area used by Card Services itself (4 KB) must be included in the /MA range.
- c. All of the /MA range must be excluded from your memory manager line.

Phoenix Card Services

- a. The memory used by Card Services starting at the /ADDR address and the memory used by the PC Card should be excluded from the memory manager line.
- b. If the /ADDR line is not used, the driver will use the first available address on a 4-KB boundary for Card Services. The memory manager line must exclude this area and the PC Card memory area.

Expanded Memory Specification

Expanded memory specification (EMS) requires 64 KB (one page frame) of contiguous memory. This may cause you to move your PC Card memory range. With EMM386 you set the page frame base address using the FRAME= option on the memory manager line in the CONFIG.SYS. If the FRAME= option is not used, EMM386 will find the first 64-KB block of contiguous memory. For example:

1. Using a point enabler with the PC Card at D0000-DBFFF, the C0000-CFFFF range is free for the EMS page. A sample enhanced mode memory manager line in your CONFIG.SYS is:

```
DEVICE=C:\DOS\EMM386.EXE RAM 1024 X=D000-D1FF FRAME=C000
```

Note: The Token-Ring PC Card uses D0000-D1FFF for 8-KB MMIO. The FRAME= parameter sets the base address of the

EMS page frame (the page frame uses C0000-CFFFF). So, no PC Cards should be set to use memory in the range C0000-CFFFF.

2. Using a point enabler with the PC Card at D0000-DBFFF, the C0000-CFFFF range is free for the EMS page. A sample compatibility mode memory manager line in your CONFIG.SYS is:

```
DEVICE=C:\DOS\EMM386.EXE RAM 1024 X=D000-D1FF  
X=D800-DBFF FRAME=C000
```

Note: The Token-Ring PC Card uses D0000-D1FFF for 8-KB MMIO and D8000-DBFFF for 16-KB SRAM. The FRAME= parameter sets the base address of the EMS page frame (the page frame uses C0000-CFFFF). So, no PC Cards should be set to use memory in the range C0000-CFFFF.

3. Using IBM Card Services, you can set the /MA option such that a 64-KB block is free for the EMS page frame. A sample memory manager line in your CONFIG.SYS is:

```
DEVICE=C:\DOS\EMM386.EXE RAM 1024 X=D000-DBFF FRAME=C000  
.  
.  
DEVICE=C:\DICRMU01.SYS /MA=D000-DBFF
```

Note: Because of the /MA option, IBM CS will use memory in the range D0000-DBFFF only. The FRAME= parameter sets the base address of the EMS page frame (the page frame uses C0000-CFFFF). So, no PC Cards should be set to use memory in the range C0000-CFFFF.

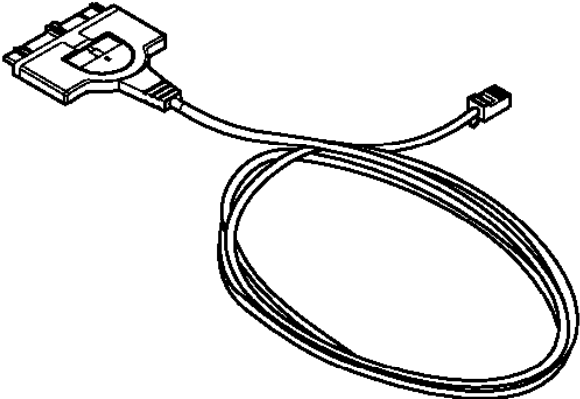
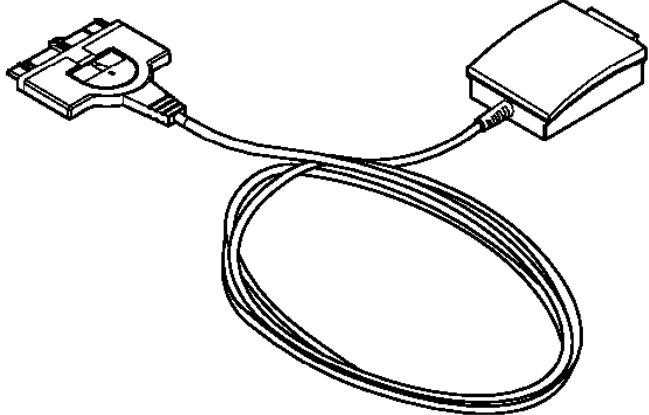
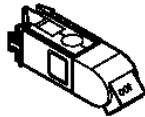
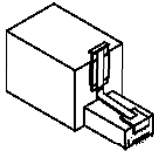
Appendix D. SystemSoft Card and Socket Services Specifics

Notes for installing on Compaq machines using SystemSoft Card and Socket Services with DOS or Windows 3.1:

- 1** After installing and configuring the card using LANAIID, go to the CPQDOS directory, or the directory containing SystemSoft C&SS and the file PC-CARD.EXE.
- 2** Run PCCARD.BAT and click **Utility** and then **Resource Allocation**.
- 3** Click **Open** and the appropriate memory range for the card.
- 4** Click **Edit** and then **Change**.
- 5** Change the memory range to comply with the range of the card and then click **Include**.
Note: When performing step 5, it may be necessary to change the exclude range specified in the EMM386 driver setting in the CONFIG.SYS file.
- 6** Click **OK**.
- 7** Click the appropriate I/O and IRQ ranges for the card and include their ranges as well by repeating the previous three steps.
- 8** Click **Save** and remove any cards from their slots when prompted to do so.
- 9** Click **OK, Done, File**, and then **Exit**.
- 10** This procedure will modify the CSALLOC.INI file.
- 11** The CARDID.INI file may also need to be edited manually to comply with the card's settings.

Appendix E. Parts Information

Table E-1. Part Numbers

Part Number	Description	Diagram
38H7044	PC Card Cable	
38H7046	PC Card Cable	
73G8314	STP Connector (RJ-45 for Data Connector); converts RJ-45 to Token-Ring	
73G2305	RJ-11 to RJ-45 Modular Adapter	

To order the first three items, call the IBM Maintenance Parts and Warranty Center 1-800-388-7080 (United States only). To order the last item, contact your authorized IBM cable dealer.

Appendix F. Hot-Pluggability and Suspend/Resume Issues

The DOS ODI, DOS NDIS, OS/2 ODI, OS/2 NDIS, and Windows 95 (NDIS 3) drivers support a level of *hot-pluggability* and Suspend/Resume. Hot-pluggability refers to the ability to remove and insert your card at any time while the machine is running. If you follow these guidelines, no damage will occur to either your PC Card, machine, or software. Hot-plugging has the advantage of allowing you to remove your card when you are using battery power, thus reducing the drain on your battery. It also provides greater freedom in using portable computers in a portable manner. The IBM Turbo 16/4 Token-Ring PC Card appears to be removed physically from a system when the cable is removed. The PC Card appears to the system to be inserted when its cable is reattached to the PC Card. This makes it possible to hot-plug the PC Card without physically removing it from the socket. Attach or remove your cable instead of physically removing the PC Card.

To use the hot-plugging features of this card, you must:

- Use Card and Socket Services. If you are using a point enabler, *do not* attempt to unplug your card while the machine is powered on. You might damage both your card and the machine in this case.
- Use the Windows 95, DOS ODI environment, DOS NDIS environment, OS/2 ODI environment, or OS/2 NDIS environment. At the present time the DOS Native environment does not support hot-pluggability. Removing your card while using this environment might result in a system failure or the inability to access your LAN applications.
- Do not hot-plug a card when in a Windows for Workgroups environment. Your card does not have to be present when NET START is run. If you plan to access your network in your Windows session, insert your card before starting Windows. If you plan to pull out your card, shut down Windows before doing so. It is suggested that you include your Network Address in the protocol.ini if you execute NET START without a

card present. This ensures that the system has your card's address even if the card is not present.

The following sections describe, in more detail, the exact procedure to follow for each of the supported hot-plugging environments.

Windows 95 (NDIS 3)

Windows 95 has built-in support for hot plugging and suspend/resume. Windows 95 recognizes the PC Card when it is inserted into a PCMCIA socket (or the cable is attached to an inserted PC Card) and loads the correct driver and configured protocol stack for the PC Card.

If you plan to disconnect from your network, click the PC Card icon on the status bar. A message box appears with a message to stop the PC Card. Click this box. When the Safe to remove message appears, you can either remove the cable or physically remove your PC Card.

DOS ODI Hot-Pluggability and Suspend/Resume

It is recommended that you use the NetWare Event Service Layer program (NESL.COM) for hot-plugging to work in this environment. Without this support, you should use the following procedure.

To remove the card or go into a suspend mode, you must first unload all the drivers. This is done by removing them in the reverse order they were installed. This can be accomplished by typing the following commands at the DOS prompt:

```
netx u      (or vlm u)
ipxodi u
tokencs u
lsl u
```

At this point, you can remove the card from your machine. Once the card is removed, you can enter and exit suspend mode as often as you like before reinstalling the card. It is best to reinstall the card while the machine is not in suspend mode.

After reinserting the card or resuming, you can restart your network software by typing the following commands at the DOS prompt:

```
lsl  
tokens  
ipxodi  
netx
```

DOS NDIS Hot-Pluggability

You can insert and remove your card before and after using Windows for Workgroups. You cannot hot-plug the card while using Windows for Workgroups. Insert the card before starting the software. Remove the card only after exiting the Windows for Workgroups environment.

OS/2 ODI Hot-Pluggability and Suspend/Resume

You can remove the card or go into suspend mode at any time as long as you are not running any applications that use shared resources. When you reinsert the card, you might have to log back on to your server and reattach your shared resources.

OS/2 NDIS Hot-Pluggability and Suspend/Resume

You can remove the card or go into suspend mode at any time as long as you are not running any applications that use shared resources. After you reinsert the card or resume, you should have all of your LAN shared resources connected. If you use CM/2 to connect to the host, you will have to log on again.

One scenario that does not work is suspending and then removing the card. The card will not be recognized when it is reinserted. If you want to do something like this, you must first remove the card and then suspend. You can then resume later and reinsert the card later.

Appendix G. Remote Program Load

The Remote Program Load (RPL) function enables a network adapter to boot a computer using files the computer receives from a LAN server. The computer that requests these files is referred to as the *client computer*, and the computer that responds with these files is referred to as the *LAN server*. In order for RPL to take place, two things must occur. First, the RPL feature of the adapter in the client machine initiates the RPL request. Second, a LAN server responds to the RPL request with the files to bring up, or boot the client computer.

The IBM Turbo 16/4 Token-Ring PC Card supports RPL from the following servers:

- IBM OS/2 LAN Server Version 3.0 (CSD level IP07060 or higher)
- IBM OS/2 LAN Server Version 4.0 (CSD level IP08152 or higher)
- IBM OS/2 Warp Server
- Novell NetWare 3.11 or higher

Please read the \RPL\README.RPL file on *Diskette 2, Drivers* for any updated information on RPL procedures available after this manual was published.

The following sections describe:

- “Setting Up Your Client Computer for RPL” on page G-2
- “Setting Up Your OS/2 LAN Server to Support RPL from the IBM Turbo 16/4 Token-Ring PC Card” on page G-3
- “Setting Up Your Novell NetWare Server to Support RPL from the IBM Turbo 16/4 Token-Ring PC Card” on page G-4
- “RPL Messages” on page G-8
- “Troubleshooting RPL Problems” on page G-9

Setting Up Your Client Computer for RPL

In order for the RPL process to begin, the RPL feature must be enabled on the adapter installed in the client computer, and the client computer must recognize the RPL feature of the adapter as the first or only bootable device present.

RPL is always enabled on the IBM Turbo 16/4 Token-Ring PC Card.

To make RPL the first bootable device, refer to your computer's user's manual or contact the manufacturer if you are not sure whether it supports RPL.

In most IBM ThinkPads, RPL is supported. To enable RPL on the IBM ThinkPad, you need to select the network device as the first bootable device in the startup sequence in the configuration utility (usually you enter the configuration utility by pressing F1 while the machine is powered up and the memory is being counted in the upper left corner of the screen). Refer to the user's manual for your IBM Thinkpad if you need further instructions for altering the startup sequence or entering the configuration utility.

Once you have successfully selected RPL as the first startup, or boot, device, you will see an RPL panel when your client machine is booting. The following is an example of this RPL panel:

```
IBM Turbo 16/4 T-Ring PC Card RPL v1.00 (970110)
(C) Copyright 1991 - 1994 Novell, Inc. All Rights Reserved.
(C) Copyright 1996 IBM Corp. All Rights Reserved.

RPL-ROM-HSM: 200 BU-0000
RPL-ROM-HSM: 201 OP-0000 16

RPL-ROM-ADR: 0004 ACB8 0001
RPL-ROM-IRQ: 2
RPL-ROM-MM1: D600
RPL-ROM-MM2: D800
RPL-ROM-PIO: 0A20

RPL-ROM-FFC: 1
RPL-ROM-SFC: 1
RPL-ROM-SEQ: 1
```

This sample shows how the screen will appear if the adapter has successfully opened onto the ring and has contacted a LAN Server.

Setting Up Your OS/2 LAN Server to Support RPL from the IBM Turbo 16/4 Token-Ring PC Card

This manual assumes that you have already set up your OS/2 LAN Server for RPL and installed the DOS or OS/2 RPL image. If you have not, refer to the OS/2 LAN Server documentation and install RPL support before installing RPL support for the IBM Turbo 16/4 Token-Ring PC Card on the OS/2 LAN Server. In summary, at this point you should have already performed the following steps:

- 1** Installed OS/2 LAN Server DOS or OS/2 RPL support.
- 2** Run RIPLINST.EXE if you installed OS/2 RPL support, to install an OS/2 RPL image. The RIPLINST.EXE utility is normally on diskette 7 of the OS/2 installation diskettes. You must use the OS/2 unpack command to unpack the RIPLINST file before you can run it.
- 3** Installed any service fixpaks required
LAN Server 3.0: IP07060 or later
LAN Server 4.0: IP08152 or later
Use the OS/2 SYSLEVEL command on your OS/2 LAN Server to check the CSD level.
- 4** Run any post-service updates for RPL described in the fixpak IPxxxxx.INF file (xxxxx is the fixpak level being applied). Use the OS/2 VIEW.EXE command to view this file.

Once these steps are complete, run the following steps on the OS/2 LAN Server to add RPL support for the IBM Turbo 16/4 Token-Ring PC Card:

- 1** Insert *Diskette 2, Drivers*. Open an OS/2 window.
- 2** Run A:\RPL\CFGRPL to add configuration files and drivers for this PC Card.
- 3** While logged on with administrator authority, create an RPL workstation image for each client computer with an IBM

Turbo 16/4 Token-Ring PC Card installed. This procedure is described in the OS/2 LAN Server documentation. For the Server Record Identifier, use:

Client Operating Environment	Record Identifier
OS/2 2.11	R_221_OTKTCS
OS/2 3.0	R_230_OTKTCS
OS/2 4.0	R_240_OTKTCS
DOS	R_DTKTCS_NDIS

- 4** Run RPLSETD for each OS/2 client created to select the bus type (ISA), display type, and swap file location.

Setting Up Your Novell NetWare Server to Support RPL from the IBM Turbo 16/4 Token-Ring PC Card

RPL to NetWare servers with the IBM Turbo 16/4 Token-Ring PC Card uses two programs on the NetWare server. These programs are shipped with the NetWare server product. The below table lists the recommended versions of them to use. If needed, an update is available from Novell's World Wide Web page. Novell's Home page is <http://www.novell.com>. Both programs are included in the file rplkt4.exe.

Table G-1. NetWare Program Versions

File	Directory	Size	Date and Time
RPL.NLM	\SYSTEM	6389	5-23-96 3:24p
RBOOT.RPL	\LOGIN	8074	4-30-96 10:46a

To RPL clients with the IBM Turbo 16/4 Token-Ring PC Card from a NetWare server, you must:

- 1** Power on a NetWare Client machine and log on to the NetWare Server with supervisor authority.
- 2** Generate a bootable client diskette for this adapter, and run the DOSGEN program located in the \SYSTEM directory on the Novell NetWare Server. For information on running

DOSGEN or for more detailed information on setting up unique RPL images for specific adapters, refer to the Novell NetWare documentation.

- 3** Add the following two lines to the AUTOEXEC.NCF file located in the \SYSTEM directory on the NetWare Server:

```
load rpl
bind rpl to <driver>
```

where <driver> is the Token-Ring driver loaded on your NetWare Server.

The following steps make up a sample procedure for creating a NetWare Client boot image:

- 1** Prepare a bootable DOS diskette. Perform either step 1a for a VLM image or 1b on page G-6 for a NETX image:

- a** VLM image

Place the following files on the bootable DOS diskette:

COMMAND.COM	AUTOEXEC.BAT	CONFIG.SYS	NET.CFG
LSL.COM	TOKENCS.COM	ROUTE.COM	IPXODI.COM
VLM.EXE	CONN.VLM	SECURITY.VLM	NWP.VLM
REDIR.VLM	IPXNCP.VLM	NDS.VLM	FIO.VLM
PRINT.VLM	TRAN.VLM	BIND.VLM	GENERAL.VLM
NETX.VLM			

Your CONFIG.SYS file should have the following statements:

```
REM Use these three if you want to use high memory and
REM XMS memory.
REM DOS=HIGH
REM DEVICE=A:\HIMEM.SYS
REM DEVICE=A:EMM386.EXE NOEMS
FILES=40
BUFFERS=20
LASTDRIVE=Z
```

Your AUTOEXEC.BAT file should have the following statements:

```

PATH A:\
PROMPT $P$G
SET NWLANGUAGE=ENGLISH
LSL
TOKENCS
ROUTE
IPXODI
VLM
LOGIN yourID
REM If you issue commands that reload COMMAND.COM,
REM you must also copy COMMAND.COM
REM to the NetWare Server \system directory and
REM uncomment the COMSPEC command statement below.
REM SET COMSPEC=F:\SYSTEM\COMMAND.COM

```

b NETX image

Place the following files on the bootable DOS diskette:

```

COMMAND.COM  AUTOEXEC.BAT  LSL.COM          NETX.EXE
TOKENCS.COM  ROUTE.COM          IPXODI.COM       NET.CFG

```

Your AUTOEXEC.BAT should have the following statements:

```

PATH A:\
PROMPT $P$G
LSL
TOKENCS
ROUTE
IPXODI
NETX
F:
LOGIN yourID
REM If you issue commands that reload COMMAND.COM,
REM you must also copy COMMAND.COM
REM to the NetWare Server \system directory and
REM uncomment the COMSPEC command statement below.
REM SET COMSPEC=F:\SYSTEM\COMMAND.COM

```

- 2** Update the diskette with TOKENCS.COM from *Diskette 2, Drivers*.

- 3** Generate the image using DOSGEN (see the Novell documentation for information on creating images and running DOSGEN).

Following is a sample of the NET.CFG file for VLM or NETX clients:

```
Link Driver TOKENCS
```

```
    FRAME TOKEN-RING MSB
```

```
    MAX FRAME SIZE 4096
```

```
    PORT A20
```

```
NetWare DOS Requester
```

```
    FIRST NETWORK DRIVE = F
```

```
    NETWARE PROTOCOL = NDS BIND
```

RPL Messages

RPL-ROM-HSM: 200 BU-0000

Explanation: Bring-Up. This field is displayed as X'0000' if the adapter has been successfully initialized. If not, a code other than X'0000' is displayed. If a failure occurs, a second attempt will be made before RPL halts. See "Troubleshooting RPL Problems" on page G-9.

RPL-ROM-HSM: 201 OP-0000 16

Explanation: Open Return Code. The first 4 digits are X'0000' and the last 2 digits identify the adapter data rate, if the adapter has been successfully opened and attached to the network. If not, a code other than X'0000' is displayed. If a failure occurs, a second attempt will be made before RPL halts. See "Troubleshooting RPL Problems" on page G-9.

RPL-ROM-ADR: 0004 ACB8 0001

Explanation: Adapter Address. The permanently encoded address of the Token-Ring adapter in your computer. This address is always 12 hexadecimal characters (6 bytes) long.

RPL-ROM-IRQ: 2

Explanation: Interrupt. This is the hardware interrupt the adapter is using.

RPL-ROM-MM1: D600

Explanation: Memory (Read-Only Memory). Segment address in memory where the 8 KB of RPL ROM is located.

RPL-ROM-MM2: D800

Explanation: Shared RAM Memory. Segment address in memory where the 16 KB of RPL RAM is located.

RPL-ROM-PIO: 0A20

Explanation: I/O Address. Adapter I/O Address port.

RPL-ROM-FFC: 1

Explanation: FIND Frame Count. The number (in hexadecimal) of FIND frames that have been transmitted. An excessive request count indicates that the LAN server is not present, is congested, or is not correctly configured to RPL this adapter.

RPL-ROM-SFC: 1

Explanation: SEND.FILE.REQUEST Frame Count. The number of SEND.FILE.REQUEST frames that have been transmitted. An excessive SEND.FILE.REQUEST frame count indicates that the LAN server is not responding after having been found.

RPL-ROM-SEQ: 1

Explanation: File Response Sequence Number. This value is displayed when the LAN server has responded to the SEND.FILE.REQUEST. It indicates how many times valid FILE.DATA.RESPONSE frames have been received.

Troubleshooting RPL Problems

The following chart is helpful if, when using an RPL feature on a client computer, you do not get the expected results.

If other computers on the network need problem determination, you might need one or more of the following documents:

- The operator's guide for your computer
- The problem determination guide for network-related problems

Table G-2 (Page 1 of 2). Failure Indication Messages

Failure Indication	Action
The computer's BASIC panel appears, or the computer boots to the hard disk or diskette drive.	Perform the steps in "Setting Up Your Client Computer for RPL" on page G-2.
A Bring-Up Error. The BU field on the client computer has a non-0 value and an RPL halted message.	See list item 1.

Table G-2 (Page 2 of 2). Failure Indication Messages

Failure Indication	Action
An Open Error. The OP field on the client computer has a non-0 value and an RPL halted message.	See list item 2.
The Client computer display panel shows any response that has not been identified.	Read the problem/solution section in the \RPL\README.RPL file on <i>Diskette 2, Drivers</i> . If this does not help, contact IBM Support.

1 Bring-Up Error

The RPL feature tried twice and was unable to initialize the adapter for use. The BU error codes and the action to take are listed here:

Hex Value	Cause	Action
0020-002F, 0030-003F	A module on the adapter is not responding correctly.	The adapter appears to be defective. Run the adapter diagnostics.
FFFF or FFFE	Initialize time-out.	The adapter never received an initialization interrupt. The adapter appears to be defective. Run the adapter diagnostics.
	All others.	Adapter failure. The adapter appears to be defective. Run the adapter diagnostics. Contact your network administrator if problems persist.

2 Open Error

The open error field (OP) contains an error code.

Hex Value	Cause	Action
0011, 0010	No media attached.	Connect the UTP or STP cable to the adapter.
0024	The adapter detected a ring speed mismatch.	The adapter will automatically change speed and open again. To keep this from occurring on every boot, follow the steps in "Setting Up Your Client Computer for RPL" on page G-2, and choose the correct ring speed.
002D	The adapter is trying to be the first active adapter on a Token-Ring network.	Start your LAN server. If the error persists, reboot the client computer.
All Others	Adapter open failure.	Refer to the <i>IBM Token-Ring Network Problem Determination Guide</i> or contact IBM Support.

Appendix H. LANAIDC Parameter Information

LANAIDC is the command line version of LANAID. It contains all of the function of LANAID without the graphical user interface. Its primary intended users are LAN administrators and other users who want to duplicate a certain IBM Turbo 16/4 Token-Ring PC Card configuration on multiple computers.

The LANAIDC program is in the same directory as LANAID. Typing LANAIDC without parameters will cause LANAIDC to use a configuration file called LANAIDC.CFG to configure the PC Card. This file is created by the graphical LANAID program after it successfully completes a PC Card configuration. See "Using LANAIDC to duplicate configurations" for more information about using the configuration file.

Type **lanaidc /h** to show the long help list for all the configuration parameters, and type **lanaidc /?** to show the short help list. Also, LANAIDC can be chosen from the menu that is displayed when the computer is booted from the LANAID installation diskette. Using this method to configure the PC Card with LANAIDC is not recommended, however, since correct configuration depends on the computer being booted in the environment under which the PC Card will run.

Using LANAIDC to duplicate configurations

In order to take a configuration performed by LANAID on one computer and duplicate it on others, follow these steps:

1. Boot the computer in the same environment that the PC Card will use.
2. If LANAID has not yet been installed, install it according to the instructions. See Chapter 5, "LANAID and IBM LAN Client."
3. Use LANAID to configure that computer for the PC Card, and exit LANAID. During configuration, LANAID creates a file called LANAIDC.CFG that contains all of the information required to recreate the same environment. The

LANAIDC.CFG file will have been placed in the same directory as LANAID.

4. Copy the following files to a diskette from the directory where LANAID was installed:

```
LANAIDC.EXE  
LANAIDC.MSG  
DDPRINS.MSG  
INSTALL.LST  
LANAIDC.CFG
```

5. Place the diskette in the computer on which the PC Card configuration is to be duplicated. At this point, you can either copy the files to a directory on the hard disk, which will allow LANAIDC to run more quickly, or you can run LANAIDC from the diskette.
6. Type **lanaidc** and press **Enter**, either from the diskette or the directory on the hard disk where the files were copied.
7. Upon completion, LANAIDC should display the PC Card configuration values.

LANAIDC Parameters

The parameters LANAIDC uses to configure the PC Card are listed here. If no options are given, LANAIDC.CFG will be used for input parameters. LANAIDC.CFG is created by LANAID after a successful store has been performed.

/FILE=<drive:\path\filename> - specify a file with input parameters
 /CFGSYS=<drive> - specify the drive of the CONFIG.SYS
 /MENUITEM=<keyword> - specify the menu item to install to in CONFIG.SYS
 /NOS - specify one of the following Network Operating Systems
 /NOS=NOVELL
 /NOS=W4W
 /NOS=LSPNDIS
 /NOS=VINES
 /NOS=LANTASTIC
 /NOS=OTHERNDIS
 /NOS=IBMLC
 /NOS=LSPNATIVE
 /NOS=MSLANMAN
 /NOSDIR=<drive:\dir> - specify directory where Network Operating System is installed
 /MODE=ENHANCED - specify Enhanced Mode
 /MODE=AUTO16 - specify Auto 16/4 Mode
 /IO=<###> - specify Hex IO address
 - Enhanced Mode values: 300 to EFC on a 4 byte boundary
 - Auto16 Mode values: A20 or A24
 /INT=<##> or /INT=AUTOSET - specify interrupt level
 (3,4,5,7,9,10,11,14,15) or Autoset if Card Services is present
 /MMIO=<#####> or /MMIO=AUTOSET- specify Hex MMIO address
 - values: C0000-DE000 on an 8K boundary or Autoset if Card Services is present
 /SRAM=<#####> or /SRAM=AUTOSET- specify Hex SRAM address
 (Auto16 Mode only)
 - values: C0000-DC000 on a 16K boundary or Autoset if Card Services is present
 /RS=<##> - specify ring speed (4 or 16)
 /AUTO=Y or /AUTO=N - enable/disable Auto Sense

/RSPROMPT=Y or /RSPROMPT=N - enable Ring Speed Prompt
 /SOCKET=<x> - specify socket letter (Point Enabler only)
 /VIEW - view the current configuration
 /LCDIR=<drive:\dir> - required input, install IBM LAN Client in
 this directory
 /NOUPDATE - opt. do not allow CONFIG.SYS and AUTOEXEC.BAT
 to be updated
 /WINDIR=<drive:\dir> - opt. Windows directory for Windows support
 /FTOKEN - opt. specify Frame Type = Token-Ring
 /FTOKENSNAP - opt. specify Frame Type = Token-Ring SNAP
 /NODEADDR=<#####x> - opt. Hex node address
 /MAXFRAMESIZE=<#####> - opt. Link Support Buffer 20-18000
 default=4500

Protocols

/NWCL32 - install Netware Client (32) Protocol Stack
 /FIRSTNETDRIVE=<#> - opt. sets 1st network drive, A-Z
 /PREFERREDSEVER=<#####> - opt. sets NetWare Server
 /AUTORECONLEVEL=<#> - opt. 0-5, default is 2
 /NAMECONTEXT=<#####> - opt. Netware 4 Networks only
 /8022 or /NETBIOS or /DLS - install 802.2, NetBios or DLS
 /MACHID=<#####> - required DLS Machine ID
 /USERNM=<#####> - required DLS User Name
 /DOMAINNM=<#####> - required DLS Domain Name
 /REDIR=B or /REDIR=F
 or /REDIR=V or /REDIR=P - required DLS Redirection,
 Full, Basic, Virtual, or Protect Mode
 /WINDLS - opt. install DLS window support,
 default=no
 /PEERDLS - opt. install DLS Peer Services,
 default=no
 /DLSSTART=N or /DLSSTART=Y or /DLSSTART=L - opt. DLS startup
 N=don't start DLS
 Y=start DLS but don't Logon,
 L= start DLS and log user on. default=N

```
/TCPIP - install TCP/IP support
/TCPIPADDR=<###.###.###.###> - required specify the local
IP address
/TCPIPMASK=<###.###.###.###> - required specify the local subnet
mask
/TCPIPGATE=<###.###.###.###> - opt. specify the default router
/TCPIPDOMAIN=<#####> - optional specify the domain name
/NAMESEVER=<###.###.###.###> - optional to identify nameservers
Each nameserver needs to be
specified with a /NAMESEVER=
keyword.

/? - display abbreviated help
/H or /HELP - display extended help
```

Appendix I. Notices and Warranty

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Notice to Users in the United Kingdom

The United Kingdom Telecommunications Act 1984. This apparatus is approved under General Approval number NS/G/1234/J/100003 for indirect connections to public telecommunications systems in the United Kingdom.

Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does

cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class B Emission Compliance Statement

This Class B digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Avis de conformité aux normes d'Industrie Canada

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Community (EC) Mark of Conformity Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22 / European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen. Der Aussteller der Konformitätserklärung ist die IBM Corporation, 3039 Cornwallis Road, Research Triangle Park, NC 27709.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse B.

Japanese Voluntary Control Council for Interference (VCCI) Statement

This equipment is in the 2nd Class category (information equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council for Interference by Information Technology Equipment aimed at preventing radio interference in such residential areas.

When used near a radio or TV receiver, it may become the cause of radio interference.

Read the instructions for correct handling.

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Product Warranty

IBML

International Business Machines Corporation Armonk, NY 10504

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Machine: Turbo 16/4 Token-Ring PC Card

Warranty Period*: Lifetime

**Elements and accessories are warranted for three months. Contact your place of purchase for warranty service information.*

Production Status

Each Machine is manufactured from new parts, or new and serviceable used parts (which perform like new parts). In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's warranty terms apply.

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IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. IBM calculates the expiration of the warranty period from the Machine's Date of Installation. The date on your receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

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For a feature, conversion, or upgrade, IBM or your reseller may require that the Machine on which it is installed be 1) the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Some of these transactions (called "Net-Priced" transactions) may include additional parts and associated replacement parts that are provided on an exchange basis. All removed parts become the property of IBM and must be returned to IBM.

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If a Machine does not function as warranted during the warranty period, IBM in its sole discretion will repair, replace it (with a Machine that is at least functionally equivalent), or refund the purchase price. To obtain coverage under the warranty you may be required to present proof of purchase.

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1. obtain authorization from the owner (for example, your lessor) to have IBM or your reseller service a Machine that you do not own;
2. where applicable, before service is provided —
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provide,
 - b. secure all programs, data, and funds contained in a Machine,
 - c. inform IBM or your reseller of changes in a Machine’s location, and
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3. be responsible for loss of, or damage to, a Machine in transit when you are responsible for the transportation charges.

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2. the amount of any other actual loss or damage, up to the greater of \$100,000 or the charge for the Machine that is the subject of the claim.

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1. third-party claims against you for losses or damages (other than those under the first item listed above);
2. loss of, or damage to, your records or data; or
3. economic consequential damages (including lost profits or savings) or incidental damages, even if IBM is informed of their possibility.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Glossary of Terms and Abbreviations

This glossary defines terms and abbreviations used in this manual. If you do not find the term you are looking for, refer to the index or to the *IBM Dictionary of Computing*, SC20-1699 (New York/ McGraw-Hill, Inc., 1994).

A

access unit. A unit that allows multiple attaching devices access to a Token-Ring network at a central point such as a wiring closet or in an open work area.

adapter address. Twelve hexadecimal digits that identify a LAN adapter.

address. (1) In data communication, the IEEE-assigned unique code or the unique locally administered code assigned to each device or workstation connected to a network. (2) A character, group of characters, or a value that identifies a register, a particular part of storage, a data source, or a data sink. The value is represented by one or more characters. (3) To refer to a device or an item of data by its address. (4) The location in the storage of a computer where data is stored. (5) In word processing, the location, identified by the address code, of a specific section of the recording medium or storage.

alert. (1) For IBM LAN management products, a

notification indicating a possible security violation, a persistent error condition, or an interruption or potential interruption in the flow of data around the network. See also *network management vector transport*. (2) In SNA, a record sent to a system problem management focal point to communicate the existence of an alert condition. (3) In the NetView program, a high-priority event that warrants immediate attention. This data base record is generated for certain event types that are defined by user-constructed filters.

attach. To make a device a part of a network logically.

Note:

Not to be confused with *connect*, which implies physically connecting a device to a network.

attaching device. Any device that is physically connected to a network and can communicate over the network.

B

Basic Input/Output System (BIOS). In IBM personal computers with PC I/O channel architecture, microcode that controls basic hardware operations such as interactions with diskette drives, fixed disk drives, and the keyboard.

C

command. (1) A request for performance of an operation or execution of a program. (2) A character string from a source external to a system that represents a request for system action.

configuration. (1) The arrangement of a computer system or network as defined by the nature, number, and chief characteristics of its functional units. More specifically, the term may refer to a hardware configuration or a software configuration. (2) The devices and programs that make up a system, subsystem, or network. (3) See also *system configuration*.

configuration parameters. Variables in a configuration definition, the values of which characterize the relationship of a product, such as a bridge, to other products in the same network.

connect. In a LAN, to physically join a cable from a station to an access unit or network connection point. Contrast with *attach*.

D

default. Pertaining to an attribute, value, or option that is assumed when none is explicitly specified.

device driver. The code needed to attach and use a device on a computer or a network.

diagnostics. Modules or tests used by computer users and service personnel to diagnose hardware problems.

diskette drive. The mechanism used to seek, read, and write data on diskettes.

F

fastpath transmit. An alternate transmit interface to the PC Card that provides higher throughput.

fault. An accidental condition that causes a functional unit to fail to perform its required function.

fixed disk drive. Synonym for hard disk drive.

frame. (1) The unit of transmission in some LANs, including the IBM Token-Ring Network and the IBM PC Network. It includes delimiters, control characters, information, and checking characters. On a Token-Ring network, a frame is created from a token when the token has data appended to it. On a token bus network (IBM PC Network), all frames including the token frame contain a preamble, start delimiter, control address, optional data and checking characters, end delimiter, and are followed by a minimum silence period. (2) A housing for machine elements. (3) In synchronous data link control (SDLC), the vehicle for every command, every response, and all information that is transmitted using SDLC

procedures. Each frame begins and ends with a flag.

H

hard disk drive. A stand-alone disk drive that reads and writes data on rigid disks and can be attached to a port on the system unit.

Synonymous with fixed disk drive, hard drive.

hot plugging. The ability to remove your adapter as long as you have shut down all the applications using the adapter. When you insert your adapter again, you can restart those applications.

I

initialize. In a LAN, to prepare the adapter (and adapter support code, if used) for use by an application program.

input/output (I/O). (1) Pertaining to a device whose parts can perform an input process and an output process at the same time. (2) Pertaining to a functional unit or channel involved in an input process, output process, or both, concurrently or not, and to the data involved in such a process.

insert. To make an attaching device an active part of a LAN.

interface. (1) A shared boundary between two functional units, defined by functional characteristics, common physical interconnection characteristics,

signal characteristics, and other characteristics as appropriate.

(2) A shared boundary. An interface may be a hardware component to link two devices or a portion of storage or registers accessed by two or more computer programs. (3) Hardware, software, or both, that links systems, programs, or devices.

interrupt. (1) A suspension of a process, such as execution of a computer program, caused by an external event and performed in such a way that the process can be resumed. (2) To stop a process in such a way that it can be resumed. (3) In data communication, to take an action at a receiving station that causes the sending station to end a transmission. (4) A means of passing processing control from one software or microcode module or routine to another, or of requesting a particular software, microcode, or hardware function.

interrupt level. The means of identifying the source of an interrupt, the function requested by an interrupt, or the code or feature that provides a function or service.

L

LAN adapter. The circuit card within a communicating device (such as a personal computer) that, together with its associated software, enables the device to be attached to a LAN.

LANAID. The LAN Adapter Installation and Diagnostic program. This program works to

simplify the installation and configuration of hardware and software in a non-Plug and Play environment.

LAN Client. IBM LAN Client is a protocol stack that operates in protected mode in the DOS TCP/IP, Novell IPX Client, NetBIOS, and IEEE 802.2 environments.

locally administered address. An adapter address that the user can assign to override the universally administered address. Contrast with *universally administered address*.

M

MAC frame. Frames used to carry information to maintain the ring protocol and for exchange of management information.

medium access control (MAC) protocol. In a local area network, the part of the protocol that governs communication on the transmission medium without concern for the physical characteristics of the medium, but taking into account the topological aspects of the network, in order to enable the exchange of data between data stations.

message. (1) A logical partition of the user device's data stream to and from the adapter. (2) A group of characters and control bits transferred as an entity.

Micro Channel. The architecture used by IBM Personal System/2 computers, Models 50 and above.

This term is used to distinguish these computers from personal computers using a PC I/O channel, such as an IBM PC, XT, or an IBM Personal System/2 computer, Model 25 or 30.

N

network administrator. A person who manages the use and maintenance of a network.

node. (1) Any device, attached to a network, that transmits and/or receives data. (2) An endpoint of a link, or a junction common to two or more links in a network. (3) In a network, a point where one or more functional units interconnect transmission lines.

node address. The address of an adapter on a LAN.

O

open. (1) To make an adapter ready for use. (2) A break in an electrical circuit. (3) To make a file ready for use.

operating system. Software that controls the execution of programs. An operating system may provide services such as resource allocation, scheduling, input/output control, and data management. Examples are IBM PC DOS and IBM OS/2.

option. (1) A specification in a statement, a selection from a menu, or a setting of a switch, that may be used to influence the

execution of a program. (2) A hardware or software function that may be selected or enabled as part of a configuration process. (3) A piece of hardware (such as a network adapter) that can be installed in a device to modify or enhance device function.

P

panel. The complete set of formatted information that appears in a single display on a visual display unit.

parameter. (1) A variable that is given a constant value for a specified application and that may denote the application. (2) An item in a menu or for which the user specifies a value or for which the system provides a value when the menu is interpreted. (3) Data passed between programs or procedures.

PC Card. In a LAN, within a communicating device, a circuit card that, with its associated software and/or microcode, enables the device to communicate over the network.

port. (1) An access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached. Synonymous with *socket*.

protocol. (1) A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (2) In SNA, the meanings of and the

sequencing rules for requests and responses used for managing the network, transferring data, and synchronizing the states of network components. (3) A specification for the format and relative timing of information exchanged between communicating parties.

R

random access memory (RAM). A computer's or adapter's volatile storage area into which data may be entered and retrieved in a nonsequential manner.

read-only memory (ROM). A computer's or adapter's storage area whose contents cannot be modified by the user except under special circumstances.

remove. (1) To take an attaching device off a network. (2) To stop an adapter from participating in data passing on a network.

ring network. A network configuration in which a series of attaching devices is connected by unidirectional transmission links to form a closed path. A ring of an IBM Token-Ring Network is referred to as a LAN segment or as a Token-Ring Network segment.

S

server. (1) A device, program, or code module on a network dedicated to providing a specific service to a network. (2) On a LAN, a data station that provides facilities to other data stations.

Examples are a file server, print server, and mail server.

shallowmode. A new mode that allows the workstation to assist the PC Card in the reception of information from the Token Ring. When chosen, fastpath transmit is used as well.

shared RAM. Random access memory (RAM) on an adapter that is shared by the computer in which the adapter is installed.

socket. Synonym for *port* (2).

system. In data processing, a collection of people, machines, and methods organized to accomplish a set of specific functions.

system configuration. A process that specifies the devices and programs that form a particular data processing system.

T

telephone twisted pair. One or more twisted pairs of copper wire in the unshielded voice-grade cable commonly used to connect a telephone to its wall jack. Also referred to as “unshielded twisted pair” (UTP).

token. A sequence of bits passed from one device to another on the Token-Ring network that signifies permission to transmit over the network. It consists of a starting

delimiter, an access control field, and an end delimiter. The access control field contains a bit that indicates to a receiving device that the token is ready to accept information. If a device has data to send along the network, it appends the data to the token. When data is appended, the token then becomes a frame. See *frame*.

Token Ring. A network with a ring topology that passes tokens from one attaching device (node) to another. A node that is ready to send can capture a token and insert data for transmission.

Token-Ring network. (1) A ring network that allows unidirectional data transmission between data stations by a token-passing procedure over one transmission medium so that the transmitted data returns to and is removed by the transmitting station. The IBM Token-Ring Network is a baseband LAN with a star-wired ring topology that passes tokens from network adapter to network adapter. (2) A network that uses a ring topology, in which tokens are passed in a sequence from node to node. A node that is ready to send can capture the token and insert data for transmission. (3) A group of interconnected Token Rings.

twisted pair. A transmission medium that consists of two insulated conductors twisted together to reduce noise.

U

unshielded twisted pair (UTP). See *telephone twisted pair*.

universally administered address. The address permanently encoded in an adapter at the time of manufacture. All universally administered addresses are unique. Contrast with *locally administered address*.

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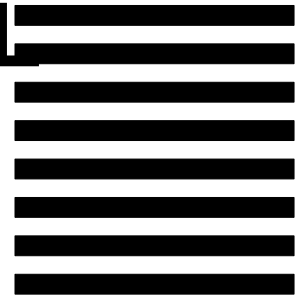
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