



Remotely Managed PCs

Network Administrator's Guide

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Note

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About This Guide

This guide is intended for network administrators who are interested in learning about the built-in networking features of IBM Personal Computer models. These features make IBM PCs especially suited for a remotely managed network environment. The information in this guide can help you take advantage of the networking features to get these models quickly installed in your network and to manage them remotely through the use of network-management software.

Several network-management software packages are discussed to show their diversity of function, protocols, implementation, and compatibility.

Also included is a section dedicated to setting up and managing IBM PC models that do not have diskette drives. For PC models without a diskette drive, you must perform tasks such as installing operating systems, installing and updating device drivers, flashing BIOS, and running diagnostics differently from what you might be accustomed to doing.

World Wide Web addresses are used throughout this guide to point to sources of additional information. As of the writing of this guide, the addresses were verified to be correct, but with the World Wide Web being as dynamic as it is, addresses do change. If you run across an invalid address, try the vendor's main address and use the search engine to locate the subject matter within the Web site. The following are examples of main addresses:

```
http://www.ibm.com
http://www.microsoft.com
http://www.intel.com
```

This guide also refers to the *Ready-to-Configure CD*. The actual name of this CD varies by model. On some models it is called the *Ready-to-Configure Utility Program CD*; on others it is called the *Ready-to-Configure CD*. On some models announced during the second half of 1998, the *Ready-to-Configure Utility Program CD* has been replaced with the *Software Selection CD*, which has a similar function, but a different interface.

Change History

This guide is subject to change as new information becomes available. The following will help you identify new content or changes that might affect you.

September 1998: The guide was updated to include information about the following:

- Alert on LAN
- System Management Controller
- Desktop Management Interface
- Enhanced Asset Information Area (also known as the Asset ID EEPROM)
- Universal Management Agent (UMA) and the UMA Plus plug-in modules
- LANClient Control Manager, Version 2.x
- Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) hard disk drives

Machine-type numbers have been added to model names for clarification.

November 14, 1997: Corrected selectable startup sequence information for PC 300XL and PC 300GL. Modified *plug in and go* information to allow for variations in factory-set selectable startup sequences.

December 5, 1997: Changed all IBM Web-site addresses starting with `http://www.us.pc.ibm.com` to start with `http://www.pc.ibm.com/us`. For example, the old address

`http://www.us.pc.ibm.com/cdt`

is now

`http://www.pc.ibm.com/us/cdt`

November 5, 1997: Incorporated editorial changes. No technical or procedural changes.

Chapter 1. Remotely Managed Computers

A remotely managed computer is a client workstation that is attached to a server-based network and managed remotely by a network administrator. The amount of remote network management varies depending on the customer's needs, but can include any or all of the following services:

Electronic Software Distribution: Delivering of operating systems, application programs, and device drivers through the network.

Maintenance: Updating BIOS and making diagnostic programs available over the network, as well as providing new versions of device drivers and other software.

Security: Maintaining passwords, performing virus scans on a regular basis, and monitoring for unauthorized cover removal or disconnection from the network.

Data Protection: Backing up the client workstations' data.

Software Control: Monitoring the software installed on each client workstation so you can ensure you have the correct number of software licenses and verify that no unauthorized software has been installed.

Asset Control: Verifying machine type, serial number, installed hardware features, and physical location of each client workstation on the network.

Remote Diagnostics: Running diagnostic routines or taking control of a remote computer to diagnose and perhaps repair a computer without having to physically send a member of your support staff to that location.

This list is not an all-inclusive list by any means. It is intended to point out a few of the tasks that can be handled remotely in a network-managed environment. In most cases, creating a network-managed environment is desirable because it enables network administrators to be more responsive to their customer's needs and less obtrusive for maintenance activities. Maintenance tasks can be done in off hours, when the computers are not normally in use. However, if you intend to use client workstations without diskette drives, a network-managed environment is essential.

Performance and Administrative Considerations

One method of network management currently in use today involves setting up one or more application servers for shared software applications and a file server for data storage. From an administration standpoint, this method is very effective. All application programs are maintained in one place and all data can be backed up from a central location. However, there are disadvantages. If a server has a problem, everyone on the network could find themselves in a down situation. Also, depending on the speed of the servers, the speed of the network itself, and the number of users on the network, performance might be unacceptable, especially during peak periods.

The alternative to using application servers and file servers is to store the application software and end-user data on the client workstation, thereby minimizing the dependency on the servers and reducing traffic on the LAN. Taking this approach has traditionally resulted in an administrative nightmare, but new network-management software tools and advancements in client workstations are making this a more viable alternative.

In most cases, the balance between administration and performance is a hybrid solution that involves maintaining shared resources where required (such as a shared database), off-loading applications and data to the client workstation where practical to reduce network traffic, and implementing new network-management tools to reduce the administrative overhead.

The Elements of a Network-Managed Environment

In addition to your server and server operating system, the ability to set up a network-managed environment depends on two key components:

- Your selection of network management software (see Chapter 2, “Network-Management Software” on page 5 for examples)
- Your selection of PCs to be used as client workstations

The IBM Personal Systems Group commercial desktop product line has been tailored for the network-managed environment by incorporating features such as:

- **Integrated network controller:** Many models have either an Ethernet controller integrated into the system board or an Ethernet adapter as a standard feature. Some models are also available with token-ring adapters.
- **Wake on LAN:** With the Wake on LAN feature, PCs can be powered on remotely over the network by a server or another client workstation. The server or client sends a wake-up packet across the network to the specified MAC address. This feature is key for performing off-hour maintenance tasks from a remote location.
- **Built-in extended network EEPROM:** All models that have either an integrated network controller or a network adapter also have an extended network EEPROM, which allows the PC to start an operating system or other startable image from a network server.
- **Selectable RPL/DHCP protocols:** Most models that have either an integrated network controller or a network adapter can be configured to operate with either an RPL or DHCP server.
- **Dual Selectable Startup sequences:** You can use the selectable startup sequence to define the order in which the PC looks for devices that can provide an operating system or other startup software. If the first device is not present, that device is bypassed and the PC looks to the next device. You can have up to four devices in the sequence. The following is a list of typical devices from which you can choose.
 - Diskette 0
 - Diskette 1
 - Network
 - Hard Disk 0
 - Hard Disk 1
 - CD-ROM

All models have two selectable startup sequences:

- **Startup sequence:** This is the sequence used when the computer is powered on from its power switch.
- **Automatic power on startup sequence:** This is the sequence used when the computer is powered on remotely (for example, over the LAN using the Wake on LAN feature).

Both of these sequences are very important when using network-management software, especially if that software initiates multiple restarts.

- **Flash over LAN capability:** With this feature, network-management software, such as the IBM LANClient Control Manager (LCCM) program, can update the POST/BIOS code over the network.
- **Disketteless operation:** If you are experiencing a problem with end users installing unauthorized software, introducing viruses, or copying software, you can disable the diskette drive and diskette drive controller through the Configuration/Setup Utility. However if you disable the diskette drive, you must either re-enable the drive for maintenance activities (running diagnostics, updating device drivers, and

so on) or use network-management software for maintenance activities. For additional information, see Chapter 5, “Special Considerations for Models without Diskette Drives” on page 35.

- **Alert on LAN:** Models that have the Alert on LAN feature have a module on the system board that monitors the critical functions of the computer regardless of the power-on state of the computer. When the computer is powered off or if a malfunction prevents the operating system from running, the hardware (Alert on LAN module) sends alerts over the network as events occur. When the operating system is running, a software agent (the Alert on LAN agent) that resides on the client computer periodically polls the Alert on LAN module for information and generates alerts over the network as needed. Alerts can be generated if someone tampers with the computer, if an error condition exists, or to report an informational event (such as the start of the power-on self-test (POST), a problem detected during POST, the completion of POST, and the start of the operating system). The Alert on LAN module interacts with client-based and server-based management software to alert a network administrator of an existing or potential problem. The Alert on LAN module continues to operate when the computer is in the powered-off state as long as the computer power cord is attached to a functioning ac power source. The Alert on LAN feature was made available on selected IBM products starting in the second quarter of 1998. For a listing of supported products, visit the Alert on LAN Web site at:

<http://www.ibm.com/pc/us/desktop/alertonlan>

For more information about the Alert on LAN feature, see “Alert on LAN” on page 24.

- **Enhanced Asset Information Area:** The Enhanced Asset Information Area is an EEPROM located on the system board where you can record, store, and retrieve information that is useful for tracking assets. Some of the fields, such as the asset serial number, are filled in during the manufacturing process. Other fields are blank and are intended to be filled in by the purchaser either through a hand-held radio frequency device or through software such as the IBM AssetCare program. The following is a list of fields typically defined in the Enhanced Asset Information Area:

- Asset name (component)
- Asset serial number
- Asset description
- System name (computer name as shown in the Windows Network Neighborhood)
- IP address
- MAC address
- Subnet Mask
- LCCM profile (name of a profile defining the software image to be installed over the network by the LANClient Control Manager (LCCM) program)
- Operating system
- Universally unique identifier (UUID)
- Name (of operator or other responsible party)
- Phone
- Department
- Location
- Position
- Login name
- Lease start (date)
- Lease end (date)
- Lease duration
- Lease amount
- Lessor
- Purchase date
- Last inventoried (date)
- Asset number
- RF-ID (The radio frequency identification number encoded in the computer)

- Personalization fields (label, value)
- Warranty fields (duration, end date, cost)
- System Management Controller: This controller monitors the following:
 - System-board temperature
 - Cooling-fan speed
 - Power-supply and processor voltages
 - Cover removal

Depending on the model, the System Management Controller alerts are intercepted either by software, which turns them into useful error indications, or by the Alert on LAN module (if installed) which transmits alert packets to the network administrator over the network. Like the Alert on LAN module, the cover-removal detection feature of System Management Controller continues to operate when the computer is in the powered-off state as long as the computer power cord is attached to a functioning ac power source.

- DMI BIOS, System Management BIOS, and DMI Software: The Desktop Management Interface (DMI) provides an effective way of managing computers. A database residing on each computer contains information about all DMI-compliant system components (hardware and software) contained in, attached to, or installed on that computer. The information is stored and organized within Management Information Format (MIF) files. The DMI service layer manages the database, interacts with the DMI-compliant components (including the DMI BIOS extension, Enhanced Asset Information Area, and operating system), and interacts with DMI management applications (such as the IBM Universal Management Agent program, Intel® LANDesk® Client Manager, and IBM Netfinity Manager and Services). By implementing the DMI tools and management applications, you can take advantage of a variety of features such as remote asset management, remote resource management, and remote verification of software.

The DMI architecture also lends itself to even more sophisticated management tasks, such as sending alerts over the network, responding to alerts by launching specialized applications, and taking control of a client over the network. For more information about DMI, see Chapter 4, “Understanding the Desktop Management Interface” on page 31.

- S.M.A.R.T. Hard Disk Drives: These hard disk drives use integrated Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) to monitor the status of the drive and generate predictive failure analysis (PFA) alerts if a potential failure exists within the drive. These alerts can be intercepted by software and converted into useful responses such as automated backup routines, e-mail messages, paging system messages, and screen messages. Two examples of software designed to handle PFA alerts are IBM SMART Reaction (a hard disk backup, mirror, and restoration tool) and the IBM Universal Management Agent program.

Because some of these features are set at the factory for a network environment, IBM Personal Computers are ready to be installed out of the box in most commercial environments. See “Plug In and Go” on page 13 for more information.

For information about the default settings and instructions for accessing, enabling, and disabling these features, see Chapter 3, “Working with Network-Management Features” on page 13.

Chapter 2. Network-Management Software

The term network-management software includes a broad range of software designed to reduce the administrative burden associated with networks. Unlike simple application programs, some network-management programs are designed to run in either a remote program load (RPL) or dynamic host configuration protocol (DHCP) environment. Some *push* software down from the server to the client workstation, while others set up an environment that allows a client workstation to *pull* software from the server. The approaches to reducing the administrative burden are as diverse as the individual tasks being addressed.

Push Technology

Push technology allows many tasks to be performed remotely by a network administrator. Actions are initiated at the server console and the services are *pushed* down to the selected client workstations with little or no end-user intervention. Some network-management software using push technology can accomplish tasks during off hours by using the Wake on LAN feature built into many IBM PC models.

Push technology usually requires some planning and script preparation. Some examples of tasks that can be managed with push technology are:

- Updating flash BIOS (Flash over LAN)
- Installing an operating system (with or without application programs)
- Installing updated files
- Enabling and disabling a BIOS administrator password
- Changing CMOS settings

Pull Technology

Pull technology allows many tasks to be performed at the client workstation by the end-user or a member of the support staff. Actions are initiated at the client workstation and services are *pulled* from a server. Access to the services is controlled by a network administrator, but the person located at the client workstation initiates the request for the service and in many cases controls how that service is implemented. Some examples of tasks that can be managed using pull technology are:

- Installing application programs
- Installing an operating system
- Updating an operating system with a later version

Network Protocols

The configuration of your network and the protocols you are using will influence your selection of network-management software. For example, some network-management software is designed to be used with client workstations configured for RPL. The span of control for this type of network management software is limited to a network segment where the workstations and servers are physically connected without the use of routers. Others are designed to be used with client workstations configured for DHCP. This type of network management software can be used within a network segment or in a wide area network (WAN) environment where switches and routers are used. And still others are basic application programs that are RPL and DHCP independent.

Coexistence of Network Management Software

Unfortunately, some network-management software cannot coexist with others. This could be because they use incompatible protocols or, if they use the same protocol, they might compete to provide service to the same client workstation. Because no single network-management software package provides a total solution for every condition that could possibly exist, you might need to use more than one. It is always a good idea to not only evaluate the features of network-management software, but also be aware of the protocols each uses and the compatibility with other network-management packages you are considering.

Client Workstation Hardware

The method of setting up a client workstation for either RPL or DHCP varies from network adapter to network adapter. It is generally controlled by an optional EEPROM module on the client workstation's network adapter (or on the client workstation's system board in the case of an on-board network feature). On some network adapters, you can switch between RPL and DHCP using a setup utility program. On other network adapters, you have to reprogram (flash) the EEPROM to change from one protocol to another. For information about setting up a specific client workstation, see "DHCP and RPL Settings" on page 20.

Tools Available

Network management is becoming an increasingly important part of managing a business, and new network-management tools are becoming available everyday. The tools discussed in this section are samples of the types of network-management software available today and how these tools can be used in combination to provide solutions.

IBM Universal Management Agent Program

The IBM Universal Management Agent (UMA) program is a result of the work being done through the IBM-Intel Advanced Manageability Alliance. UMA provides a number of network-management tools. The UMA program launches and manages each tool from a central interface using ActiveX controls in an Internet or Intranet environment. You can use the tools locally on the computer where the UMA program is installed or remotely using the Internet or Intranet to access the computer where the UMA program is installed.

The UMA program is divided into the following major components:

- **System Monitors:** This component contains Events, Alarms, and Responses (EAR); PC Health; BIOS Error Logging; and The Event Log Viewer. You can use these programs to monitor computer hardware status, set up automatic responses to system alerts, schedule events (such as backup operations), and view a history of errors, alerts, and events.
- **Resource Utilization:** You can use this component to gather information about audio devices, drives, input/output ports, memory, network devices, system resources, video devices, the battery (on mobile computers only), the keyboard, and the mouse.
- **Advanced Management Tools:** This component gives you access to the Desktop Management Interface (DMI) information and the Alert on LAN information.
- **Inventory Data:** You can use this component to view information about the basic hardware, to access a computer summary report, to view a software inventory, to view information about the operating system and associated device drivers, and to view the AssetCare information from the Enhanced Asset Information Area.

- **Configuration and Diagnostics:** This component contains a memory-scrubbing program (to correct latent errors in ECC memory) and the User Manager program (used to configure security features associated with UMA).

The UMA program is designed to accept *plug-in* programs to expand its functions. For example, the Universal Management Agent Plus plug-in program adds the following:

- **SMART Reaction:** The SMART Reaction program is a full-function backup, restore, and mirror program. You can use the program to perform routine, scheduled backup and mirror operations or perform emergency backup or mirror operations triggered by predictive failure analysis (PFA) alerts from S.M.A.R.T. hard disk drives.
- **System Updates:** System Updates provides direct access to the latest information available for your IBM PC by automatically linking to the IBM support Web site for device driver updates and new system information.
- **EZ Admin:** EZ Admin reduces the administrative overhead associated with user-induced problems by hiding or disabling operating system features or limiting user access to specific programs.
- **CoSession Remote for UMA:** Network administrators and other user-support personnel can use Artisoft CoSession Remote for UMA to access and control a second computer through the UMA interface, using an Internet or Intranet connection through either a modem or network. CoSession Remote gives the ability to run programs, reconfigure the computer, and remotely update software without having to be on site.
- **PC Doctor for UMA:** You can use the PC Doctor diagnostic tools to run diagnostic tests against major computer components. The UMA implementation of PC Doctor allows you to run these tests locally or remotely through the Internet or Intranet.

The UMA program can also integrate into a number of server-based management programs such as IBM Netfinity Manager; enterprise-management systems such as Tivoli TME 10, Tivoli NetView, and Microsoft System Management Server (SMS); and Microsoft Management Console (MMC). Additionally, you can configure the UMA program to forward SNMP traps to workgroup- and enterprise-level network management applications such as Microsoft SMS, Tivoli NetView, and Computer Associates Unicenter.

The UMA program is available from IBM free of charge to anyone who has a qualifying model of IBM PC, IntelliStation, ThinkPad, or Netfinity Server computer. For more information, visit the Universal Management Agent Web site at:

<http://www.ibm.com/pc/us/desktop/uma>

IBM LANClient Control Manager

LANClient Control Manager (LCCM) is a powerful tool designed specifically to remotely install and maintain software and BIOS updates on PCs connected to the network. LCCM uses push technology to accomplish the following tasks:

- Scan the network and recognize newly installed PCs
- Collect the serial number, type/model number, network adapter type, MAC address, type of video, amount of installed memory, and hard disk capacity
- Perform remote FDISK and FORMAT operations
- Remotely install operating systems and application programs, and personalize them for individual users
- Remotely flash system BIOS (on selected IBM models)
- Remotely flash adapter BIOS/EEPROM
- Copy and distribute CMOS settings
- Perform maintenance routines, such as replacing files on or backing up data from a selected client workstation

You can schedule tasks as much as seven days in advance and perform them without an operator being present at the client workstation. LCCM uses Wake on LAN technology to wake up client workstations that are powered off, so tasks can be done in off hours without disrupting productivity.

Version 1.x of LCCM is available for servers running either IBM OS/2 Warp Server or Novell NetWare in an RPL environment. Version 1.x does not support client workstations over routers or in a DHCP environment. Version 2.x is available for servers running Microsoft Windows NT Server in either an RPL or DHCP environment and provides support for client workstations over routers. In addition, LCCM Version 2.x can read a customer-defined LCCM profile name from the Enhanced Asset Information Area and use this information to determine which software images to download. The LCCM profile name can be programmed into the Enhanced Asset Information Area using a hand-held radio frequency device or through software such as the AIAWRITE program provided as part of LCCM.

LCCM is available from IBM free of charge to anyone who has a qualifying model of IBM PC, IntelliStation, or ThinkPad computer. For more information, visit the IBM LCCM Web site at:

<http://www.pc.ibm.com/us/desktop/lccm/index.html>

From the LCCM Web site, you can download the LCCM program, view compatibility charts, view the *LCCM Training and Procedures Guide* to learn more about the product, or download a demonstration file.

IBM Netfinity Manager

IBM Netfinity Manager 5.x is a complete local and remote hardware and software management application. The product consists of two parts:

- Netfinity Manager, which resides on the server or administrator console
- Client Services for Netfinity Manager, which resides on the individual client workstations and other servers to be managed

Netfinity Manager 5.x has the following features:

- Desktop Management Interface (DMI) Browser: Allows the network administrator to remotely collect data about individual client workstations for asset management. End users can also use this feature locally to view information specific to their computers.
- System Information Tool: Detects and reports detailed information, including adapters, SCSI configuration and devices, disk drives, PCMCIA devices, memory, I/O devices, and more.
- System Profile: Provides a fully customizable user- and system- information facility.
- System Monitoring: Displays line graphs and real-time monitors for a variety of system resources, including the microprocessor, disk drives, and memory. When user-defined thresholds are exceeded, the system monitor sends an alert to either the end user or network administrator.
- Security Manager: Prevents unauthorized access to the Netfinity functions.
- Alert Manager: Receives and processes application-generated alerts. You can examine, edit, and print reports from the alert log and customize actions (including logging alerts, notifying remote users, displaying pop-up messages, and starting programs) in response to received alerts.

IBM Netfinity Manager is a separately purchased product. However, IBM provides Client Services for Netfinity Manager with IBM PC and IntelliStation models as part of the preinstalled software package and on the *Ready-to-Configure CD*. Additionally, Client Services for Netfinity Manager is an optionally installable component of the Universal Management Agent program. Versions of IBM Netfinity are available for OS/2, Windows NT, Windows 95, Windows 3.x, and NetWare 4.x. For more information, visit the IBM Netfinity 5.x Web site at:

<http://www.pc.ibm.com/us/server/netfinity>

Intel LANDesk Client Manager

Intel® LANDesk® Client Manager (LDCM) 3.x provides the capability for managing components within a PC system. It uses the DMI standard to view, monitor, and administer manageable components across multiple platforms, either locally or remotely on a network. LDCM provides the user with self-help diagnostics (including a PC health meter), local alerting of potential problems, and hardware and software inventory. Automatic polling and alerting of memory and hardware conditions and predictive failure mechanisms minimize downtime and increase effective troubleshooting. LDCM takes periodic "snapshots" of critical configuration files for easy change management and restoration when needed. LDCM is designed for use with the Intel LANDesk Server Manager Pro and the other LANDesk server-based products. Versions of LANDesk Server Manager Pro products are available for Windows NT and Novell NetWare servers.

Intel LANDesk products are separately-purchased products. However, IBM provides Intel LDCM for IBM PC and IntelliStation models through one of the following distribution methods:

- The *Ready-to-Configure CD* or *Software Selection CD* provided with the computer. Depending on your model, LDCM might be on the CD as a stand-alone product, as part of IBM ClientCare, or as part of IBM System Management Tools.
- *LANDesk Client Manager CD*
- World Wide Web (for selected 6272 and 6282 models only) at:

<http://www.pc.ibm.com/us/cdt/6272.html>

These versions of LDCM are tailored specifically for each model. The method of distribution varies by model and date of manufacture. For more information about Intel LANDesk products, visit the Intel Web site at:

<http://www.intel.com>

Microsoft System Management Server

Microsoft System Management Server (SMS) is designed to minimize administration and reduce the number of visits to the client workstation. Main features include:

- **Automated software and hardware inventory:** Detects client workstations on the network, collects information about hardware and software, and stores this information in a database.
- **Remote software distribution and installation:** Enables the network administrator to perform unattended software installations. Included is the System Management Server Installer, which is used to create custom installation scripts, perform controlled test installations, and implement a rollback in case of a software distribution failure.
- **Remote diagnostic tools:** Equips the network administrator with tools to perform diagnostic routines and resolve problems from a remote location. Tools include network monitoring, remote control, remote diagnostics, simple network management protocol (SNMP) trap forwarding and receiving, and more.

Microsoft SMS is a separately-purchased product. For additional information about Microsoft SMS and other Microsoft network-management software, visit the Microsoft Web site at:

<http://www.microsoft.com/management>

Microsoft Zero Administration Kit

The Microsoft Zero Administration Kit (ZAK) uses existing technologies in Microsoft Windows NT Server 4.0 and the System Management Server to reduce the administrative overhead associated with fixing end-user-induced problems. The basic premise behind ZAK is to limit the end-user interface to only those items that are needed by task-based end users to do their job.

In general, the task-based end user works in one of two modes:

- In the *TaskStation* mode, the end user runs a single task-specific application. Typical environments include banks, data-entry operations, and telephone ordering centers that use one or two form-based applications. In this environment, you can use ZAK to hide the Windows interface and limit the end-user interface to the application itself. When the user logs on, that user's application is automatically launched. In TaskStation mode, the network administrator has complete control over which application is launched.
- In the *AppStation* mode, the end user runs a well-defined set of applications. Typical environments for the AppStation mode are end users who perform multiple administrative and clerical tasks, such as banks and insurance companies. In this environment, you can use ZAK to create a simplified Windows interface containing a blank desktop with a customized Start menu and task bar. When the user logs on, and selects the **Start** button, the Start menu contains only those programs required for that user's job. The network administrator has control over which items are listed in the Programs group.

ZAK is primarily designed for use by large companies. By restricting the user's access to interface components, ZAK prevents the user from:

- Modifying the control panel or registry incorrectly
- Deleting important files
- Installing unauthorized software or using any software other than that defined by the network administrator
- Becoming distracted with system settings like colors, backgrounds, and desktop arrangements.

ZAK is intended to use pull technology and can operate in either RPL or DHCP environments. Microsoft's prescribed method of attaching to a server is through the use of a network startup (boot) diskette. However, you can use IBM LANClient Control Manager to push the ZAK installation to the client workstation.

ZAK is administered from a Windows NT 4.0 server (with service pack 3 installed) and uses a preconfigured set of system policies and user profiles for Windows NT Workstation and Windows 95 client workstations.

Microsoft ZAK is available as a downloadable product from the Microsoft Web site at no charge, or you can order a CD-based version for a fee.

For additional information about Microsoft ZAK, visit the Microsoft Web site at:

<http://www.microsoft.com/windows/zak>

Network-Management Software Matrix

The following matrix shows network-management tasks and compatibility information for some of the network-management software available today. There are many more network-management software packages available on the market than are listed here.

Figure 1. Network-Management Software Matrix

Function	LCCM	Netfinity Manager	LANDesk Client Manager	SMS	UMA
Electronic SW delivery	Yes (Note 1)	--	--	Yes (Note 2)	Yes (Note 7)
Flash system BIOS over the LAN	Yes	--	--	--	--
Flash adapter EEPROM over the LAN	Yes (Note 3)	--	--	--	--
Back up client data to server	Yes (Note 4)	--	--	--	Yes (Note 6)
Asset control	Limited (Note 5)	Yes	Yes	Yes	Yes
Critical-file monitor	--	Yes	Yes	--	Yes (Note 7)
Event scheduler	Yes (Note 4)	Yes	Yes	--	Yes
Process manager	--	Yes	--	--	--
Enable/disable BIOS administrator password	Yes	--	--	--	--
Change CMOS settings	Yes	--	--	--	--
Real-time remote control over clients	--	Yes	--	--	Yes (Note 8)
System monitoring and alerts	--	Yes	Yes	--	Yes
Remote diagnostics	--	--	--	Yes	Yes (Note 8)
Predictive failure mechanism	--	Yes	Yes	--	Yes
Supported server operating systems	Windows NT, NetWare, OS/2	Windows NT, NetWare, OS/2	Windows NT	Windows NT	Windows NT
Supported client operating systems	Windows NT, Windows 95, Windows 3.x, OS/2	Windows NT, Windows 95, Windows 3.x, OS/2	Windows NT, Windows 95	Windows NT, Windows 95	Windows NT, Windows 95, Windows 98 (Note 9)
Network protocols	RPL only in LCCM V 1.x DHCP or RPL in LCCM V 2.x)	Independent (TCP/IP, IPX, NetBIOS)	Independent (TCP/IP, IPX)	Independent (TCP/IP, IPX, NetBIOS)	Independent (TCP/IP)

Notes:

1. LCCM distributes preconfigured images (operating system with application programs) and individual files. LCCM also can install OS/2 over the network using the IBM LAN CID Utility program and can perform unattended installation of Windows NT.
2. SMS distributes selected Microsoft operating systems, Microsoft application software, and third-party application software that conforms to certain Microsoft specifications.
3. LCCM support for flashing an adapter EEPROM over the LAN varies by adapter.
4. LCCM Version 1.x is limited to a one-time scheduled event. LCCM Version 2.x has a built-in repeat function, where an event can be scheduled and repeated daily, weekly, monthly, and so on.
5. LCCM is limited to collecting the client workstation MAC address, model/type, serial number, type of video chip, amount of installed memory, and hard disk capacity. LCCM collects this information during the scan operation.
6. You can configure the Events, Alarms, and Responses program within UMA to interact with a backup program to perform routine, scheduled backup operations or to perform an emergency backup operation in response to a Predictive Failure Alert (PFA) from a S.M.A.R.T. hard disk drive.

7. Requires the installation of either the Netfinity or the LDCM Interface component provided with UMA. Additional, the Universal Management Agent plug-in provides the SMART Reaction Client program, which is used to back up and mirror data to a server or peer computer.
8. This function requires the UMA Plus plug-in program. Electronic software delivery and real-time remote control of clients is achieved using the CoSession Remote program. Remote diagnostics is achieved using one of the following:
 - The PC Doctor diagnostics provided with UMA Plus
 - or-
 - CoSession Remote Control and a client-based diagnostic program
9. UMA provides Windows 98 support in Versions 1.01 and later.

Chapter 3. Working with Network-Management Features

This chapter describes how the network-management features are implemented in network-ready models of the IBM PC 300GL, PC 300PL, and PC 300XL product lines.

Plug In and Go

Part of the IBM Personal Systems Group's promise of value is the plug in and go feature on selected models. In short, *plug in and go* means that the model is ready to be installed either as a stand-alone computer or as part of a network environment. Simply unpack the computer, plug in the appropriate cables, and turn on the computer. On network-ready models, the network features are set as follows:

- Wake On LAN: Enabled
- Extended network EEPROM: Enabled
- RPL protocol: Enabled
- Flash over LAN: Enabled
- Startup sequences: Depending on the model, the startup sequence is set so that the computer starts from either the local hard disk or a network server. See "Model-Specific Implementations" on page 14 for the startup sequence used on specific models.

The following table shows the typical network-enabled startup sequence.

Figure 2. Typical Startup Sequence -- Network Enabled

	Network Detected	Network Not Detected
First device	Local diskette	Local diskette
Second device	Network (RPL)	Local hard disk
Third device	Local hard disk	---
Fourth device	---	---

The default startup sequence is changed during the manufacturing process to the network-enabled startup sequence for selected models. When the computer is powered on, it first checks for the presence of a self-starting (bootable) diskette. If one is not present, it then checks for a functioning network. If a functioning network is detected, the computer attempts to start from the network by broadcasting a request-to-RPL packet across the network. The computer continues to broadcast the request until an image is provided by a server. On some models, the end user can override the request by pressing the Home key. When the Home key is pressed, the computer defaults to the next startup device, usually the hard disk.

When the network is set ahead of the hard disk in the startup sequence, the request to RPL triggers network management software, such as IBM LANClient Control Manager, to interrogate the client workstation for a MAC address, build a profile, and download a customized software image (operating system and application programs) without any operator intervention at the client workstation. LANClient Control Manager also keys off of the request to RPL for maintenance operations, such as flashing the system BIOS.

If the client workstation is installed on a network, and started remotely using the Wake on LAN feature, the automatic power-on startup sequence is used. The automatic power-on startup sequence can be set to start from either the network, local hard disk, or other startable device. See "Model-Specific Implementations" on page 14 for the factory-set automatic power-on startup sequence used on specific models.

Starting Your Computer Locally

If you are setting up a computer that has a network-enabled startup sequence in a network environment where you will not be using RPL, you might want to change the startup sequence to remove network as a startup device. Taking this action bypasses the RPL startup screen, and the computer starts from its own hard disk.

If you are in a DHCP environment you will have to either change the CMOS settings using the Setup/Configuration Utility program, flash the network adapter EEPROM, or change the network adapter EEPROM settings to enable DHCP. If you enable DHCP, each time you power on the computer, a message similar to the following will appear:

Press "Spacebar" to Boot from Network

If your computer is properly connected to a network, you must press the Spacebar to invoke DHCP across the network.

See "Working with Network-Related Settings" on page 20 for instructions on changing the startup sequence and RPL/DHCP settings.

Model-Specific Implementations

The startup sequence, method of enabling DHCP, and other network-management settings vary from model to model. This section describes the network management settings for each model.

Important: The information in this section pertains to models that are shipped with an integrated Ethernet controller or a network adapter as a standard feature. This information does not apply to models that have network adapters installed as an option.

PC 300GL 6272 and 6282 with Diskette Drive

(All models of 6282 and all models of 6272 except 88X, 89X, 90X, and 91X.)

Network Controller

These models have an integrated 10BASE-T Ethernet controller (Crystal CS8920).

Figure 3. PC 300GL 6272 and 8282 with Integrated 10BASE-T Ethernet Controller

Feature	Setting
Architecture	ISA, Plug and Play
Network Connector	RJ-45
Selectable RPL/DHCP	Through Configuration/Setup Utility program. See "DHCP and RPL Settings" on page 20 for details.
Wake on LAN Enable/Disable	Through Configuration/Setup Utility program. See "Wake on LAN" on page 22 for details.
RPL/DHCP Bypass	Yes, by pressing Home key

Network Settings as Shipped

Figure 4. PC 300GL 6272 and 6282 Network Settings as Shipped

Feature	Setting
RPL/DCHP	RPL
Wake on LAN	Enabled
POST/BIOS update over LAN	Enabled
Selectable Startup Sequence	Enabled for Network Startup (Boot)
Automatic Power On Startup Sequence	Enabled for Network Startup (Boot)

Startup Sequence

Figure 5. PC 300GL 6272 and 6282 Startup Sequence

Sequence	Selectable Startup Sequence	Automatic Power-On Startup Sequence
First device	Diskette Drive 0	Network
Second device	Network	Hard disk drive 0
Third device	Hard disk drive 0	Disabled
Fourth device	Disabled	Disabled

To change the startup sequence, see “Selectable Startup Sequence” on page 23.

To change the automatic power-on startup sequence, see “Automatic Power-On Startup Sequence” on page 23.

PC 300GL 6272 without Diskette Drive

(Model 6272-88X, 89X, 90X, and 91X)

The PC 300GL models without diskette drives (6272-88X, 89X, 90X, and 91X) are designed specifically for the network-managed environment. Although the absence of a removable media drive (diskette drive and CD-ROM drive) enhances security by preventing unauthorized software from being installed from diskette or CD, it does present a challenge for initially installing software, upgrading software as required, and performing many maintenance tasks that are traditionally diskette or CD-ROM based. See Chapter 5, “Special Considerations for Models without Diskette Drives” on page 35 for information about accomplishing these tasks.

The PC 300GL 6272-88X, 89X, 90X, and 91X models are preset to be integrated into an RPL-based network.

Network Controller

The PC 300GL 6272-88X, 89X, 90X, and 91X models are available with the following network adapters:

- IBM PCI Wake on LAN Token-Ring Adapter
- IBM 100/10 EtherJet PCI Adapter with Wake on LAN

Figure 6. PC 300GL 6272-88X, 89X, 90X, and 91X with IBM PCI Wake on LAN Token-Ring Adapter

Feature	Setting
Architecture	PCI
Network Connectors	RJ-45 and 9-pin D-shell
RPL/DHCP	RPL only; no DHCP support.
Wake on LAN Enable/Disable	Through Configuration/Setup Utility program. See "Wake on LAN" on page 22 for details.
RPL/DHCP Bypass	No

Figure 7. PC 300GL 6272-88X, 89X, 90X, and 91X with IBM 100/10 EtherJet PCI Adapter with Wake on LAN

Feature	Setting
Architecture	PCI
Network Connector	RJ-45
Cabling Requirements	Category 5 data grade cabling for either 10 Mbps or 100 Mbps operation (FCC Class A requirement)
Supported Environments	10BASE-T or 100BASE-TX
Selectable RPL/DHCP	By flashing adapter EEPROM. See "DHCP and RPL Settings" on page 20 for details.
Wake on LAN Enable/Disable	Through Setup/Configuration Utility program. See "Wake on LAN" on page 22 for details.
RPL/DHCP Bypass	Yes, by pressing the Home key.

PC 300GL 6272-88X, 89X, 90X, and 91X Network Settings as Shipped

Figure 8. PC 300GL 6272-88X, 89X, 90X, and 91X Network Settings as Shipped

Feature	Setting
RPL/DCHP	RPL
Wake On LAN	Enabled
POST/BIOS update over LAN	Enabled
Selectable Startup Sequence	Enabled for Network Startup (Boot)
Automatic Power On Startup Sequence	Enabled for Network Startup (Boot)

Startup Sequence

Figure 9. PC 300GL 6272-88X, 89X, 90X, and 91X Startup Sequence

Sequence	Selectable Startup Sequence	Automatic Power-On Startup Sequence
First device	Network	Network
Second device	Hard disk drive 0	Hard disk drive 0
Third device	Disabled	Disabled
Fourth device	Disabled	Disabled

To change the startup sequence see "Selectable Startup Sequence" on page 23.

To change the automatic power-on startup sequence, see “Automatic Power-On Startup Sequence” on page 23.

Technical Notes

Related Publications: Because these models of PC 300GL are intended for use in a network-managed environment, some of the information was intentionally shifted from *Using Your Personal Computer* into this guide.

Also, because these models are considered "sealed boxes" and are not intended to be upgraded, *Installing Options in Your Personal Computer* is not shipped with the computer. However, you might have a need to gain access to the inside of the computer for any of the following reasons:

- To change the battery
- To replace a failing part
- To clear CMOS (if an administrator or power-on password is forgotten)

For this reason, *Installing Options in Your Personal Computer* is available on the World Wide Web at:

<http://www.pc.ibm.com/us/cdt>

Special Tools for cover removal: To remove the covers, you must use a torx screwdriver with a T8 bit.

Diagnostic Programs: The PC-Doctor diagnostic programs (PC Doctor for Windows 95, PC Doctor for Windows NT, and IBM PC Enhanced Diagnostics) are provided on the *Ready-to-Configure CD* shipped with the computer. For information about using these programs in a network-managed environment, see Chapter 5, “Special Considerations for Models without Diskette Drives” on page 35.

Resolving POST Error Messages: Because of the "sealed box" concept, the end-user documentation provided with the computer does not contain any instructions for resolving POST error messages that require cover removal. However, your technical staff might need that information. Therefore, a listing of POST error codes and corrective actions are provided in this publication. See “POST Error Codes” on page 65 for more information.

PC 300XL 6588

Network Controller

The PC 300XL 6588 models have an Intel 82557-based 10/100 PCI Ethernet controller integrated into the system board.

Figure 10. PC 300XL 6588 Integrated Intel 82557-based 10/100 PCI Ethernet Controller

Feature	Setting
Architecture	PCI
Supported Environments	10BASE-T and 100BASE-TX
Network Connectors	RJ-45
Selectable RPL/DHCP	Through Configuration/Setup Utility program. See “DHCP and RPL Settings” on page 20 for details.
Wake on LAN Enable/Disable	Through Configuration/Setup Utility program. See “Wake on LAN” on page 22 for details.
RPL/DHCP Bypass	Yes, by pressing the Home key.

Network Settings as Shipped

Figure 11. PC 300XL 6588 Network Settings as Shipped

Feature	Setting
RPL/DCHP	RPL
Wake On LAN	Enabled
POST/BIOS update over LAN	Enabled
Selectable Startup Sequence	Enabled for local hard disk boot. See “Startup Sequence” on page 18 for details.
Automatic Power On Startup Sequence	Disabled

Startup Sequence

Figure 12. PC 300XL 6588 Startup Sequence

Sequence	Selectable Startup Sequence	Automatic Power-On Startup Sequence (when enabled)
First device	Diskette 0	Network
Second device	Hard disk drive 0	Hard disk drive 0
Third device	Network	Disabled
Fourth device	Disabled	Disabled

To change the startup sequence, see “Selectable Startup Sequence” on page 23.

To change the automatic power-on startup sequence, see “Automatic Power-On Startup Sequence” on page 23.

PC 300PL 6562 and 6592

Network Controller

The PC 300PL 6562 and 6592 models have an Intel 82557-based 10/100 PCI Ethernet Controller integrated into the system board.

Figure 13. PC 300PL 6562 and 6592 Integrated Intel 82557-based 10/100 PCI Ethernet Controller

Feature	Setting
Architecture	PCI
Network Connectors	RJ-45
Supported Environments	10BASE-T or 100BASE-TX
Selectable RPL/DHCP	Through Configuration/Setup Utility program. See “DHCP and RPL Settings” on page 20 for details.
Wake on LAN Enable/Disable	Through Configuration/Setup Utility program. See “Wake on LAN” on page 22 for details.
RPL/DHCP Bypass	Yes, by pressing the Home key.

Network Settings as Shipped

Figure 14. PC 300PL 6562 and 6592 Network Settings as Shipped

Feature	Setting
RPL/DCHP	RPL
Wake On LAN	Enabled
POST/BIOS update over LAN	Enabled
Selectable Startup Sequence	Sequence varies. See “Startup Sequence” on page 19 for details.
Automatic Power On Startup Sequence	Enabled for Network Startup (Boot).

Startup Sequence

PC 300PL 6562 and 6592 models manufactured at the IBM manufacturing facility in Research Triangle Park, North Carolina, U.S.A., during the last three weeks of October 1997, have the startup sequence set for Network Boot.

Figure 15. PC 300PL 6562 and 6592 Startup Sequence (Network Boot)

Sequence	Selectable Startup Sequence	Automatic Power On Startup Sequence
First device	Diskette 0	Network
Second device	Network (RPL)	Hard disk drive 0
Third device	Hard disk drive 0	Disabled
Fourth device	Disabled	Disabled

PC 300PL 6562 and 6592 models manufactured outside of these dates or at other manufacturing facilities have the startup sequence set for Local Hard Disk Boot.

Figure 16. PC 300PL 6562 and 6592 Startup Sequence (Local Hard Disk Boot)

Sequence	Selectable Startup Sequence	Automatic Power On Startup Sequence
First device	Diskette 0	Network
Second device	Hard disk drive 0	Hard disk drive 0
Third device	Network	Disabled
Fourth device	Disabled	Disabled

To change the startup sequence, see “Selectable Startup Sequence” on page 23.

To change the automatic power-on startup sequence, see “Automatic Power-On Startup Sequence” on page 23.

Technical Notes

Startup Sequence: The startup sequence varies by manufacturing date and manufacturing location. See “Startup Sequence” for details.

Working with Network-Related Settings

This section contains procedures to modify various network-related settings. Some of the procedures pertain to a specific network adapter or integrated Ethernet controller, while other procedures are common for all IBM PC models described in this document.

Accessing the Configuration/Setup Utility Program

You view and change the settings for many of the network features built into your computer through the Configuration/Setup Utility program. Use the following instructions to start the Configuration/Setup Utility program:

1. Turn on any external devices connected to your computer, and then start your computer by pressing the power switch.
2. When the Configuration/Setup Utility prompt displays, quickly press **F1**.

If you have *not* set an administrator password, the Configuration/Setup Utility program menu appears. If you have set an administrator password, a prompt displays. Type the administrator password, and press **Enter**. For information about using passwords, see *Using Your Personal Computer*.

After you enter the Configuration/Setup Utility program, at the bottom of each screen you can find information about moving through the screens, the functions of specific keys, or the meaning of a symbol. You can also press **F1** for general help.

Disabling an Integrated Ethernet Controller

If your computer has the integrated Ethernet controller and you install an optional network adapter, you must disable support for the integrated Ethernet controller. To access the Ethernet Support setting, do the following:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program”).
2. Select **Devices and I/O Ports**.
3. Select **Ethernet Setup**.
4. Set Ethernet Support to **Disabled**.
5. Exit and save the setting.

The serial number for the integrated Ethernet controller is 10000000. You might need this information if you install an optional network adapter.

For information about removing and installing adapters, see *Installing Options in Your Personal Computer*.

DHCP and RPL Settings

The method of changing between DHCP and RPL varies depending on the type of network controller or adapter. This section provides information about:

- Integrated Ethernet Controllers (10BASE-T and Intel 82557-based 10/100 Mbps)
- IBM 100/10 EtherJet PCI Adapter with Wake on LAN
- IBM PCI Wake on LAN Token-Ring Adapter

Integrated Ethernet Controllers

The integrated Ethernet controllers use either RPL or DHCP when communicating over the network. The controller is set to **RPL** at the factory. If you want to change the protocol for the integrated Ethernet controller, do the following:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program”).
2. Select **Devices and I/O Ports**.
3. Select **Ethernet Setup**.
4. Set Ethernet Support to **Enabled**.
5. Under Network Boot, press ← or → to select **RPL** or **DHCP**.
6. Exit and save the setting.

IBM 100/10 EtherJet PCI Adapter with Wake on LAN

This adapter is set to RPL at the factory. To change the setting from RPL to DHCP, you must reflash the adapter EEPROM. The flash diskette is available from the following World Wide Web address:

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

If you have a computer without a diskette drive, or you want to flash the EEPROM over the network, see Chapter 5, “Special Considerations for Models without Diskette Drives” on page 35. If you have a computer with a diskette drive, use the following procedure:

1. Turn off the computer.
2. Insert the flash diskette into diskette drive A.
3. Turn on the computer.
4. When the selection screen appears, do one of the following:
 - Press **D**, then press **Enter** to set the protocol to DHCP.
 - Press **R**, then press **Enter** to set the protocol to RPL.

Note: You can use this same procedure to update the EEPROM if a flash-update diskette becomes available.

IBM PCI Wake on LAN Token-Ring Adapter

This adapter is set to RPL at the factory. Currently, there is no utility program available to change the protocol from RPL to DHCP. Should a utility become available, this document will be updated to contain the procedure.

Viewing the MAC Address

There are several ways to view the MAC address.

- If the computer is set up to start from a network, the MAC address appears on the RPL or DHCP screen.
- If you have an integrated Ethernet controller, you can view the MAC address through the Configuration/Setup Utility program as follows:
 1. Access the Configuration/Setup Utility program (see page “Accessing the Configuration/Setup Utility Program” on page 20).
 2. Select **Devices and I/O Ports**.

3. Select **Ethernet Setup**. The MAC address for the integrated Ethernet displays.
- If you have an IBM PCI Wake on LAN Token-Ring Adapter installed, you can look at the label on the mounting bracket of the adapter or you can use the LANAID program.

To use the LANAID program:

1. Create *Diskette 1, LANAID and Diagnostics* from the *IBM PCI Token-Ring Adapter Drivers and Instructions* CD.
 2. Turn off the computer and insert the diskette into diskette drive A.
 3. Turn on the computer.
 4. At the command prompt, type LANAIDC /VIEW, then press **Enter**.
- If you have an IBM 100/10 EtherJet PCI Adapter with Wake on LAN, the MAC address is on a label attached to the printed circuit board. You have to remove the computer cover to see it.

If you are running Windows 95 or Windows NT, you can also use the following procedure:

1. Click on the Windows **Start** button.
2. Select **Settings**.
3. Select **Control Panel**.
4. Double-click on the IBMFESet icon.

The MAC address is shown as the Ethernet Address on the screen.

Wake on LAN

This option is set to Enabled at the factory. Normally, you do not have to change this setting.

Note: If you install an optional network adapter, it must support the Wake on LAN feature in order to use this feature of your computer.

To access the setting for the Wake on LAN feature, do the following:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program” on page 20).
2. Select **Advanced Power Management**.
3. Select **Automatic Power On**.
4. Select **Wake on LAN**.
5. Press ← or → to change the setting.
6. Exit and save the setting.

POST/BIOS Update Over Network

This option is set to Enabled at the factory. If you want to disable this setting, do the following:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program” on page 20).
2. Select **System Security**.
3. Select **POST/BIOS Update**.
4. Press ← or → to change the setting.
5. Exit and save the setting.

Selectable Startup Sequence

IBM has enabled your computer to start up over the network. (For more information, see “Plug In and Go” on page 13.) You can easily change the startup sequence through the Configuration/Setup Utility program. To change the startup sequence:

1. Access the Configuration/Setup Utility program (see page “Accessing the Configuration/Setup Utility Program” on page 20).
2. Select **Start Options**.
3. Select **Startup Sequence**.
4. Press ← or → to change the settings for the four startup devices. Press ↓ or ↑ to move among the devices.
5. Exit and save the setting.

Note: Some default settings are different from the settings set at the factory. If you choose to reset all settings to their defaults, you will change the network-enabled startup sequence that was set on the manufacturing line. For information about the settings set at the factory, see “Model-Specific Implementations” on page 14.

The following shows the default startup sequence that will result from loading the default settings from the Configuration/Setup Utility program; the settings change to the following.

Figure 17. Startup Sequence - Default Settings

Sequence	Selectable Startup Sequence	Automatic Power On Startup Sequence
First Startup Device	Diskette Drive 0	Network
Second Startup Device	Hard Disk Drive 0	Hard Disk Drive 0
Third Startup Device	Network	Disabled
Fourth Startup Device	Disabled	Disabled

Automatic Power-On Startup Sequence

The automatic power-on startup sequence determines how your computer loads the operating system when it is started over a network. To change the automatic power-on startup sequence of your computer:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program” on page 20).
2. Select **Start Options**.
3. Select **Startup Sequence**.
4. Highlight **Automatic Power-On Startup Sequence**.
5. Press ← or → to enable or disable this setting.
6. Press ↓.
7. Press ← or → to change the setting for each device. Press ↓ or ↑ to move among the devices.
8. Exit and save the setting.

Alert on LAN

Alert on LAN is a result of the IBM-Intel Advanced Manageability Alliance. The term *Alert on LAN* refers to the ability of a computer to send status and alert packets to a management server regardless of the power-on state of the computer. Computers that have the Alert on LAN feature have an Alert on LAN module on the system board or network adapter that interacts with the System Management Controller to monitor critical functions. When the computer is powered off or if a malfunction prevents the operating system from running, the hardware (the Alert on LAN module) sends status packets and alert packets as events occur. When the operating system is running, a software agent (the Alert on LAN agent) that resides on the client computer periodically polls the Alert on LAN module for information and sends the packets as needed. The Alert on LAN module can be integrated (or *wired*) into the system board to monitor a variety of components. The specific components that are monitored vary from model to model, but typically, the Alert on LAN module works in conjunction with the System Management Controller to monitor items such as:

- **Security and tampering events:**
 - Computer case opened
 - Processor missing
 - Computer unplugged from network
- **Error Conditions:**
 - System voltage
 - System temperature
 - Operating system hang condition
 - Power-on self-test (POST) errors
 - POST hang condition
- **Informational events:**
 - Starting POST
 - POST complete/Boot operating system

Some of the events are monitored by the Alert on LAN module itself, while others are monitored by the System Management controller, which passes the information along to the Alert on LAN module.

How Alerts Are Sent

Alert and status packets are sent to the IP address of an administrator computer on the network. Alert packets are the result of an error condition or a specific event such as removing the client computer cover. Status packets (called *heartbeats*) provide an additional level of security. The Alert on LAN client sends the heartbeats at regularly timed intervals. The administrator computer monitors the heartbeats and, if they stop, generates an alert. Because a heartbeat stops only if the computer is unplugged from the ac power source or disconnected from the network, this alert is often an indication of tampering or unauthorized removal of equipment. The method of accessing the alert information depends on the network-management software you are using.

The Alert on LAN solution requires that the client computer be enabled for Alert on LAN; that is, it must contain the Alert on LAN module and the appropriate network-management *client* software (for example, IBM ClientCare, IBM System Management Tools, Netfinity Services, or IBM Universal Management Agent). The managing server or administrator console must be using the appropriate network-management *server* software (for example, LANDesk Client Manager Administrator or Netfinity Manager) in order to configure the client computer, monitor the client computer, and receive alerts. The Alert On LAN component contained in the IBM Universal Management Agent (UMA) program provides a method of configuring the client and viewing the current status either locally or over the Internet or

Intranet, but it does not provide the *server* software required to monitor the client and receive alerts. See “Alert on LAN Software” on page 28 for a list of client and server software combinations required to support the Alert on LAN function and for information about how to acquire the software.

Alert on LAN Settings

The following list contains the information that can be written to or received from the Alert on LAN module:

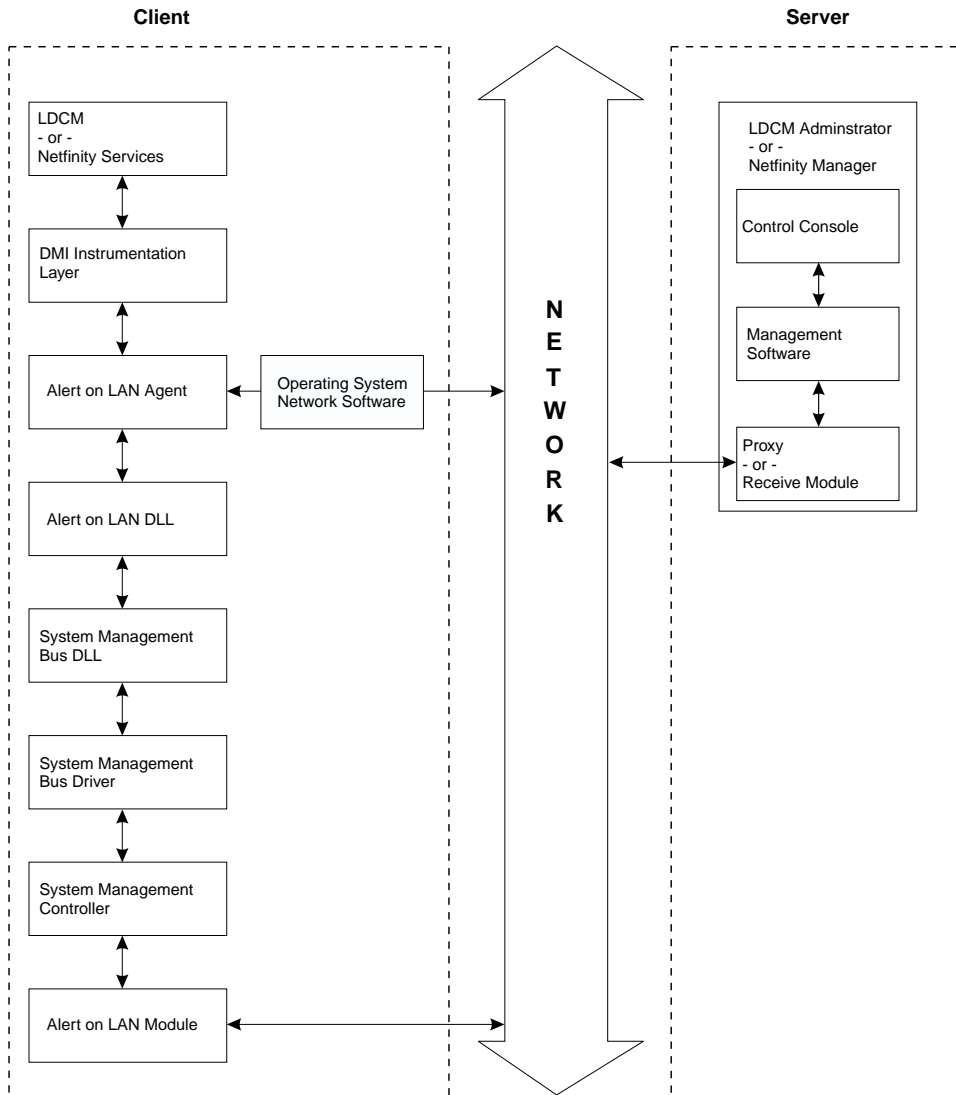
- **Alert transmission status:** If enabled, the Alert on LAN module reports status to the defined proxy server.
- **Hardware version:** The version of the Alert on LAN module.
- **System ID:** Identifies how the Alert on LAN module is wired to the computer.
- **System UUID:** Universally Unique Identifier (also referred to as a Globally Unique Identifier or GUID). A unique 16-byte number that positively identifies the computer. The UUID is assigned by the BIOS manufacturer and is stored in the computer BIOS.
- **Proxy server IP address:** The IP address of the proxy server that monitors heartbeats, receives alerts from the Alert on LAN module, and forwards notifications to network-management software.
- **Proxy server UDP port:** The user datagram protocol (UDP) port used by the proxy server.
- **Heartbeat timer period:** Specifies how often the Alert on LAN agent sends a heartbeat packet to the proxy server. The heartbeat interval is rounded down to the nearest multiple of 43 seconds and must be a minimum of 86 seconds. A value of 0 indicates that the timer is disabled.
- **Watchdog timer period:** Determines how frequently the watchdog timer is reset. If the Alert on LAN software fails to reset the timer before the timer expires (for example, if the operating system hangs), the Alert on LAN module sends a watchdog message to the proxy server. The watchdog timer interval is rounded down to the nearest multiple of 43 seconds and must be a minimum of 86 seconds. A value of 0 indicates that the timer is disabled.
- **Retransmission timer period:** The Alert on LAN module sends three alerts for each notification. This value defines the period of time between each alert. The retransmission timer value is rounded down to the nearest multiple of 3 seconds.
- **Agent polling period:** Defines how frequently the software agent checks the status of the Alert on LAN module.

The following is a list of Alert on LAN alerts that can be sent to the proxy server:

- **Cover tamper:** Sends an alert if the computer case is opened or removed.
- **Voltage/Fan out of spec:** Sends an alert if the voltage on any of the computer voltage supply lines varies beyond an acceptable tolerance or if the fan speed varies beyond an acceptable tolerance.
- **Temperature out of spec:** Sends an alert if the temperature of the processor rises above an acceptable level.
- **LAN leash tamper:** Sends an alert if the network cable is unplugged from the network adapter.
- **Processor missing:** Sends an alert if the microprocessor is removed from its socket.

Software Architecture

The Alert on LAN *management system* consists of two elements: the Alert on LAN client and the Alert on LAN management server (hereafter called the *server*). The Alert on LAN client and server communicate over the network by means of *alert and status packets*. The following is a graphical overview of the software associated with the Alert on LAN client and server.



Special client-software packages, such as the IBM Universal Management Agent, IBM System Management Tools, and IBM ClientCare, contain the required Alert on LAN software. See “Alert on LAN Software” on page 28 for details.

Client Role

The role of the Alert on LAN client is to generate heartbeats (status packets), detect software hang conditions, monitor the overall operating condition (health) of the hardware, and report any discovered problem by generating an alert packet. When the Alert on LAN Client is in the powered-off state, the Alert on LAN module is responsible for all client-based Alert on LAN responsibilities. However, when the Alert on LAN client enters the powered-on state, it uses several software components to fulfill its role:

- System BIOS
- System-management (SM) bus driver
- Alert on LAN agent
- Management software (such as UMA, LDCM or Netfinity Services)
- Operating-system network software

The operating-system network software plays an important, but passive, role. Each of the other software components provides a specific set of functions within the Alert on LAN client.

- During the power-on process, the system BIOS works in conjunction with the Alert on LAN module to detect and report POST errors.
- At the end of the power-on process, BIOS disables the Alert on LAN module from generating alert packets (except for those associated with an operating system hang condition). This eliminates conflicts with normal operating-system network traffic when the operating system loads.
- Once the operating system loads and takes control of the client:
 - The Alert on LAN agent takes over the role of generating packets for heartbeats and events. The Alert on LAN module is still responsible for interacting with the System Management Controller to monitor the various hardware and software components, but delegates the responsibility of generating all alert packets (except for those associated with an operating-system hang condition) to the Alert on LAN agent.
 - The system-management bus driver arbitrates access to the system-management bus for Alert on LAN functions and other operating-system components that require access to the system-management bus.
 - The management software is used by a user or network administrator to program and control the Alert on LAN client locally or remotely by performing tasks such as enabling or disabling specific alerts, setting the management server IP address, and setting the heartbeat period. The network administrator can use the management software to view status information, which includes the IP address of the management server, alerts that are currently active, and the current heartbeat generation period.

Server Role

The role of the Alert on LAN server is to monitor the heartbeats of the Alert on LAN clients, receive alert packets, and notify the network administrator of errors or possible security breaches when appropriate. The Alert on LAN server uses the following software components to fulfill its role:

- Proxy or receive module
- Alert on LAN configuration console
- Management software

These components are contained within the LANDesk Client Manager Version 3.3 Administrator and Netfinity Manager Version 5.20 products.

The Alert on LAN proxy monitors the network for Alert on LAN alert packets, checks for the loss of heartbeats, and translates Alert on LAN events into a standard alert-handling infrastructure.

The Alert on LAN configuration console provides a user interface for the Alert on LAN client, collects and discovers Alert on LAN configuration information from various sources, and configures other Alert on LAN software components. In most cases, the network administrator uses the configuration console to set up the Alert on LAN hardware and software on the client. For information about the various settings that are controlled through the configuration console, see “Alert on LAN Settings” on page 25. As an alternative, the network administrator can use the Alert on LAN component contained in the IBM Universal Management Agent program to set up the Alert on LAN hardware and software on the client over the Internet or Intranet, or at the client itself. The Universal Management Agent program is a client-based tool. For details about the IBM Universal Management Agent program, see “IBM Universal Management Agent Program” on page 6.

Alert on LAN Software

To simplify the acquisition and installation of the software required for Alert on LAN support, IBM and Intel have integrated the Alert on LAN software into several server software products and developed special software packages for the client. You can use any of the following client/server software combinations to provide Alert on LAN support.

Figure 18. Alert on LAN Client/Server Software Solutions

Solution	Server Software	Client Software
IBM Netfinity	IBM Netfinity Manager Version 5.2	IBM Universal Management Agent (use the custom installation method and include the Netfinity component) -or- IBM Netfinity Services Version 5.10.3 or later and IBM System Management Tools -or- IBM Netfinity Services Version 5.10.3 or later and IBM ClientCare
Intel LANDesk	Intel LANDesk Client Manager Version 3.3 Administrator	IBM Universal Management Agent (include the LANDesk Client Manager component) -or- IBM System Management Tools (include the LANDesk Client Manager component) -or- IBM Client Care (include the LANDesk Client Manager component)

Notes:

- IBM Universal Management Agent, System Management Tools, and ClientCare contain a special version of Intel LANDesk Client Manager that supports the Alert on LAN feature. This version of Intel LANDesk Client Manager is different from versions available through other sources.
- IBM ClientCare care was renamed to IBM System Management Tools during 1998. The content remained the same.

You can acquire the server software products required for Alert on LAN support from the following sources.

Figure 19. Sources for Alert on LAN Server Software

Server Software	Source
Netfinity Manager Version 5.2	IBM ServerGuide (provided free with selected IBM Netfinity Servers) -or- IBM resellers
Intel LANDesk Client Manager Version 3.3 Administrator	http://www.ibm.com/pc/us/desktop/alertonlan (provided free)

You can acquire the client software products required for Alert on LAN support from the following sources.

Figure 20. Sources for Alert on LAN Client Software

Client Software	Source
IBM Universal Management Agent	http://www.ibm.com/pc/us/desktop/uma (provided free for selected models)
Netfinity Services Version 5.10.3 or later	<p><i>Ready-to-Configure Utility Program CD</i> (provided free with selected IBM PC 300 series and IntelliStation computers)</p> <p>-or-</p> <p><i>Software Selection CD</i> (provided free with selected IBM PC 300 series and IntelliStation computers)</p> <p>-or-</p> <p>The preinstalled software package on selected IBM PC 300 series and IntelliStation computers. Install Netfinity services through the Welcome Center utility program.</p> <p>-or-</p> <p>IBM ServerGuide (provided free with selected IBM Netfinity servers. Netfinity Services is part of the Netfinity Manager product.</p> <p>-or-</p> <p>IBM resellers (Netfinity Services is part of the Netfinity Manager product.)</p>
IBM System Management Tools (includes a special version of LANDesk Client Manager that supports the Alert on LAN feature)	<p><i>Ready-to-Configure Utility Program CD</i> (provided free with selected IBM PC 300 series and IntelliStation computers)</p> <p>-or-</p> <p><i>Software Selection CD</i> (provided free with selected IBM PC 300 series and IntelliStation computers)</p> <p>-or-</p> <p>The preinstalled software package on selected IBM PC 300 series and IntelliStation computers. Install IBM System Management Tools through the Welcome Center utility program.</p> <p>Note: When installing IBM System Management Tools, make sure you include the LANDesk Client Manager component if you want to use LDCM Administrator at the server.</p>
IBM ClientCare (includes a special version of LANDesk Client Manager that supports the Alert on LAN feature)	<p><i>Ready-to-Configure Utility Program CD</i> (provided free with selected IBM PC 300 series and IntelliStation computers)</p> <p>-or-</p> <p>The preinstalled software package on selected IBM PC 300 series and IntelliStation computers. Install IBM ClientCare through the Welcome Center utility program.</p> <p>Note: When installing IBM ClientCare, make sure you include the LANDesk Client Manager component if you want to use LDCM Administrator at the server.</p>

Chapter 4. Understanding the Desktop Management Interface

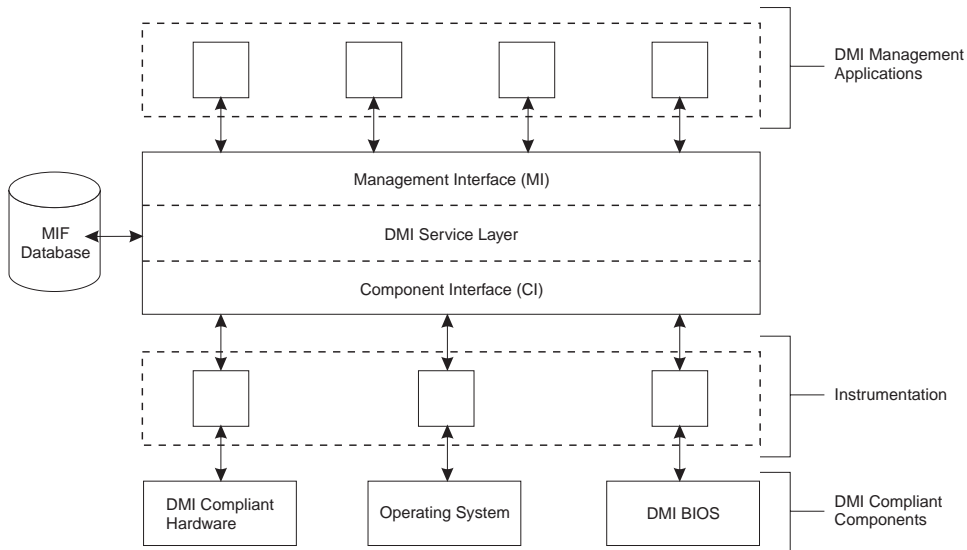
Desktop Management Interface (DMI) is a method of remotely managing computers in an enterprise environment. By using DMI, a network administrator can collect a variety of information about the computers such as the model and type number, serial number, installed hardware and software, and upgrade capabilities.

The information in this document is intended as an overview to help you get acquainted with the purpose and structure of DMI. For detailed information, see the *Desktop Management Interface Specification* available at <http://www.dmtf.org/tech/specs.html>. The DMI Specification is developed and maintained by the Desktop Management Task Force, a group made up of industry experts from many companies working together to define a set of standards that can be used across the personal computer industry.

DMI is made up of the following components:

- **Management Information Format (MIF) Database:** This database is the main component of DMI. It provides all the information about the computer system and its components. The database contains only a limited amount of actual data about the various DMI-compliant components; the bulk of the database is made up of pointers to programs (also known as *instrumentation*) that retrieve the information from a variety of sources, such as an address in an EEPROM, a BIOS location, or even a file, and routes the information to the service layer.
- **DMI BIOS Extension:** The DMI BIOS extension contains architected areas (called *data structures*) that define information about specific hardware components. For detailed information, see “DMI BIOS Extension” on page 32.
- **DMI Service Layer:** The DMI service layer is a program that manages the MIF database, collects DMI data from the various DMI-compliant components, and routes the data to the management programs when needed. The DMI service layer communicates through two interfaces: the management interface (MI) and the component interface (CI).
- **Management Interface:** The DMI service layer uses this interface to communicate with management programs.
- **Component Interface:** The DMI service layer uses this interface to communicate with DMI-compliant components through the *instrumentation*. By using the component interface, applications can make standardized calls to the DMI to communicate with and manage the components, independent of the operating system and specialized protocols.
- **Instrumentation:** Instrumentation is a term that refers to a collection of programs that interacts with the DMI-compliant components. Each instrumentation program is written to act as an agent for a specific DMI-compliant component. The instrumentation is responsible for all activities that take place between the service layer and the DMI-compliant component.

The following diagram shows how the various DMI components interact.



Example DMI Operation

1. A management application, such as the IBM Universal Management Agent, makes a DMI call through the Management Interface to retrieve information about a specific DMI-compliant component.
2. The service layer uses the MIF database to locate the instrumentation for that component.
3. The service layer starts the instrumentation through the component interface.
4. The instrumentation interacts with the component to retrieve the information, and then routes the information to the service layer through the component interface.
5. The service layer routes the information to the management program through the management interface.
6. The management program converts the information into some other format, such as an inventory report for the end user.

DMI BIOS Extension

Note: The information in this section reflects the structures defined in the DMI Specification, Version 2.0. Some models have additional fields that are defined in Version 2.1 of the specification.

The DMI BIOS extension contains architected areas (structures) for the following DMI component hardware information:

- **BIOS information:** BIOS vendor, version, starting address segment, release date, BIOS ROM size, and BIOS characteristics, such as supported bus types.
- **System information:** Manufacturer name, product name, version, and serial number.
- **Base board information:** System board manufacturer, product, version, and serial number.
- **System enclosure or chassis:** Type (chassis-lock presence), version, serial number, and asset tag number.
- **Processor information:** Socket designation, processor type, processor family, processor manufacturer, processor ID, processor version, voltage, external clock frequency, maximum speed, current speed, status, processor upgrade.
- **Memory controller information:** Error detecting method, error correcting capability, supported interleave, current interleave, maximum memory module size (capacity), supported speeds, supported

memory types, memory module voltage, number of memory slots controlled by each controller, index to the first memory module structure. A separate structure is present for each installed memory controller.

- **Memory module information:** Socket designation, bank connections, current speed, current memory type, installed size, enabled size, error status. A separate structure is present for each installed memory module.
- **Cache information (processor cache):** Socket designation, cache configuration, maximum cache size, installed size, supported SRAM type, and current SRAM type. A separate structure is present for each installed cache device.
- **Port connector information:** Internal reference designators, internal connector type, external reference designator (such as COM1), external connector type (such as DB25 male), and port type (such as SCSI II, parallel, serial, and so on). Each port is defined in its own structure. A separate structure is present for each installed port connector.
- **System slots:** Slot designation (such as PCI-1), slot type, slot data-bus width, current usage, slot length, slot ID, and slot characteristics. A separate structure is present for each slot.
- **On board devices information:** Device types and descriptions. A separate structure is present for each on-board device.
- **OEM strings:** Additional free-form information.
- **System configuration options:** Information required to configure system board jumpers and switches.
- **BIOS language information:** Number of installable languages available and current language. If this structure is not present, the BIOS supports English only.
- **Group associations:** Hierarchy of components within the computer (for example, processors with cache devices). Group name, item (structure) type, and item handle.
- **System event log:** Log area length, log header start offset, log data start offset, access method, log status, log change, token, and access method address. If this structure is not present, the event log is not supported.

Chapter 5. Special Considerations for Models without Diskette Drives

If you intend to use a client workstation that does not have a diskette drive, you have to take a few items into account before integrating this type of computer into your network. Because most programs are intended to be run from or installed from either diskette or CD-ROM, you will have to find network-based solutions to ensure certain types of programs are available to the client workstation. The information in this section is general in nature because the actual methods used to transport files or make files available remotely varies depending on your network operating system and choice of network-management software. If a specific network-management tool can provide that function, it will be referenced.

Topics discussed in this section include:

- “Using the Ready-to-Configure CD”
- “Running System Diagnostics” on page 36
- “Running Network Adapter Diagnostics” on page 38
- “Updating Device Drivers” on page 40
- “Flashing System BIOS” on page 42
- “Flashing Adapter ROM” on page 42
- “Installing and Updating Application Programs” on page 46
- “Installing Operating Systems” on page 46

Using the Ready-to-Configure CD

The *Ready-to-Configure CD* (RTC CD) ships with each IBM PC and IntelliStation model. The content of the CD is customized for each model. You can use this CD to perform the following tasks:

Create a LAN Image: With this option, you can copy the entire contents of the CD to a network drive in the directory of your choice. Any client workstation on the network that is given access to this directory can start the CD image and take advantage of all RTC CD functions.

Install the application programs and device drivers: With this option, the application programs and device drivers provided on the CD can be installed by someone sitting at the client workstation. When this option is selected, it determines which operating system is installed on the client workstation, and makes available the application programs and device drivers designed for that operating system only. Some device drivers do not have installation programs that enable them to be installed directly from the CD or CD image. When these device drivers are selected, a text file is displayed with instructions to create the diskette and install the device driver from diskette. Disregard those instructions and use the methods described in “Updating Device Drivers” on page 40.

Run the Diskette Factory: With this option, you can make diskettes for the application programs and device drivers provided on the CD. This option is useful if you intend to use other network-management tools for electronic software distribution. For example, you can convert the IBM PC Enhanced Diagnostics diskette into a diskette image and use the NetWare or OS/2 version of IBM LANClient Control Manager to assign the image to a specific client workstation when needed. Or, you can copy the contents of a diskette, such as the IBM PC Enhanced Diagnostics, into a directory on the client workstation hard disk. In some cases, the installation program for a specific application program or device driver might prohibit an automated installation over the LAN; in that case, you might have to perform a manual installation and copy specific files from a diskette to a client workstation over the LAN. See “Updating Device Drivers” on page 40 for additional information about manual procedures.

View the RTC CD Overview: This feature provides a thorough overview of the capabilities and contents of the RTC CD.

Running System Diagnostics

IBM provides diagnostic programs on the RTC CD in the following formats:

- DOS
- Windows 95 and Windows 3.X
- Windows NT

The DOS-based version, IBM PC Enhanced Diagnostics, is the most comprehensive and effective version for detecting and isolating hardware problems. IBM service technicians use the IBM PC Enhanced Diagnostics as part of their troubleshooting routine. These diagnostics are intended to be run from a self-starting diskette. But, because there is no way to run diagnostics from diskette on these models, **the network administrator must make the IBM PC Enhanced Diagnostics available to your support staff and IBM service technicians.** The most reliable method is to install the diagnostic program on the client workstation hard disk.

Note: Although it is possible to create a startable (bootable) image using your network operating system and assign it to the client workstation when needed, the amount of memory required to set up the link between the server and client workstation might prevent some diagnostic programs from running correctly. Therefore, for reliability, install the diagnostic program on the client workstation hard disk.

However, if you are using a server running NetWare or OS/2 Warp Server, you can create a diagnostic diskette image and use IBM LANClient Control Manager to assign the image to the selected client workstations. The IBM PC Enhanced Diagnostic Diskette provided on the *Ready-to-Configure CD* shipped with the IBM PC 300GL models without diskette drives (6272-88X, 89X, 90X, 91X) has been tested to operate in this environment. For details about using LANClient Control Manager to make a diagnostic image available, refer to the LANClient Control Manager *Training and Procedures Guide* available on the World Wide Web at:

<http://www.pc.ibm.com/us/desktop/lccm/index.html>

Installing Diagnostics on Windows 95 Client Workstations

To install the DOS-based diagnostics on the client workstation hard disk:

1. Create the IBM PC Enhanced Diagnostics diskette using the Diskette Factory feature on the *Ready-to-Configure CD* provided with your client workstation.
2. Create a subdirectory on the server and copy the contents of the IBM PC Enhanced Diagnostics diskette into this directory.
3. Create on the client workstation a subdirectory named IBMDIAG.
4. Copy the IBM PC Enhanced Diagnostics files from the server into the IBMDIAG directory on the client workstation.

To run the DOS-based diagnostics:

1. Shut down Windows 95 and restart it in DOS mode.
2. At the command prompt:
 - a. Type CD \ and then press **Enter**.
 - b. Type CD IBMDIAG and then press **Enter**.
 - c. Type PCDR and then press **Enter**.

The diagnostic program will start.

Installing Diagnostics on Windows NT Client Workstations

The DOS-based diagnostic program, IBM PC Enhanced Diagnostics, does not run correctly when started from a Windows NT command prompt. Before you can install the DOS-based diagnostics on a client workstation running Windows NT, the client workstation must also have DOS installed on its hard disk and be configured to start from either Windows NT or DOS. Currently, preinstalled software packages from IBM are not configured in this manner. Therefore, you must first reformat the primary partition, install DOS, then reinstall Windows NT. For additional information about installing operating systems on models without diskette drives, see "Installing Operating Systems" on page 46.

After you have prepared the client workstation hard disk, you can use the following procedures to install and run the DOS-based diagnostics.

To install the DOS-based diagnostics:

1. Create the IBM PC Enhanced Diagnostics diskette using the Diskette Factory feature on the *Ready-to-Configure CD* provided with your client workstation.
2. Create a subdirectory on the server and copy the contents of the IBM PC Enhanced Diagnostics diskette into this directory.
3. Create a subdirectory on the client workstation and name it IBMDIAG.
4. Copy the IBM PC Enhanced Diagnostics files from the server into the IBMDIAG directory on the client workstation.

To run the DOS-based diagnostics:

1. Shut down Windows NT and restart it in DOS mode.
2. At the command prompt, type `CD IBMDIAG` and then press **Enter**.
3. Type `PCDR` and then press **Enter**.

The diagnostic program will start.

Installing Diagnostics on OS/2 Client Workstations

The DOS-based diagnostic program does not run correctly when started from an OS/2 command prompt, a DOS Window, or a DOS full-screen session. Before you can install the DOS-based diagnostics on a client workstation running OS/2, the client workstation must be configured as either of the following:

- **Multiboot:** This OS/2 configuration sets up a small partition for the Boot Manager program and separate partitions for OS/2 and DOS. When the computer starts, a Boot Manager menu appears, and you can select to start either OS/2 or DOS. In this environment, the DOS and OS/2 partitions are not visible to each other. Therefore, you need to create a third, shared partition for data. This is the partition where the diagnostics files will reside. You can also put any other applications or data in this partition.
- **Dual Boot:** This OS/2 configuration puts DOS and OS/2 within the same partition. The computer remembers whether DOS or OS/2 was running when the computer was last shut down, and when restarted, resumes operation in that environment. To switch from OS/2 to DOS or DOS to OS/2, the user must type a `BOOT` command at a command prompt.

For additional information about installing operating systems on models without diskette drives, see "Installing Operating Systems" on page 46.

After you have prepared the client workstation hard disk, you can use the following procedures to install and run the DOS-based diagnostics.

To install the DOS-based diagnostics:

1. Create the IBM PC Enhanced Diagnostics diskette using the Diskette Factory feature on the *Ready-to-Configure CD* provided with your client workstation.
2. Create a subdirectory on the server and copy the contents of the IBM PC Enhanced Diagnostics diskette into this directory.
3. Create a subdirectory on the client workstation and name it IBMDIAG.
Note: In a multiboot environment, this directory must be in the shared partition.
4. Copy the IBM PC Enhanced Diagnostics files from the server into the IBMDIAG directory on the client workstation.

To run the DOS-based diagnostics in a multiboot environment:

1. Shut down OS/2 and restart the computer
2. From the Boot Manager menu, select the DOS partition.
3. At the command prompt, type *d:* (where *d* is the drive letter of your shared partition), then press **Enter**.
4. Type `CD IBMDIAG` and then press **Enter**.
5. Type `PCDR` and then press **Enter**.
The diagnostic program will start.

To run the DOS-based diagnostics in a dual-boot environment:

1. Save all data and close all open applications.
2. From an OS/2 command prompt, type `c:\os2\boot /dos` and then press **Enter**.
3. When the message appears asking if you want to continue, press **Y** and then press **Enter**.
The computer restarts in DOS.
4. At the DOS command prompt, type `cd IBMDIAG` and then press **Enter**.
5. Type `PCDR` and then press **Enter**.
The diagnostic program will start.
6. After running the diagnostics, return to the OS/2 mode as follows:
 - a. From a DOS command prompt, type `c:\os2\boot /os2` and then press **Enter**.
 - b. When the message appears asking if you want to continue, press **Y** and then press **Enter**.

Running Network Adapter Diagnostics

The method of running diagnostics on a network adapter varies from adapter to adapter. This section provides information about the IBM 100/10 EtherJet PCI Adapter with Wake on LAN and the IBM PCI Wake on LAN Token-Ring Adapter.

Installing the IBM 100/10 EtherJet PCI Adapter with Wake on LAN Diagnostics

The Windows-based diagnostics are automatically installed when you install the device drivers for Windows NT. However, for Windows 95, you must install the diagnostics using a separate procedure.

To install the Windows-based diagnostics for Windows 95:

1. Search for the **IBMFESet.INF** file on the client workstation.
 - If the **IBMFESet.INF** file is present, go to step 9
 - If the **IBMFESet.INF** file is not present, continue with step 2.
2. Use the Diskette Factory feature on the RTC CD to create the two device driver diskettes for the IBM 100/10 EtherJet PCI Adapter with Wake on LAN.
3. Create a **DRIVERS** directory on the server.
4. Create a two subdirectories under the **DRIVERS** directory; one for each of the diskettes you created.
5. Copy the contents of each diskette into its respective directory.
6. Create a **DRIVERS** directory on the client workstation, if one does not already exist.
7. Create two subdirectories under the **DRIVERS** directory for the two diskettes you created in step 2.
8. Copy the device driver diskette contents from the two server subdirectories into the two client workstation subdirectories.
9. Using Windows Explorer, change to the directory containing the contents from the IBM 100/10 EtherJet PCI Adapter with Wake on LAN diskette 1 (the directory containing **IBMFESet.INF**).
10. Using the right mouse button, click on **IBMFESet.INF**.
11. Select **Install**.

The **IBMFESet** icon is now installed in the Control Panel.

Running IBM 100/10 EtherJet PCI Adapter with Wake on LAN Diagnostics

The IBM 100/10 EtherJet PCI Adapter with Wake on LAN has a Windows-based diagnostic program that is provided on the device driver diskette. The following procedure assumes that these diagnostics have already been installed. If the **IBMFESet** icon is not in the Control Panel, go to "Installing the IBM 100/10 EtherJet PCI Adapter with Wake on LAN Diagnostics."

To run these diagnostic routines on a Windows NT or Windows 95 client workstation:

1. Click on the Windows **Start** button.
2. Select **Settings**.
3. Select **Control Panel**.
4. Double-click on the **IBMFESet** icon. The Adapter Properties window appears.
5. Click on **Test**; then follow the instructions on the screen.

IBM PCI Wake on LAN Token-Ring Adapter

Because of the design of *Diskette 1*, *LANAID* and *Diagnostics*, the diagnostic program can be run from a diskette drive only. At this time, a LAN solution for running the token-ring diagnostic program is not available. Should a LAN solution become available, this guide will be updated to include information about running the diagnostic program.

Updating Device Drivers

Almost all device driver updates are distributed electronically as files that create physical diskettes. Because of the different methods used by device driver developers in their installation routines, not all device drivers can be installed over the LAN using the same techniques. In general, there are four ways to install or update device drivers over the network.

Peer-to-peer hard disk drive mapping: You can install a spare client workstation on the network, create a device driver directory, install the files and directory structure from each device driver diskette into individual subdirectories, then set up the parent device driver directory on this client workstation as a publicly-accessible drive. To minimize the chance of files getting erased, or the possible introduction of a virus from another client workstation, you might want to give this directory read-only access. If you want to restrict use, you can implement password access.

Server hard disk drive mapping: This is probably the most secure method of making device drivers available to client workstations. You can create a device driver directory on the server hard disk, install the device drivers in individual subdirectories, then make the parent device driver directory accessible as a read-only drive. Installing the device drivers on the server allows you to limit access to only those who need access, for example, your support staff.

Diskette and CD-ROM drive mapping: Because some device driver developers do a certain amount of checking in their installation programs, it might not be possible to copy the diskette or CD contents into a hard disk directory and make it installable. Some device drivers check for volume labels or assume that device driver is always being installed from a diskette drive. This situation does not happen often, but it does happen. Under these circumstances, the only way to make the device driver available over the network is to map to another client workstation diskette or CD-ROM drive. Unfortunately, someone must be at the peer client workstation to insert the appropriate diskette or CD when needed.

File replacement: If device drivers already exist on a client workstation and you just need to update them with a later version, you can use the file replacement method if the old and new files have the same name. This method can be a little risky because you are bypassing the normal device driver installation program. You must know which files are installed by the device driver program and the directories into which they are written.

Note: None of these methods can be used unless you already have network access, which means you must already have the operating system and network adapter device drivers installed. For information about installing the operating system and the initial installation of device drivers, see "Installing Operating Systems" on page 46.

File Replacement

You can use IBM LANClient Control Manager to automate this process and transport the updated files to a specific client workstation or group of client workstations. You can perform the process during hours when the client workstation is normally off, and the process requires no operator intervention at the client workstation.

You can also replace files using normal operating system functions.

Mapping to a Server or Peer Drive

After the server or peer client workstation has the appropriate directory structure and device-driver diskette files installed, you can access the device-driver diskette files in one of two ways for installation.

Local hard disk access: You can copy the contents of the remote device-driver directories into the matching directories on the client workstation. With this method, someone at the client workstation can install or update device drivers using normal methods, but direct the installation program to source from the local directory instead of a diskette.

Remote hard disk access: Before using this method, you must assign a drive letter to the remote drive. Then, someone at the client workstation can install or update device drivers using normal methods, but direct the installation program to source from the remote drive and directory instead of a diskette. Because this procedure requires a functioning network adapter at all times, do not use this method for updating a network adapter device driver.

Note: In the following procedure, if you are updating Windows 95 device drivers and are prompted to insert the Windows CD, direct the installation program to the directory containing the .CAB files.

To update Windows 95 device drivers:

1. From the Windows 95 desktop, click on **Start**.
2. Select **Settings**.
3. Select **Control Panel**.
4. Double-click on **System**.
5. Double-click on **Device Manager**.
6. Click on the device for which you want to update the device driver. The properties notebook opens for that device.
7. Click on the **Driver** tab.
8. Click on **Change driver**.
9. Click on **Have disk**.
10. Use the Browse button to select the drive and directory that contains the appropriate device driver files, then click on **OK**.
11. From the Install from Disk window, verify that the correct .INF file is selected; then click on **OK**.

Note: If the correct .INF file is not selected, type the correct file name. For example, for the IBM 100/10 EtherJet PCI Adapter with Wake on LAN, you must use the NETIBMFE.INF file in Windows 95.
12. From the Select Device window, click on **OK**.
13. From the Properties notebook, click on **OK**.
14. From the System Settings Change window, do one of the following:
 - If this is the last device driver you want to update, click on **Yes** to restart Windows.
 - If you have more device drivers to update, click on **No**, then install the next device driver.

To update Windows NT device drivers, use the procedure provided in the device driver manufacturer's documentation, but when you instruct the installation program that you have a disk, you must also use the browse button to point to the directory on your local hard disk or the drive and directory of a remote hard disk that contains the appropriate device driver files.

To update OS/2 device drivers, use the procedure provided in the device driver manufacturer's documentation, but when prompted for the source and target paths, instead of assigning drive A as the source, type in the path of the directory on your local hard disk or the drive and directory of a remote hard disk that contains the appropriate device driver files.

Flashing System BIOS

The software required to update system BIOS is distributed on self-starting (bootable) diskettes. The only supported method of updating system BIOS on a PC without a diskette drive is to use IBM LANClient Control Manager. LANClient Control Manager converts the Flash BIOS diskette into an image that can be assigned to a specific client workstation or group of client workstations and processed over the network. The process is performed without any operator intervention at the client workstation.

Flashing Adapter ROM

The information in this section covers the two network adapters available in the IBM PC 300GL model without diskette drives.

IBM 100/10 EtherJet PCI Adapter with Wake on LAN

You can flash the EEPROM on this adapter to accomplish either of the following tasks:

- Install a later version of the EEPROM software
- Change between RPL and DHCP protocols

You can flash the EEPROM using any of the following methods:

- Using LANClient Control Manager (LCCM), you can flash the EEPROM remotely.
- Using your network operating system, you can create and assign a bootable diskette image, then flash the EEPROM from the client workstation.
- You can install the Flash program on the client workstation hard disk and run it from the client workstation.

You can obtain the Flash diskette from the following World Wide Web address:

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

Using LCCM to Flash the Adapter

You can use LCCM to flash the adapter EEPROM over the LAN without any operator intervention at the client workstation. For details, see the *LCCM Supplement for IBM PCs without Diskette Drives*.

Note: LCCM Version 1.X supports RPL only. If you use LCCM to change the adapter protocol from RPL to DHCP, LCCM will no longer be able to communicate with the client workstation.

Creating and Assigning a Diskette Image

An alternative method of flashing the adapter is to create a diskette image of the Flash diskette and assign it to the client workstation on an as-needed basis. You can use this method if you are using a NetWare server, regardless of what operating system is installed on the client workstation. This method is not supported on a Windows NT server or an OS/2 Warp server.

To create the diskette image and flash the adapter EEPROM:

1. From the NetWare server, run the NetWare utility program DOSGEN.EXE to merge the content of the Flash diskette into a single .SYS file.
2. Give the output .SYS file an understandable name, such as ENETFLSH.SYS.
3. Copy the .SYS file into the NetWare \LOGIN directory on the server.
4. Assign the .SYS file to the client workstation. See the NetWare documentation if you need assistance.
5. Start the client workstation. When the flash program loads, follow the instructions on the screen.
6. After you have completed the flash operation, unassign the .SYS file from the client workstation.

Installing the Flash Diskette Files on the Client Hard Disk

Using this method of flashing the adapter, someone at the client workstation can flash the adapter EEPROM without any dependency on network resources. You can use this method on a client workstation that has any of following operating systems installed:

- DOS (or DOS with Windows)
- Windows 95
- OS/2
- Windows NT (with selectable DOS boot)

To copy the Flash diskette files:

1. Create a directory on the server and name it SVRFLSH.

You can use any name you want, but the directory name SVRFLSH will be used in the remainder of this procedure to identify this server directory

2. Copy the contents of the flash diskette into the SVRFLSH directory.
3. In the SVRFLSH directory, create a batch file named FLASH.BAT that has the following contents:

```
futil.exe -ibm pd0189.bin rboot273.com
```

Note: The character strings pd0189 and rboot273 might change from version to version. To ensure you have the correct character strings for your version of the Flash diskette, do the following:

- a. Using a text editor, open the CONFIG.SYS file located in the SVRFLSH directory.
 - b. In the CONFIG.SYS file, verify that the character strings in the last line match the line you entered in the FLASH.BAT file. Change the FLASH.BAT file if necessary.
 - c. Close the CONFIG.SYS file.
4. Save the FLASH.BAT file.
 5. Create a directory on the client workstation named CLNTFLSH.

You can use any name you want, but the directory name CLNTFLSH will be used in the remainder of this procedure to identify this client workstation directory.

6. Copy the contents of the server SVRFLSH directory into the client workstation CLNTFLSH directory.

You can copy the files to the client workstation over the network using a variety of methods. The most common method is as follows:

- a. From the client workstation, log on as the administrator.
- b. Use the NET USE command to map a drive letter to the server SVRFLSH directory. For example:

```
NET USE X: \\SERVERNAME\SVRFLSH
```

- c. Copy the files from the server to the client workstation. For example:

```
XCOPY X:*. * /s c:\CLNTFLSH\*. *
```

To run the flash program from a Windows NT client workstation:

1. Shut down Windows NT and restart the client workstation.
2. When the Boot Menu appears, select **DOS**.
3. When a DOS prompt appears, do the following:
 - a. Type `CD CLNTFLSH` and then press **Enter**.
 - b. Type `FLASH` and then press **Enter**.
4. When the Flash program loads, follow the instructions on the screen to flash the EEPROM.
5. When the flash process is complete, restart the client workstation in Windows NT mode.

To run the flash program from a Windows 95 client workstation:

1. Shut down Windows 95 and restart the client workstation in DOS mode.
2. When a DOS prompt appears, do the following:
 - a. Type `CD CLNTFLSH` and then press **Enter**.
 - b. Type `FLASH` and then press **Enter**.
3. When the Flash program loads, follow the instructions on the screen to flash the EEPROM.
4. When the flash process is complete, restart the client workstation in Windows 95 mode.

To run the flash program from an OS/2 client workstation:

1. Restart the client workstation in a native DOS mode.

Note: The flash program will not run from a DOS window or DOS full-screen session within OS/2.
2. When a DOS prompt appears, do the following:
 - a. Type `CD CLNTFLSH` and then press **Enter**.
 - b. Type `FLASH` and then press **Enter**.
3. When the Flash program loads, follow the instructions on the screen to flash the EEPROM.
4. When the flash process is complete, restart the client workstation in OS/2 mode.

To run the flash program from a DOS or Windows 3.1 client workstation:

1. Close Windows 3.1.
2. From a DOS prompt, do the following:
 - a. Type `CD CLNTFLSH` and then press **Enter**.
 - b. Type `FLASH` and then press **Enter**.
3. When the Flash program loads, follow the instructions on the screen to flash the EEPROM.
4. When the flash process is complete, restart Windows.

IBM PCI Wake on LAN Token-Ring Adapter

The IBM PCI Wake on LAN Token-Ring Adapter is shipped with the following default settings:

- AutoSense On
- RPL Enabled
- Expansion ROM Enabled

To change these default settings, you must first create *Diskette 1, LANAID and Diagnostics* from the *IBM PCI Token-Ring Adapter Drivers and Instructions* CD, then store LANAID on the client workstation.

To create the diskette:

1. Insert the CD into a CD-ROM drive.
2. From a command prompt in a full-screen DOS session, type:

```
D:\STARTCD
```

where D: is the drive letter of your CD-ROM drive.

3. From the CD main menu, select **2, Create configuration and diagnostic diskette (LANAID)** and follow the instructions on the screen.

To store LANAID on the client workstation:

1. Create a directory on the server and name it TRDSK01S.

Note: You can use any name you want for this directory, however the name TRDSK01S will be used throughout the remainder of this procedure to identify this directory.

2. Copy the contents of *Diskette 1, LANAID and Diagnostics*, to the server TRDSK01S directory.
3. Create a directory on the client workstation named TRDSK01.

Note: Because the token-ring diskettes are numbered, it is a good idea to create the TRDSK01 directory under a DRIVERS directory. By doing so, you can store Diskette 2 (the device driver diskette) and any other unique device driver diskettes in the same directory. For example:

```
DRIVERS-|  
        |-TRDSK01  
        |-TRDSK02  
        |-VIDEO
```

4. Copy the contents of the server TRDSK01S directory into the client workstation TRDSK01 directory.
5. At the client workstation, go to a command prompt.
6. Change to the TRDSK01 directory.
7. From the command prompt, type INSTALL and then follow the instructions to select the appropriate drive and directory. The default is C:\LANAID.

The LANAID program installs.

To change the settings:

1. From a DOS full-screen session, change to the drive and directory where the LANAID program is stored.
2. At the command prompt, type LANAID and then press **Enter**.
3. On the panel titled LANAID Version 2.x..., the MAC address is shown. Use the pull-down menu to show the MAC address of any other PCI Token-Ring Adapters, if any are installed. Select the address of the adapter with which you want to work.
4. Select **Adapter Configuration** and follow the instructions to change the settings.

Installing and Updating Application Programs

Because of the various media (CD, single diskette, multiple diskettes) used to distribute application programs, the method of making them installable over a LAN varies significantly. Also, because of the different methods used by application developers in their installation routines, not all application programs can be installed over the LAN. In general, there are three ways to install applications programs.

Peer-to-peer hard disk drive mapping: You can install a spare client workstation on the network, create an application directory, copy the files and directory structure from a CD (or single diskette) into individual subdirectories, then set up the parent application directory on this client workstation as a publicly-accessible drive. To minimize the chance of files getting erased, or the possible introduction of a virus from another client workstation, you might want to give this directory read-only access. If you want to restrict use, you can implement password access.

Server hard disk drive mapping: This is probably the most secure method of making application programs available to client workstations. You can create an application directory on the server hard disk, copy the files and directory structure from a CD (or single diskette) in individual subdirectories, then make the parent application directory accessible as a read-only drive. Copying the application program files on the server allows you to limit access to only those who need access, for example, your support staff.

Diskette and CD-ROM drive mapping: Because some application programs span multiple diskettes, and some installation programs cannot accommodate installation from any source other than the original media, it might not be possible to copy the contents of a diskette or CD into a hard disk directory and make it installable over a LAN. Should you run into one of these application programs, the only way to make the application installable over the network is to map to another client workstation diskette or CD-ROM drive. Unfortunately, someone must be at the peer client workstation to insert the appropriate diskette or CD when needed.

After the server or peer client workstation has the appropriate directory structure and application program files installed, you can access the application program files in one of two ways for installation.

Local hard disk access: You can copy the contents of the application program directories into matching directories on the client workstation. With this method, someone at the client workstation can install or update device drivers using normal methods, but direct the installation program to source from the local directory instead of a CD or diskette. If additional components need to be added in the future, the user has all of the files necessary on the local hard disk to make the change.

Remote hard disk access: Before using this method, you must assign a drive letter to the remote drive. Then, someone at the client workstation can install application programs using normal methods, but direct the installation program to source from the remote drive and directory instead of a CD or diskette. If additional components need to be added in the future, users will have to ensure that the client workstation is mapped to the correct remote drive and directory that contains the correct source files.

Installing Operating Systems

Before you install an operating system on a client workstation without a diskette drive, you must consider not only how you install the operating system over a network, but also how you will maintain it.

Because many diagnostic and utility programs are provided on their own self-starting DOS-based diskettes, it is very important that you make allowances for these when you set up client workstations without diskette drives. Some DOS-based diskettes do not run from a Windows NT or OS/2 command prompt. When you install operating systems, such as Windows NT and OS/2, you must ensure that they are installed in such a manner that the client workstation can also be started in a native DOS mode. By

doing so, you can copy the contents of these diskettes into a directory on the client workstation, start the client workstation in a native DOS mode, and run the program from the hard disk. There is no guarantee that every diskette-based program can be run in this manner, but a vast majority will run without any problems.

You must also make allowances for items like device drivers and utility programs that are normally delivered on diskette and designed to be installed under a specific operating system. To accommodate these, you must set up a directory structure on the client workstation so that the content of each diskette is in a unique directory and the directories are organized in an orderly fashion. By setting up your client workstations in this manner, device drivers are accessible from the hard disk for installation, and the contents of the directories can be replaced over the network as a maintenance activity when updated versions of the device drivers become available.

Most of the procedures in this section deal with installing an operating system in an RPL/remote-boot environment. Before following these procedures, ensure that your server is set up for RPL/remote boot and is functioning correctly. The procedures in this section are examples of ways to install an operating system on a client workstation without a diskette drive using normal network-operating-system techniques. Depending on your skills, you can automate many of the steps by creating batch files or you can take a totally different approach using other network-management software.

Preparing the Client Workstation

Before you can install an operating system in a model without a diskette drive, you must first disable the diskette-drive controller so the operating system installation program will work correctly.

To disable the diskette-drive controller:

1. Access the Configuration/Setup Utility program (see “Accessing the Configuration/Setup Utility Program” on page 20).
2. Select **System Security**, then press **Enter**.
3. Select **Secure Hard Disk Drives and Diskette Drives**, then press **Enter**.
4. Select **Diskette Drive Access**.
5. Press ← or → to **Disable** this setting.
6. Exit and save the setting.

Using LCCM to Install an Operating System

If you have an RPL/remote-boot server running on your network, you can use LCCM to install operating systems. The following list shows the various operating systems LCCM can install based on the network operating system being used:

- **OS/2 Warp Server:** You can use LCCM to install OS/2 Warp, DOS, or DOS with Windows 3.x. OS/2 CID installation is also supported.
- **Windows NT 4.0 Server:** You can use LCCM to install Windows NT Workstation, Windows 95, DOS, or DOS with Windows 3.x.
- **Novell NetWare Versions 3.12, 4.1, and 4.11:** You can use LCCM to install Windows 95, DOS, or DOS with Windows 3.x.

With LCCM, you set up one computer as a donor workstation, copy the software image, and distribute the image to other computers (client workstations) that have the same hardware configuration. LCCM also enables you to personalize each image for items such as the user name, product ID number, workgroup name, and password. LCCM wakes up a client workstation if it is powered off, sets up the network

environment between the server and client workstations, executes instructions, and transports files. This simplifies the task of installing an operating system on a single workstation or group of workstations.

For information about using LCCM to install an operating system on a client workstation without a diskette drive, see the *LCCM Training and Procedures Guide Supplement for PCs without Diskette Drives*. For details about using LANClient Control Manager to distribute images to other client workstations, refer to the *LCCM Training and Procedures Guide*. Both of these publications are available on the World Wide Web at:

<http://www.pc.ibm.com/us/desktop/lccm/index.html>

If you want to install an operating system using normal network-operating-system techniques, follow the instructions in this section.

Installing Windows 95

This procedure requires the following:

- A server set up for RPL/remote boot.
- One licensed copy of DOS (or an operating system that contains a DOS subset).
- One licensed copy of Windows 95 (either the retail package or backup CD package). You will need the following components from the Windows 95 package.
 - Windows 95 CD
 - Windows 95 Certificate of Authenticity (attached to the Windows 95 documentation)
- One licensed copy of a client networking program (to be started in DOS mode).
- The MAC address of the client workstation on which you want to install the operating system.
- The *Ready-to-Configure CD* (or device driver diskettes for the client workstation network adapter and other built-in features such as video or audio).

Important Note About Automation: You can automate many of the steps within this procedure by creating batch files. You can also develop a lightly attended installation by creating a custom .INF file for use during installation. For details about creating and implementing a custom .INF file for use during installation, refer to the *Windows 95 Resource Kit* published by Microsoft Press. Within this procedure, the name of the Windows 95 SETUP program varies based on language. If you are using a Windows 95 CD that is in a language other than English, see Appendix A, “Windows 95 Setup Program by Language” on page 59 for a list of names for the various languages.

To install Windows 95:

1. Set up a directory structure on your server as shown:

```
OSINST-|
        |-WIN95CAB
        |-DIAG
        |-DRIVERS
```

Note: You can name these directories any name you want, but the following names will be used throughout this procedure:

OSINST: This is the server's main operating-system installation directory, to which the client workstation will be mapped. In this procedure, this directory is mapped as drive X and the client workstation hard disk is C. Your drive designations might be different.

WIN95CAB: This directory will contain the Windows 95 .CAB files and SETUP.EXE file.

DIAG: This directory will have subdirectories that contain the contents of the DOS-based diagnostic diskette for a specific model.

DRIVERS: This directory will have subdirectories containing the contents of the individual device driver diskettes.

2. Insert the Windows 95 CD into the server CD ROM drive.
3. Copy the contents of the WIN95 directory on the CD to the server WIN95CAB directory.
4. Using the client workstation *Ready-to-Configure CD*, use the Diskette Factory feature to create diskettes for the following:
 - All device drivers that pertain to the model you are installing
 - IBM PC Enhanced Diagnostics

Note: You might want to check the IBM Personal Systems Web site to see if later versions of device drivers are available. The files can be accessed at:

http://www.pc.ibm.com/us/support/desktop/desktop_support.html

5. If you have an IBM PCI Wake on LAN Token-Ring Adapter installed in the client workstation, create *Diskette 1, LANAID and Diagnostics* and *Diskette 2, Drivers* from the *IBM PCI Token-Ring Adapter Drivers and Instructions CD*. See Appendix C, "Creating Diskettes from the Token-Ring CD" on page 63 for instructions.
6. Under the DRIVERS directory, create a separate directory for each device driver diskette.

Note: You might want to name the directories by function (for example AUDIO1, VIDEO1, NETWRK1, NETWRK2 and so on). It is also a good idea to create a log file containing the descriptions of each directory. A typical log file could look like the following:

```
NETWRK1: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
          (Diskette 1: Device Drivers) Version 2.5
NETWRK2: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
          (Diskette 2: Diagnostics and Help) Version 2.5
VIDEO1:  CIRRUS CLGD5446 Driver for Windows 95
          Version X.X
AUDIO1:  IBM 16-bit Sound Card for Windows 95
          Version X.X
```

7. Copy the contents of each device-driver diskette into its respective directory on the server.
8. Create a directory under the DIAG directory and give it a name that identifies the client workstation model or type, for example, PC300GL.

Note: You can name this directory any name you want, but the name PC300GL will be used throughout this procedure.
9. Copy the content of the *IBM PC Enhanced Diagnostics* diskette into the DIAG\PC300GL directory on the server.
10. Create a startable (bootable) DOS diskette with the following contents:
 - System files
 - COMMAND.COM
 - Client networking program
 - AUTOEXEC.BAT file to automatically start the client networking program and map to the server OSINST directory.
 - FDISK.COM

- FORMAT.COM
- XCOPY.COM
- ATTRIB.EXE
- SYS.COM

11. Install the device drivers for the client workstation network adapter onto the diskette.
12. Convert the diskette you just created to an RPL image.
 - If you are using a NetWare Server, see “Creating an Image Using NetWare” on page 75.
 - If you are using an OS/2 Server, see “Creating an Image Using OS/2 Warp” on page 75.
 - If you are using Windows NT, refer to the *Windows NT Server Resource Kit* available from Microsoft Press.
13. Ensure that the target client workstation:
 - Is configured for RPL (see “DHCP and RPL Settings” on page 20).
 - Has the startup sequence set to start from the network (see “Selectable Startup Sequence” on page 23).
 - Has the diskette-drive controller is disabled (see “Preparing the Client Workstation” on page 47).
14. Assign to the target client workstation the RPL image you created.
15. Turn on the target client workstation.
16. Partition the target client workstation hard disk.
 - Do not create any partitions larger than 2GB.
 - Set the first partition as bootable.
17. Format the partitions. The first partition must be formatted using the /s parameter. For example:
`FORMAT C: /S`
18. Create on the target client workstation a directory called WIN95INS.

Note: You can name this directory any name you want, but the name WIN95INS will be used throughout this procedure.
19. Use XCOPY to copy the contents of the server WIN95CAB directory into the client workstation WIN95INS directory, for example,
`XCOPY X:\WIN95CAB *.* C:\WIN95INS *.*`
20. Create on the client workstation a directory called DRIVERS.

Note: You can name this directory any name you want, but the name DRIVERS will be used throughout this procedure.
21. Use XCOPY to copy the subdirectories under the server DRIVERS directory to the client workstation DRIVERS directory, for example,
`XCOPY X:\DRIVERS *.* C:\DRIVERS *.* /s`

Note: If any of the device-driver diskettes have a deep directory structure causing the XCOPY command to exceed 56 characters, the XCOPY command will terminate before copying all of the directories. If this occurs, use an archive program like PKZIP for DOS to zip the server DRIVERS directory (and all subdirectories) into a single file residing on the client workstation, then unpack it on the client workstation.
22. Create on the client workstation a directory called IBMDIAG.

Note: It is very important that you use IBMDIAG for this subdirectory. If an IBM servicer needs to run diagnostics on a PC without a diskette drive, the servicer will expect diagnostics to be in this directory.

23. Use XCOPY to copy the contents of the server DIAG\PC300GL directory to the client workstation IBMDIAG directory.
24. Turn off the client workstation.
25. Remove network from the startup sequence. See "Selectable Startup Sequence" on page 23 for details.
26. Restart the client workstation.
27. From the client workstation DOS prompt:
 - a. Type CD WIN95INS and then press **Enter**.
 - b. Type Setup, then press **Enter**.

Follow the instructions on the screen to install Windows 95.

Note: If you receive a message at any time during the Windows 95 installation instructing you to remove the floppy disk from the diskette drive, ignore the message and click on **OK** to continue.

When the Windows 95 installation is complete, the computer will restart and the Windows 95 desktop will be displayed. Continue with the next step to install the device drivers.

28. Install the device drivers as follows:
 - a. From the Windows 95 desktop, click on **Start**.
 - b. Select **Settings**.
 - c. Select **Control Panel**.
 - d. Double-click on **System**.
 - e. Double-click on **Device Manager**.
 - f. Double-click on the device for which you want to install the device driver.

Note: If a device, such as Network Adapter, is not listed, double-click on **Other Devices**.
The Properties notebook opens for that device.
 - g. Click on the **Driver** tab.

If prompted for the type of hardware, select your hardware type, then click on **OK**.
 - h. Click on **Change driver**.
 - i. Click on **Have disk**.
 - j. Use the Browse button to select the drive and directory that contains the appropriate device driver files, then click on **OK**.
 - k. From the Install from Disk window, verify that the correct .INF file is selected, then click on **OK**.

Note: If the correct .INF file is not selected, type the correct file name. For example, for the IBM 100/10 EtherJet PCI Adapter with Wake on LAN, you must use the NETIBMFE.INF file.
 - l. From the Select Device window, click on **OK**.
 - m. From the Properties notebook, click on **OK**.
 - n. From the System Settings Change window, do one of the following:
 - If this is the last device driver you want to update, click on **Yes** to restart Windows, then continue with the next step.

- If you have more device drivers to update, click on **No**, then install the next device driver.
29. If you have an IBM 100/10 EtherJet PCI Adapter with Wake on LAN installed, install the network diagnostic program, IBMFESet, as follows:
- a. Using File Explorer, change to the directory that contains the IBM 100/10 EtherJet Adapter device drivers.
 - b. Using the right mouse button, click on **IBMFESet** (or **IBMFESet.INF**).
 - c. Select **Install**.

The IBMFESet icon will be installed in the Control Panel.

Windows 95 is now installed with all the correct device drivers and the required DOS-based diagnostics. You will also have access to other client workstations and servers through the Network Neighborhood. If you want to install applications from the *Ready-to-Configure CD*, see "Using the Ready-to-Configure CD" on page 35.

Installing DOS with Windows 3.X

IBM PC DOS 7.0 is distributed on diskettes in XDF format. Files in XDF format cannot be viewed or copied using standard DOS, Windows 95, or Windows NT utilities. Therefore, you cannot copy the files from the diskettes to a server or peer hard disk and perform a remote installation.

However, you can map to a server or peer diskette drive and perform the DOS installation directly from the DOS installation diskettes. Once the DOS installation is complete, you can copy the Windows 3.x files to the client workstation's local hard disk and run the Windows setup program.

Note: You cannot use this method with NetWare and Windows NT servers. The memory requirements for installing PC DOS 7.0 exceed the amount of memory available after setting up network connection with a Windows NT server. And, you cannot map to a NetWare server diskette drive. An alternative method of installing DOS, which you can use with either a Windows NT or NetWare server, requires the use of a computer with a diskette drive to act as a donor. You can install DOS on the donor, copy the installed files to a server, then after partitioning and formatting the client workstation hard disk (using the `FORMAT C: /S` command), copy the DOS files from the server to the client workstation.

Two items to keep in mind are device drivers and maintenance. The following procedure includes the steps necessary to install DOS, Windows 3.x, IBM PC Enhanced Diagnostics, and device drivers. If you follow this procedure, maintenance procedures, such as running diagnostics and fixing end-user-induced device driver problems, can be performed without the network administrator taking any special actions.

This procedure requires the following:

- A server set up for RPL/remote boot
- One licensed copy of DOS
- One licensed copy of Windows 3.x
- One licensed copy of a client networking program (to be started in DOS mode)
- The MAC address of the client workstation on which you want to install the operating system
- The *Ready-to-Configure CD* (or device driver diskettes for the client workstation network adapter and other built-in features such as video or audio)

To install DOS with Windows 3.x:

1. Set up a directory structure on your server as shown:

```

OSINST-|
        | -DIAG
        |
        | -DRIVERS
        |
        | -WINSTALL

```

Note: You can name these directories any name you want, but the following names will be used throughout this procedure:

OSINST: This is the server's main operating-system installation directory, to which the client workstation will be mapped. In this procedure, this directory is mapped as drive X, the server (or peer) diskette drive is mapped as drive Y, and the client workstation hard disk is drive C. Your drive designations might be different.

DIAG: This directory will have subdirectories that contain the contents of the IBM PC Enhanced Diagnostics diskette for a specific model.

DRIVERS: This directory will have subdirectories containing the contents of the individual device driver diskettes.

WINSTALL: This directory will contain all the files from the Windows 3.x diskettes.

2. Using the client workstation *Ready-to-Configure CD*, use the Diskette Factory feature to create diskettes for the following:

- All DOS and Windows 3.X device drivers that pertain to the model you are installing
- IBM PC Enhanced Diagnostics

Note: You might want to check the IBM Personal Systems Web site to see if later versions of device drivers are available. The files can be accessed at:

http://www.pc.ibm.com/us/support/desktop/desktop_support.html

3. If you have an IBM PCI Wake On LAN Token-Ring Adapter installed in the client workstation, create *Diskette 1, LAN AID and Diagnostics* and *Diskette 2, Drivers* from the *IBM PCI Token-Ring Adapter Drivers and Instructions CD*. See Appendix C, "Creating Diskettes from the Token-Ring CD" on page 63 for instructions.

4. Under the DRIVERS directory, create a separate directory for each device driver diskette.

Note: You might want to name the directories by function (for example AUDIO1, VIDEO1, NETWRK1, NETWRK2 and so on). It is also a good idea to create a log file containing the descriptions of each directory. A typical log file could look like the following:

```

NETWRK1: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
         (Diskette 1: Device Drivers) Version 2.5
NETWRK2: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
         (Diskette 2: Diagnostics and Help) Version 2.5
VIDEO1:  CIRRUS CLGD5446 Driver for Windows 3.X
         Version X.X
AUDIO1:  IBM 16-bit Sound Card for Windows 3.X
         Version X.X

```

5. Copy the contents of each device-driver diskette into its respective directory on the server.

6. Create a directory under the DIAG directory and give it a name that identifies the client workstation model or type, for example, PC300GL.

Note: You can name this directory any name you want, but the name PC300GL will be used throughout this procedure.

7. Copy the contents of the *IBM PC Enhanced Diagnostics* diskette into the DIAG\PC300GL directory on the server.

8. Copy the contents of all the Windows 3.x diskettes into the server's WINSTALL directory.
9. Create a startable (bootable) DOS diskette with the following contents:
 - System files
 - COMMAND.COM
 - Client networking program
 - AUTOEXEC.BAT file to automatically start the client networking program, map drive X to the server OSINST directory, and map drive Y to the server diskette drive.
 - FDISK.COM
 - FORMAT.COM
 - XCOPY.COM
 - ATTRIB.EXE
 - SYS.COM
10. Install the DOS device drivers for the client workstation network adapter onto the diskette.
Note: Ensure that the CONFIG.SYS file has a Files= statement of at least 30.
11. Convert the diskette you just created to an RPL image.
 - If you are using a NetWare Server, see “Creating an Image Using NetWare” on page 75.
 - If you are using an OS/2 Server, see “Creating an Image Using OS/2 Warp” on page 75.
 - If you are using Windows NT, refer to the *Windows NT Server Resource Kit* available from Microsoft Press.
12. Ensure that the target client workstation:
 - Is configured for RPL (see “DHCP and RPL Settings” on page 20).
 - Has the startup sequence set to start from the network (see “Selectable Startup Sequence” on page 23).
 - Has the diskette drive controller disabled (see “Preparing the Client Workstation” on page 47).
13. Assign to the target client workstation the RPL image you created.
14. Turn on the target client workstation.
15. Partition the target client workstation hard disk.
 - Do not create any partitions larger than 2GB.
 - Set the first partition as bootable.
16. Format the partitions. The first partition must be formatted using the /s parameter. For example:
FORMAT C: /S
17. Insert the first DOS installation diskette into the server diskette drive.
18. From the client workstation:
 - a. Type Y: and then press **Enter**.
 - b. Type SETUP and then press **Enter**.The DOS installation program begins. Follow the instructions on the screen, inserting and removing the DOS installation diskettes from the server diskette drive as required. When the DOS installation is complete, continue with the next step.
19. Restart the client workstation using the RPL image you created earlier.

20. Create on the client workstation a directory called DRIVERS.

Note: You can name this directory any name you want, but the name DRIVERS will be used throughout this procedure.

21. Use XCOPY to copy the subdirectories under the server DRIVERS directory to the client workstation DRIVERS directory. For example,

```
XCOPY X:\DRIVERS\NETWRK1 *.* C:\DRIVERS\NETWRK1 *.* /s
```

Note: If any of the device-driver diskettes have a deep directory structure that causes the XCOPY command to exceed 56 characters, the XCOPY operation will terminate before copying all of the directories. If this occurs, use an archive program like PKZIP for DOS to zip the server device driver subdirectories into a single file residing on the server, then use XCOPY to copy the zipped files into their appropriate subdirectories and unpack them. Remember that the archive program will have to reside in a directory that is accessible from the client workstation, for example, the server's OSINST directory.

22. Create on the client workstation a directory called IBMDIAG.

Note: It is very important that you name this directory IBMDIAG and make it accessible from the root directory. If an IBM servicer needs to run diagnostics on a PC without a diskette drive, the servicer will expect diagnostics to be in this directory.

23. Copy the contents of the server DIAG\PC300GL directory to the client workstation IBMDIAG directory.

24. Create on the client workstation a directory called WINSTALL.

25. Copy the files from the server WINSTALL directory to the client workstation WINSTALL directory.

26. Restart the client workstation and modify the startup sequence to remove network as a startup device. See "Selectable Startup Sequence" on page 23 for details.

27. Restart the client workstation. DOS will start from the client workstation hard disk.

28. From the DOS prompt:

- Type CD WINSTALL and then press **Enter**.
- Type SETUP and then press **Enter**.

The Windows 3.x installation program begins. Follow the instructions on the screen. When the Windows 3.x installation is complete, continue with the next step.

29. Install all required DOS and Windows device drivers according to the device-driver manufacturers' instructions (usually in a README file), but instead of using diskettes, point to the appropriate subdirectory under the DRIVERS directory.

Installing Windows NT

You can install Windows NT Workstation over the network from a server running Windows NT Server. However, you must install Windows NT so DOS is also installed and that DOS can be started from the NT Boot menu. Refer to one of the following sources for instructions:

- *Windows NT Server Resource Kit* published by Microsoft Press.
- IBM LANClient Control Manager *Training and Procedures Guide*, which is available from the following World Wide Web address:

<http://www.pc.ibm.com/us/desktop/lccm/index.html>

LANClient Control Manager installs DOS with Windows NT by default.

Before starting the Windows NT installation procedure, ensure that the target client workstations have the diskette-drive controller disabled (see "Preparing the Client Workstation" on page 47).

After Windows NT has been installed at the client workstation, the network adapter will be functional and you will be able to use the Network Neighborhood to access the additional device driver files and IBM PC Enhanced Diagnostics files from a server or another client workstation on the network. Use the following procedure to install the device drivers and make diagnostics accessible to the client workstation.

Note: In the following procedure, a server is used to store the device driver files and IBM PC Enhanced Diagnostics files. However, you also can use a spare client workstation (that has a diskette drive and CD ROM drive) in place of a server and access the files peer-to-peer.

1. Set up a directory structure on your server as shown:

```
OSINST-|
      |-DIAG
      |-DRIVERS
```

Note: You can name these directories any name you want, but the following names will be used throughout this procedure:

OSINST: This is the server main operating system installation directory, to which the client workstation will be mapped. In this procedure, this directory is mapped as drive X and the client workstation hard disk is C. Your drive designations might be different.

DIAG: This directory will have subdirectories that contain the contents of the DOS-based diagnostic diskette for a specific model.

DRIVERS: This directory will have subdirectories containing the contents of the individual device driver diskettes.

2. Using the client workstation *Ready-to-Configure CD*, use the Diskette Factory feature to create diskettes for the following:

- All device drivers that pertain to the model you are installing
- IBM PC Enhanced Diagnostics

Note: You might want to check the IBM Personal Systems Web site to see if later versions of device drivers are available. The files can be accessed at:

http://www.pc.ibm.com/us/support/desktop/desktop_support.html

3. If you have an IBM PCI Wake On LAN Token-Ring Adapter installed in the client workstation, create *Diskette 1, LAN AID and Diagnostics* and *Diskette 2, Drivers* from the *IBM PCI Token-Ring Adapter Drivers and Instructions CD*. See Appendix C, "Creating Diskettes from the Token-Ring CD" on page 63 for instructions.

4. Under the DRIVERS directory, create a separate directory for each device driver diskette.

Note: You might want to name the directories by function (for example AUDIO1, VIDEO1, NETWRK1, NETWRK2 and so on). It is also a good idea to create a log file containing the descriptions of each directory. A typical log file could look like the following:

```
NETWRK1: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
         (Diskette 1: Device Drivers) Version 2.5
NETWRK2: IBM 100/10 EtherJet PCI Adapter with Wake on LAN
         (Diskette 2: Diagnostics and Help) Version 2.5
VIDEO1:  CIRRUS CLGD5446 Driver for Windows NT
         Version X.X
AUDIO1:  IBM 16-bit Sound Card for Windows NT
         Version X.X
```

5. Copy the contents of each device driver diskette into its respective directory on the server.

6. Create a directory under the DIAG directory and give it a name that identifies the client workstation model or type, for example, PC300GL.
Note: You can name this directory any name you want, but the name PC300GL will be used throughout this procedure.
7. Copy the contents of the *IBM PC Enhanced Diagnostics* diskette into the DIAG\PC300GL directory on the server.
8. Create on the client workstation a directory called DRIVERS.
Note: You can name this directory any name you want, but the name DRIVERS will be used throughout this procedure.
9. Copy the subdirectories under the server DRIVERS directory to the client workstation DRIVERS directory.
10. Create on the client workstation a directory called IBMDIAG.
Note: It is very important that you use IBMDIAG for this subdirectory. If an IBM servicer needs to run diagnostics on a PC without a diskette drive, the servicer will expect diagnostics to be in this directory.
11. Copy the contents of the server DIAG\PC300GL directory to the client workstation IBMDIAG directory.
12. Install the device drivers using the documentation provided with the device driver, but when you instruct the installation program that you have a disk, you must also use the Browse button to point to the directory on your hard disk that contains the appropriate device driver. For example, using the directory names in this procedure, you would point to the C:\DRIVERS\VIDEO1 directory for your video device drivers.

Windows NT is now installed with all of the correct device drivers and the required DOS-based diagnostics. If you want to install applications from the *Ready-to-Configure CD*, see "Using the Ready-to-Configure CD" on page 35.

Installing OS/2 Warp

The best method to install OS/2 Warp over the network is by using the IBM LANClient Control Manager (LCCM) program in conjunction with the IBM LAN CID Utility.

The IBM LAN CID Utility is a software distribution manager that redirects product installation files to client workstations using SRVIFS, a NETBIOS application over your LAN. Thus, the LAN CID Utility provides what is termed a *redirected installation*. The LAN CID Utility consists of REXX procedures and several supporting modules that track the current state of an installation across restarts and ensure that each step is run in the correct sequence.

With LANClient Control Manager, you can RPL to a client workstation the equivalent of the two startup (boot) diskettes required to start CID installation. For more information about using LCCM, visit the LCCM Web site at:

<http://www.pc.ibm.com/us/desktop/lccm/index.html>

From the LCCM Web site, you can access the LCCM *Training and Procedures Guide* and the *Training and Procedures Guide Supplement for PCs without Diskette Drives*.

For additional information about using the LAN CID Utility, refer to the *LAN CID Utility Online Guide*. You can install this guide from the installation CD for the version of OS/2 that you are using. This comprehensive guide details all the many features and options of the LAN CID Utility.

Appendix A. Windows 95 Setup Program by Language

The name of the Windows 95 SETUP program varies based on the language of the Windows 95 CD. The following shows the file names by language.

Figure 21. Windows 95 Setup Program by Language

Language	Setup Program Name
Arabic	SETUP.EXE
Arabic (English Enabled)	SETUP.EXE
Brazilian Portuguese	INSTALAR.EXE
Canadian French	INSTALL.EXE
Czech	SETUP.EXE
Danish	INSTALL.EXE
Dutch	SETUP.EXE
English (Asia Pacific)	SETUP.EXE
English (UK)	SETUP.EXE
English (US)	SETUP.EXE
Finnish	ASENNA
French	INSTALL.EXE
German	SETUP.EXE
Greek	SETUP.EXE
Hebrew	SETUP.EXE
Hungarian	SETUP.EXE
Italian	SETUP.EXE
Norwegian	INSTALL.EXE
Pan European Edition	SETUP.EXE
Polish	SETUP.EXE
Portuguese	CONFIG.EXE
Spanish	INSTALAR.EXE
Spanish (Latin American)	INSTALAR.EXE
Swedish	INSTALL.EXE
Thai	SETUP.EXE
Turkish	KUR.EXE

Appendix B. Sample Batch File for Windows 95 Installation

The following is a sample batch file for transporting the files required for a Windows 95 installation on a client workstation without a diskette drive. This batch file is provided to automate some of the steps in "Installing Windows 95" on page 48. You can include this file as part of the of the RPL startup (boot) image. After partitioning and formatting the client workstation hard disk, use this file to transport the necessary files. After transporting the files, start the Windows 95 installation by changing to the WIN95CAB directory and starting the SETUP.EXE program.

The drive letters in this sample file might be different from yours, depending on the type of server and your drive mapping. In this sample file:

- C is used for the client workstation drive.
- X is mapped to the OSINST directory on the server.
- PKZIP and PKUNZIP are in the OSINST directory on the server.

```

REM *****
REM ** SAMPLE FILE FOR TRANSPORTING WINDOWS 95 FILES **
REM ** AND SUPPORT SOFTWARE **
REM *****
REM ** SET UP READ/WRITE ACCESS
echo off
net logoff
net logon administrator_name password
REM **USE THE ABOVE SYNTAX FOR WINDOWS NT
REM **FOR OS/2 USE THE FOLLOWING SYNTAX:
REM ** logon administrator_name /p:password
echo on
REM ** COPY CABS
xcopy x:\win95cab\*. * /s c:\
REM ** SET UP DIRECTORY STRUCTURE ON CLIENT
REM ** FOR 100/10 ETHERJET DISKETTE 1
c:
cd\
md drivers
cd drivers
md netwrk1
REM **TRANSPORT 100/10 ETHERJET DISKETTE 1 USING PKZIP
REM **DEEP DIRECTORY STRUCTURE PREVENTS USE OF XCOPY
x:
cd\
cd \drivers\100disk1
x:pkzip netwrk1.zip -rp *. *
xcopy netwrk1.zip d:\drivers\netwrk1
REM **UNZIP 100/10 ETHERJET DISKETTE 1 ON THE CLIENT
c:
cd\
cd drivers
cd netwrk1
x:pkunzip -d netwrk1.zip c:
REM **SET UP DIRECTORY FOR ETHERJET DISKETTE 2 AND TRANSPORT
d:
cd\
cd drivers
md netwrk2
xcopy
xcopy x:\drivers\netwrk2\*. * c:\drivers\netwrk2\*. * /s
REM **SET UP DIRECTORY FOR IBM DIAGNOSTICS AND TRANSPORT
c:
cd\
md ibmdiag
xcopy x:\diag\*. * c:\ibmdiag\*. * /s
REM ** SET UP DIRECTORY FOR VIDEO DRIVERS AND TRANSPORT
c:
cd\
cd drivers
md video1
xcopy x:\drivers\video1\*. * c:\drivers\video1\*. * /s

```

Appendix C. Creating Diskettes from the Token-Ring CD

The following provides instructions for creating the LANAIID diskette and the device driver diskette from the *IBM PCI Token-Ring Adapter Drivers and Instructions* CD. You will need the files on these diskettes if you are installing a model without a diskette drive, but with the IBM PCI Wake on LAN Token-Ring Adapter.

To make the diskettes:

1. Insert the CD into a CD-ROM drive.
2. From a command prompt in a full-screen DOS session, type:

```
D:\STARTCD
```

where *D:* is the drive letter of your CD-ROM drive.

3. From the IBM PCI Token-Ring Adapter Installation menu, select option 1, **Create an environment installation package (diskette) or install from CD**. Then, follow the instructions on the screen to create a diskette for your operating-system environment.
4. When the diskette has been created, return to the IBM PCI Token-Ring Adapter Installation menu.
5. Select option 2, **Create configuration and diagnostic diskette (LANAIID)**, and follow the instructions on the screen to create the diskette.

Appendix D. Error Codes

Because of the "sealed box" concept of the PC 300GL models without diskette drives (models 6272-88X, 89X, and 90X), the documentation provided with these models does not contain any instructions for resolving problems that require cover removal. However, because you or your support staff might need this information, a listing of error codes and actions is provided in this guide.

POST Error Codes

Each time you turn on your computer, a series of tests automatically checks the base operations of the computer. This series of tests is called the power-on self-test (POST).

POST does the following:

- Checks basic system-board operations
- Checks the memory operation
- Compares the current system configuration with that established by the Configuration/Setup Utility program
- Starts the video operation
- Verifies if any installed diskette drives are working
- Verifies that the hard disk drive and any installed CD-ROM drives are working

If POST detects a problem, you might hear multiple beeps or no beep at all, and an error message displays. POST error messages are 3-, 4-, 5-, 8-, or 12-character alphanumeric messages that include brief explanations (except for I999XXXX errors).

Because an initial POST error can cause subsequent errors to occur, the computer might display more than one error message.

Use the following chart to identify and correct any POST errors.

Notes:

1. If you need to access components inside of an IBM PC 300GL without a diskette drive, you will need a torx screwdriver with a T8 bit and the *Installing Options in Your Personal Computer* publication, which is available from the following World Wide Web address:
<http://www.pc.ibm.com/us/cdt>
2. The PC-Doctor programs are diagnostic tools provided on the *Ready-to-Configure CD* provided with the computer. If you need to run diagnostics remotely on the computer, see "Running System Diagnostics" on page 36.
3. The "X" in an error message can be any alphanumeric character.

POST Message	Description
101	A failure occurred during testing of the system board and microprocessor.
102	Action: Have the computer serviced.

POST Message	Description
110	<p>A memory parity failure occurred during testing of the system board.</p> <p>Action: Run the diagnostic programs to verify that a problem exists in a dual inline memory module (DIMM).</p> <p>Refer to <i>Installing Options in Your Personal Computer</i> if you need to reconfigure the system memory to aid in identifying the defective DIMM.</p> <p>If you cannot identify the defective DIMM in this way, have the computer serviced.</p>
114	<p>An adapter read-only memory (ROM) error occurred.</p> <p>Action: Remove all adapters that are not required for system startup and reinstall them one at a time, retesting after each is reinstalled. When an adapter fails, replace it.</p> <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
121	<p>A hardware error occurred.</p> <p>Action: Have the computer serviced.</p>
161	<p>The battery on the system board is dead.</p> <p>CAUTION: Danger of explosion if lithium battery is incorrectly replaced.</p> <p>Replace the battery with the same or equivalent type recommended by the manufacturer. Dispose of batteries as required by local ordinances or regulations.</p> <p>Action: The computer can be used until you replace the battery. However, you will have to run the Configuration/Setup Utility program to set the time and date each time the computer is turned on until a new battery is installed. (For instructions on using the Configuration/Setup Utility program, see <i>Using Your Personal Computer</i>.)</p>
162	<p>A change in device configuration occurred. This message is displayed under one or more of the following conditions:</p> <ul style="list-style-type: none"> • A new device has been installed. • A device has been moved to a different location or cable connection. • A device has been removed or disconnected from a cable. • A device is failing and is no longer recognized by the computer as being installed. • An external device is not turned on. • An invalid checksum is detected in CMOS memory (nonvolatile RAM). <p>Action:</p> <ol style="list-style-type: none"> 1. Verify that all external devices are turned on. External devices must be turned on before the computer is turned on. 2. Verify that all devices are properly installed and securely connected. 3. If you added, removed, or changed the location of a device, you must save the new configuration in the Configuration/Setup Utility program. 4. If you did not add, remove, or change the location of a device, a device is probably failing. Running the diagnostic programs might isolate the failing device. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
163	<p>The clock is not working correctly.</p> <p>Action: Set the correct date and time. If the date and time are set correctly and saved and the 163 error message reappears, replace the battery.</p> <p>If this does not correct the problem, have the computer serviced.</p> <p>Note: The computer can be used until it is serviced, but any application programs that use the date and time will be affected.</p>

POST Message	Description
164	<p>A change in the memory configuration occurred. This error can be caused by adding, removing, or incorrectly installing memory.</p> <p>Note: The computer can be used with decreased memory capacity until the error is corrected.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. If you added memory, see <i>Installing Options in Your Personal Computer</i> to verify that the new memory is correct for your computer and that it is installed correctly. 2. If you added or removed memory, you must save the new configuration in the Configuration/Setup Utility program. 3. Running the diagnostic programs might isolate the location of the problem DIMM and provide additional information. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
20X	<p>A failure occurred during testing of the memory. This error can be caused by incorrectly installed memory, a failing DIMM, or a system-board failure.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. If you have added memory, see <i>Installing Options in Your Personal Computer and Using Your Personal Computer</i> to verify that the new memory is correct for your computer, and that it is installed and configured correctly. 2. Run the diagnostic programs to verify the problem. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
301 303	<p>A failure occurred during testing of the keyboard and keyboard controller. These error messages also might be accompanied by continuous beeping.</p> <p>Action:</p> <p>Ensure that:</p> <ol style="list-style-type: none"> 1. Nothing is resting on the keyboard and pressing a key. 2. No key is stuck. 3. The keyboard cable is securely attached to the keyboard connector on the computer. <p>Note: If you have just connected a new mouse or other pointing device, turn the computer off and disconnect that device. Wait at least 5 seconds, and then turn the computer on. If the error message goes away, replace the device. If the error message remains, have the keyboard and cable or the computer serviced.</p>
601	<p>A failure occurred during testing of the diskette drive and diskette-drive controller. This error can be caused by a loose or incorrectly connected cable, a failing drive, or a failing system board.</p> <p>Note: The computer can be used, but one or more diskette drives might not work.</p> <p>Action: Verify that all diskette drive cables are properly installed and securely connected.</p> <p>Running the diagnostic programs might isolate the diskette drive that failed, but you must have your computer serviced.</p>
602	<p>The computer is not able to start the diskette in the drive. The diskette might be damaged or formatted incorrectly.</p> <p>Action: Try another startable diskette that is formatted correctly and is in good condition.</p> <p>If this does not correct the problem, have the computer serviced.</p>

POST Message	Description
604	<p>A failure occurred during the testing of a diskette drive.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Verify that the Configuration/Setup Utility program correctly reflects the type of diskette drive you have installed. (For instructions on using the Configuration/Setup Utility program, refer to <i>Using Your Personal Computer</i>.) 2. Run the diagnostic programs. 3. If the diagnostic programs detect a failure, replace the diskette drive. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
662	<p>A diskette drive configuration error occurred.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Verify that the Configuration/Setup Utility program correctly reflects the number of diskette drives you have installed. (For instructions on using the Configuration/Setup Utility program, refer to <i>Using Your Personal Computer</i>.) 2. If you installed or removed a diskette drive, you must save the new configuration in the Configuration/Setup Utility program. <p>If this does not correct the problem, have the computer serviced.</p>
1762	<p>An IDE configuration error occurred. This could be caused by one of the following:</p> <ul style="list-style-type: none"> • A hard disk or other IDE drive (such as an IDE CD-ROM drive) was added or removed, but the changes to the Configuration/Setup Utility program have not yet been saved. • A hard disk or other IDE drive was added, but the master/subordinate (slave) setting on the drive is improperly set. • The power or IDE cable is disconnected or not fully seated. • A hard disk drive is failing. <p>Action: Verify that the Configuration/Setup Utility program correctly reflects the number of IDE drives installed (hard disk drives, CD-ROM-drives, and so on). For more information, refer to <i>Using Your Personal Computer</i>.</p> <p>If the information is correct, save the settings, exit from the Configuration/Setup Utility program, and restart the computer.</p> <p>If the information is not correct, do the following.</p> <ol style="list-style-type: none"> 1. Exit from the Configuration/Setup Utility program <i>without</i> saving the settings. 2. Verify that the power cable and IDE cable are fully seated into the drive connectors, and the IDE cable is fully seated into the connector on the system board. 3. If you just added a new drive, verify that the drive you added has the master-subordinate (slave) setting set correctly. If the new drive is the only drive attached to the IDE cable, it must be set as the master. If it is the second drive on the IDE cable, it must be set as the subordinate. <p>Note: If you installed two new drives on the same cable, ensure that one is set as a master and one is set as a subordinate.</p> <p>See the instructions that came with your new drive for the jumper locations and settings.</p> <ol style="list-style-type: none"> 4. Restart the computer. If the 1762 error message appears again, verify that the IDE drive information in the Configuration/Setup Utility program is correct. If it is correct, save the information and restart the computer. If the information is still incorrect, you might have a failing drive. Have the computer serviced.

POST Message	Description
178X	<p>A failure occurred during testing of the hard disk drive or a primary or secondary IDE device.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Run the diagnostic programs. 2. If the diagnostic programs detect a failure, replace the defective hard disk drive or primary or secondary IDE or EIDE device. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
1800	A PCI adapter has requested a hardware interrupt that is not available.
1801	A PCI adapter has requested memory resources that are not available.
1802	A PCI adapter has requested an I/O address that is not available, or the PCI adapter might be defective.
1803	A PCI adapter has requested a memory address that is not available, or the PCI adapter might be defective.
1804	<p>A PCI adapter has requested a memory address that is not available.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Make sure that all ISA legacy adapters are set correctly in the Configuration/Setup Utility program. If the resource settings are not correct, change and save the settings. Setting the resources used by ISA legacy adapters to Not available enables the Plug and Play function to configure around the legacy adapters. <p>For background information on PCI, ISA, Plug and Play, and legacy (non-Plug and Play) adapters, refer to <i>Installing Options in Your Personal Computer</i>. For information about required resource settings for ISA legacy adapters, refer to the documentation that comes with these adapters.</p> <ol style="list-style-type: none"> 2. Make sure that switches on all ISA legacy adapters are set correctly. For information about switch settings, refer to the documentation that comes with the ISA legacy adapters. 3. If all resources are being used by ISA legacy adapters, you might need to remove an ISA legacy adapter to make resources available to the PCI adapter you want to install. For instructions on removing adapters, see <i>Installing Options in Your Personal Computer</i>. <p>Note: If you remove an ISA legacy adapter, set the resources used by the removed adapter to Available before installing another adapter.</p> <ol style="list-style-type: none"> 4. If you have other PCI or Plug and Play adapters installed, you might need to remove one of these adapters to make resources available to the PCI adapter you want to install. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
1805	<p>A PCI adapter read-only memory (ROM) error occurred.</p> <p>Action: Remove all of the PCI adapters that are not required for system startup and reinstall them one at a time, retesting after each is reinstalled. When an adapter fails, replace it.</p> <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>

POST Message	Description
1850	A Plug and Play adapter has requested a hardware interrupt that is not available.
1851	A Plug and Play adapter has requested memory resources that are not available.
1852	A Plug and Play adapter has requested an I/O address that is not available, or the Plug and Play adapter might be defective.
1853	A Plug and Play adapter has requested a memory address that is not available, or the Plug and Play adapter might be defective.
1854	<p>A Plug and Play adapter has requested a memory address that is not available.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Make sure that all ISA legacy adapters are set correctly in the Configuration/Setup Utility program. If the resource settings are not correct, change and save the settings. Setting the resources used by ISA legacy adapters to Not available enables the Plug and Play function to configure around the legacy adapters. <p>For background information on PCI, ISA, Plug and Play, and legacy (non-Plug and Play) adapters, refer to <i>Installing Options in Your Personal Computer</i>. For information about required resource settings for ISA legacy adapters, refer to the documentation that comes with these adapters.</p> <ol style="list-style-type: none"> 2. Make sure that switches on all ISA legacy adapters are set correctly. For information about switch settings, refer to the documentation that comes with the ISA legacy adapters. 3. If all resources are being used by ISA legacy adapters, you might need to remove an ISA legacy adapter to make resources available to the Plug and Play adapter you want to install. For instructions on removing adapters, see <i>Installing Options in Your Personal Computer</i>. <p>Note: If you remove an ISA legacy adapter, set the resources used by the removed adapter to Available before installing another adapter.</p> <ol style="list-style-type: none"> 4. If you have other PCI or Plug and Play adapters installed, you might need to remove one of these adapters to make a resource available to the Plug and Play adapter you want to install. 5. If your system will be loading a Plug and Play operating system, ensure that Plug and Play Operating System is set to Yes within the Configuration/Setup Utility program. 6. Ensure that the address decode value for the adapter is properly set within the Configuration/Setup Utility program. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
1855	<p>A Plug and Play adapter read-only memory (ROM) error occurred.</p> <p>Action: Remove all of the Plug and Play adapters that are not required for system startup and reinstall them one at a time, retesting after each is reinstalled. When an adapter fails, replace it.</p> <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>

POST Message	Description
1856	<p>A Plug and Play adapter has requested a DMA address that is not available.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Make sure that all ISA legacy adapters are set correctly in the Configuration/Setup Utility program. If the DMA address settings are not correct, change and save the settings. Setting the resources used by ISA legacy adapters to Not available enables the Plug and Play function to configure around the legacy adapters. <p>For background information on PCI, ISA, Plug and Play, and legacy (non-Plug and Play) adapters, refer to <i>Installing Options in Your Personal Computer</i>. For information about required DMA resource settings for ISA legacy adapters, refer to the documentation that comes with these adapters.</p> <ol style="list-style-type: none"> 2. Make sure that switches on all ISA legacy adapters are set correctly. For information about switch settings, refer to the documentation that comes with the ISA legacy adapters. 3. If all DMA addresses are being used by ISA legacy adapters, you might need to remove an ISA legacy adapter to make a DMA address available to the Plug and Play adapter you want to install. For instructions on removing adapters, see <i>Installing Options in Your Personal Computer</i>. <p>Note: If you remove an ISA legacy adapter, set the DMA address used by the removed adapter to Available before installing another adapter.</p> <ol style="list-style-type: none"> 4. If you have other PCI or Plug and Play adapters installed, you might need to remove one of these adapters to make a DMA address available to the Plug and Play adapter you want to install. 5. If your system will be loading a Plug and Play operating system, ensure that Plug and Play Operating System is set to Yes within the Configuration/Setup Utility program. 6. Ensure that the address decode value for the adapter is properly set within the Configuration/Setup Utility program. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
1962	<p>A startup sequence error occurred.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Make sure the startup options are set correctly in the Configuration/Setup Utility program. If the settings are not correct, change and save them. 2. Make sure the primary IDE cable is properly installed and securely connected. 3. Make sure all adapters are installed correctly. For instructions on adding adapters, see <i>Installing Options in Your Personal Computer</i>. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
2462	<p>A video configuration error occurred.</p> <p>Action:</p> <ol style="list-style-type: none"> 1. Make sure the monitor signal cable is securely attached to the monitor connector. 2. If you just added or removed video memory, you must save the new configuration in the Configuration/Setup Utility program. <p>If the problem cannot be isolated and corrected, have the computer serviced.</p>
5962	<p>An IDE CD-ROM configuration error occurred.</p> <p>Action: Follow the procedures listed for POST error message 1762 on page 68.</p>

POST Message	Description
8603	<p>A failure occurred during testing of the mouse. This error can be caused by the mouse or by a failing system board.</p> <p>Note: This error can also occur if electrical power was lost for a very brief period and then restored. In this case, turn off the computer for at least 5 seconds, and then turn it back on.</p> <p>Action: Ensure the keyboard and mouse are securely attached to the correct connectors. If they are connected correctly, use the following procedure:</p> <ol style="list-style-type: none"> 1. Turn off the computer. 2. Disconnect the mouse from the computer. 3. Turn on the computer. <p>If the POST error message does not reappear, the mouse is probably failing. (See the documentation that came with the mouse for additional testing information.) If the problem remains, have the mouse serviced.</p> <p>If the POST error message reappears, run the diagnostic tests to isolate the failure. If the diagnostic tests do not find a problem and the POST error message remains, have the computer serviced.</p>
19990301	<p>A hard disk failure occurred.</p> <p>Action: Have the computer serviced.</p>
Other Numbers	<p>The computer POST found an error.</p> <p>Action: Follow the instructions on the screen.</p>

Error Messages Specific to the Integrated Ethernet

An error message appears on the screen after the Ethernet controller is initialized and a failure condition occurs. These error messages are shown below. If you experience any error related to the integrated Ethernet subsystem, record the error message, and notify your network administrator of the problem.

Note: The error messages shown in this section are available only with those models that come with the integrated Ethernet subsystem. These error messages are not available when RPL or DHCP is used through optional network adapters.

RPL-Related Error Messages

These error messages are specific to the integrated Ethernet controller and the RPL environment of your computer.

The two most common error messages are shown below.

RPL-ROM-ERR: 105 The Integrated Ethernet Failed the Loopback Test
RPL-ROM-ERR: 107 Media Test Failed; Check the Cable

Error 105 indicates that a power-on diagnostic test performed by the Ethernet controller did not execute correctly. If this error message appears, have the computer serviced. Error 107 indicates that the cable from the LAN is not securely connected to the Ethernet port on your computer. Check the cable to ensure that it is properly connected.

Other error messages that might occur are shown in the following table.

RPL-ROM-ERR: 101 The integrated Ethernet was unable to initialize.
RPL-ROM-ERR: 102 The integrated Ethernet could not be reset.
RPL-ROM-ERR: 100 The integrated Ethernet cannot be found.
RPL-ROM-ERR: 103 There are multiple Ethernets in the system.
Please specify the correct serial number in NET.CFG.
RPL-ROM-ERR: 104 The integrated Ethernet EEPROM is faulty or not present.
RPL-ROM-ERR: 106 The integrated Ethernet is configured for Plug-and-Play on a non-Plug-and-Play system.
RPL-ROM-ERR: 110 The integrated Ethernet RAM failed the memory test.

DHCP-Related Error Messages

Error messages related to DHCP and the integrated Ethernet controller are shown in the following table. Each error message consists of an error code followed by a text message.

If you encounter one of these error messages, record the message, and contact your network administrator.

E61: Service boot canceled.	M38: Cannot open TFTP connection.
E62: Cannot initialize controller.	M39: Cannot read from TFTP connection.
E63: Cannot initialize controller.	M40: BOOTP canceled by keystroke.
E67: Cannot initialize controller.	M40: DHCP canceled by keystroke.
E6d: Cannot find BOOTP server.	M41: BOOTP timeout.
E6e: Cannot start from downloaded image.	M41: DHCP timeout.
E71: Too many MTFTP packages.	M42: No client or server IP.
M10: ARP canceled by keystroke.	M43: No bootfile name.
M11: ARP timeout.	M44: Cannot ARP redirected BOOTP server.
M20: Cannot copy memory.	M6f: System is locked! Press Ctrl+Alt+Del to reboot.
M21: Cannot write to memory.	M90: Cannot initialize controller for multicast.
M22: Cannot write to memory.	M91: MTFTP canceled by keystroke.
M30: Cannot ARP TFTP address.	M92: MTFTP open timeout.
M31: TFTP canceled by keystroke.	M93: Unknown MTFTP opcode.
M32: TFTP open timeout.	M94: MTFTP read canceled by keystroke.
M33: Unknown TFTP opcode.	M95: MTFTP timeout.
M34: TFTP read canceled by keystroke.	M96: Cannot ARP MTFTP address.
M35: TFTP timeout.	M98: Cannot open MTFTP connection.
M99: Cannot read from MTFTP connection.	Txx: <message from TFTP error packet>

Note: Any x value that follows an error code represents any alphanumeric character.

Appendix E. Creating and Assigning RPL Images

This section provides information about creating and assigning RPL images using the following network operating systems:

- Novell NetWare
- OS/2 Warp
- Windows NT Server

Creating an Image Using NetWare

A standard RPL image for Novell NetWare is a DOS startup (boot) diskette that has been turned into a .SYS file by the DOSGEN.EXE utility program. For complete information on using the DOSGEN.EXE utility, refer to your NetWare documentation.

The following information outlines the steps required to create an RPL image.

To create the RPL image:

1. Create a startable (bootable) DOS diskette. Be sure that the diskette contains the following files:
 - COMMAND.COM
 - AUTOEXEC.BAT
 - CONFIG.SYS
 - System files
 - Any other required files (for example, STARTNET.BAT and Novell executable files allowing login to NetWare)
2. Run the DOSGEN.EXE program provided with Novell NetWare. This program merges all the files on the diskette into a single .SYS file.
3. Give the output .SYS file an easily understandable name (for example, DOS7STD.SYS or DOS7EMM.SYS).
4. Copy the .SYS file into the NetWare \LOGIN directory on your server. The image is now available to assign to a client workstation.

For information about assigning an image to a client workstation, refer to your NetWare documentation

Creating an Image Using OS/2 Warp

To create an RPL image from OS/2 Warp Server:

1. Create a startable (bootable) DOS diskette. Be sure that the diskette contains the following files:
 - COMMAND.COM
 - AUTOEXEC.BAT
 - CONFIG.SYS
 - System files
 - Any other required files (for example, executable files allowing login to OS/2)
2. From the OS/2 Desktop, double-click on **LAN Server Administration**.
3. Double-click on **Local Workstation** *name*.
4. Double-click on **Diskette Image Source**.

5. From the menu bar, click on **Object**. Then, from the drop-down menu, click on **Make image from diskette**.
6. In the **Image name** field, type the name you want to assign to the diagnostic image. Use an easily identifiable name.
7. In the **Target server** field, select your server name from the drop-down list.
8. In the **Source drive** field, select the drive letter of the diskette drive you will be using.
9. Insert the diskette you created into the selected drive, then click on **OK**.

The RPL image (.IMG file) will be made and placed into the correct directory.

To assign an image from OS/2 Warp Server:

1. At an OS/2 command prompt, type

```
net start remoteboot
```

This command starts the remote boot service.

Note: To automate starting remoteboot when the server loads, you can put this command in the STARTUP.CMD file or add the appropriate remoteboot= command in the Services section of the IBMLAN.INI file.

2. Return to the OS/2 main screen and double-click on the **LAN Services File and Print** icon. Then, double-click on the **LAN Server Administration** icon and logon if necessary.
3. When the LAN Service Administration information appears, double-click on **Local Workstation**.
Four icons will be present if RPL support is installed correctly and the server is running the remoteboot service. The four icons are:
 - Services
 - Remote IPL Requesters
 - DOS Image Definitions
 - Diskette Image Source
4. Double-click on **Remote IPL Requesters**. A screen appears with the **Remote IPL Requester Template** icon. Double-click on this icon.
5. To enable a DOS requester:
 - a. Click on **Object** and then click on **Create another**.
 - b. Highlight the **Enable DOS Requester** choice under Status.
 - c. In the **Machine ID** field, type a name for the workstation you want to have RPL from the server. (No spaces are allowed in the name.)
 - d. In the **Description field**, type a description (optional).
 - e. In the **Network adapter address** field, type the 12-digit network adapter address of the workstation you want to RPL using the DOS RPL image.
 - f. Click on the **Parameters** tab in the upper right section of the screen.
 - g. At the Server Record Identifier section, click on the arrow to the right of the yellow blank entry space. Several record identifiers appear. Select the one that applies to your network adapter.
 - h. At the Image ID section, click on the arrow to the right of the yellow blank entry space. A list of images appears. Click on the image you created.
 - i. Click on **Create** in the lower left-hand corner. The DOS requester is enabled and you are returned to the Remote IPL Requester Template screen.
6. Make sure the client workstation is properly attached to the LAN.

7. Turn on the client workstation. The RPL counter increment as the workstation seeks out and connects to the OS/2 server and displays a status of the remote boot as it progresses.
8. Should you have a need to disable the requesters in the future, you can use either of the following procedures to do so:
 - From the Remote IPL Requesters screen, double-click on the icon for the DOS image you created.
 - Click on **Disable**.

Creating a Remote Boot Image from a Windows NT Server

For information about creating and assigning a remote boot image using Windows NT Server, refer to one of the following sources:

- The Windows NT Server online help
- The *Windows NT Server Resource Kit* published by Microsoft Press

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