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Remote Initial Program Load for IBM OS/2 V1.3, V2.0, and Netware

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Take Note!

Before using this information and the product it supports, be sure to read the general information under "Special Notices" on page xiii.

First Edition (October 1992)

This edition applies to Remote Initial Program Load of DOS V3.x, DOS V4.x, DOS V5.0, OS/2 V1.30.2, and OS/2 V2.0 from IBM OS/2 LAN Server V2.0, NetWare V3.11, NetWare V2.2, and NetWare Lite.

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Abstract

This document describes the different ways that the Remote Initial Program Load (RIPL) facility may be configured on the various IBM-supplied file server platforms. It provides information on how DOS and OS/2 images may be RIPLed from an IBM OS/2 LAN Server V1.3 and V2.0, a NetWare V3.11 server, a NetWare V2.2 server or external router, and a NetWare Lite server.

This document is intended for use as a reference to assist those who need to know how to set up a RIPL facility for medialess workstations. A knowledge of DOS, NetWare, and OS/2 installation is assumed.

PS (130 pages)

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Special Notices

This publication is intended to help customers and systems engineers to understand the RIPL process and successfully implement RIPL features on IBM LAN file server platforms. The information in this publication is not intended as the specification of any programming interfaces that are provided by IBM OS/2 LAN Server V2.0, NetWare from IBM V3.11, NetWare from IBM V2.2, or PC-DOS. See the PUBLICATIONS section of the IBM Programming Announcement for IBM OS/2 LAN Server V2.0, Novell NetWare V3.11, Novell NetWare V2.2, and PC-DOS for more information about what publications are considered to be product documentation.

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Preface

This document is intended to be a reference document for those who are involved in implementing diskless workstations in a NetWarefrom IBM or IBM OS/2 LAN Server V2.0 environment.

It contains information relating how DOS and OS/2 images may be RIPLed from an IBM OS/2 LAN Server V2.0, a NetWare V3.11 Server, a NetWare V2.2 Server or external router, and a NetWare Lite Server.

This document is intended to be a "how to" guide for persons requiring information on setting up the RIPL feature on the current LAN file server platforms IBM offers.

This document is organized as follows:

- Chapter 1, "Introduction"
- Chapter 2, "Boot ROM Overview"

  This provides a description of how the RPL module or Boot ROM manages to load an operating system into á workstation.
- Chapter 3, "RIPL from OS/2 LAN Server V2.0"

  This chapter describes how to set up an IBM OS/2 LAN Server to provide DOS and OS/2 RIPL services.
- Chapter 4, "RIPL using NetWare from IBM"

  This chapter describes the different NetWare platforms that can be set up to provide RIPL services. It also discusses the various options available on the platforms.
- Chapter 5, "NetWare RIPL of DOS Images"

  This chapter describes how to set up various DOS configurations that can be RIPLed from a NetWare server. It also details setting up an image to access to both NetWare and IBM OS/2 LAN Servers.
- Chapter 6, "NetWare RIPL of OS/2 V1.30.2 Images"

  This chapter describes how to set up a NetWare server to provide RIPL of OS/2 V1.30.2.
- Chapter 7, "NetWare RIPL of OS/2 V2.0 Images"

  This chapter describes how to set up a NetWare server to provide RIPL of OS/2 V2.0.

Related Publications

The following publications are considered particularly suitable for a more detailed discussion of the topics covered in this document.

Prerequisite Publications

- *IBM OS/2 LAN Server V2.0 Network Administrator's Reference Volume 1: Planning and Installation*, S04G-1032
- *IBM OS/2 LAN Server V2.0 Network Administrator's Reference Volume 2: Performance Tuning*, S04G-1033
- *IBM OS/2 LAN Server V2.0 Network Administrator's Reference Volume 3: Network Administrator Tasks*, S04G-1034
- *Novell NetWare Version 3.11 Installation*, Novell # 183-000298-001
- *Novell NetWare Requester for OS/2*, Novell # 100-001157-002
- *Novell NetWare ODI Shell for DOS*, Novell # 100-000871-001
- *Novell NetWare Version 2.2 Installing/Maintaining the Network*, Novell # 183-000265-001.

Additional Publications

- *IBM Token-Ring Network Remote Program Load User's Guide*, SK2T-03333
- *IBM Local Area Network Technical Reference*, SC30-3383-3
- *IBM Token-Ring Network Architecture Reference*, SC30-3374-02
- *Implementing the NetView DM/2 LAN Download Utility*, GG24-3678.

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Chapter 1. Introduction

Local Area Networks (LANs) allow computers to communicate with one other. Most computers gain access to the network by loading an operating system and adapter support code from their fixed disk or diskette drive. A Remote Program Load (RPL) module makes it possible for a personal computer or IBM* Personal System/2* computer to gain access to the network and request operating system code and applications to be downloaded, even though it may not have a hard disk or diskette drive.

The requesting device, called the *workstation* or *requester*, does this by asking a loading device to send it a bootstrap program. The loading device is another computer that has a hard disk and is called the *file server* or *RPL server*. The RPL server uses a loader program to send the bootstrap program to the workstation. Once the workstation has a bootstrap program, it is then equipped to request an operating system, which in turn can request and use application programs. An application program is one written for or by a user that applies to the user's work.

A special ROM must be installed on a token-ring, Ethernet, or IBM PC Network adapter. This adapter must be installed in the workstation in order to make it a requester. This special ROM is also known as a *Boot ROM* or *RPL Module*.

1.1 Remote Program Load Overview

For the RPL function to be operational on a network, the network must have a RPL server and one or more workstations with the necessary boot ROM module on their Network Interface Card (NIC). The RPL server and the workstation do not need to be on the same LAN segment. They can be on different LAN segments connected with bridges.

Both the RPL server and the workstations must be on the same logical network ID. That is, a workstation can operate across a bridge, but it cannot operate across a router.

The following descriptions differentiate the RPL server and the workstation:

- RPL server

  The RPL server must have a fixed disk or diskette drive. Its purpose is to supply files to the workstations. Also, both the RPL server and the workstations must have the same type of LAN adapter installed.

- Workstation

  The workstation does not need a fixed disk or diskette drive. It receives the operating system and programs it needs from the RPL server. The workstation needs a network adapter with a boot ROM module installed.

1.2 Initial Program Load and Remote Initial Program Load

Initial Program Load (IPL) is the process of loading an operating system into a workstation from a local diskette or hard disk. Remote Initial Program Load (RIPL) on the other hand is the process of loading an operating system into a workstation from a location that is remote to the workstation.

When a PC or PS/2 is powered on or rebooted, it goes through Power-On-Self-Test (POST) routines. During this phase, it determines which hard disks and floppy drives it has configured from its CMOS setup or from its motherboard switches.

- If there is a floppy disk drive, it checks for the presence of a diskette in the drive. If one is found, it attempts to load the operating system from the diskette.
- If there is a hard disk drive, it checks for the presence of an active primary partition on the disk. If one is found, it loads the operating system from the hard disk.

Once the operating system has loaded, drivers must be loaded to allow the network interface card to communicate on the network, either to a file server or to other workstations.

On a medialess workstation, or a workstation set up to IPL from a RPL server, the IPL code comes from a boot image on the RPL server. This process is termed *Remote Initial Program Load.*

In this case, when the workstation boots and goes through its Power-On-Self-Test (POST) routines, it detects the presence of a BIOS extension at the start of the boot ROM containing the requester code. The POST routines then branch to this code, tricking the BIOS into thinking that the NIC is actually a floppy drive. The workstation attempts to IPL from a pseudo-diskette contained within this pseudo-drive.

On a machine that already has a floppy drive, this process prevents the use of the floppy drive until after the RIPL process has completed. After the workstation has logged into the network, the floppy drive is returned to its proper status and becomes accessible once again. With a medialess workstation, this setup is ideal as it fools the workstation into thinking it has a floppy drive until the RIPL process has completed. After this, the workstation has all 26 drives, A through to Z, available for mapping as network drives.

The main differences between a drive the NIC emulates and a proper floppy drive is that the emulated drive is both faster and read only.

In order to truly emulate a floppy drive, all of the diskette information must be passed to the NIC, so the boot ROM may truly emulate a drive. This includes the system sectors, the FAT table, the directory structure and all of the files. This information is gathered together in the form of a *Boot Image File*.

Chapter 2. Boot ROM Overview

This chapter discusses how the RPL module or boot ROM loads operating system code into a workstation.

2.1 BIOS

All personal computers have Basic Input/Output Services (BIOS) chips (for example, Phoenix, AMI American, Quadtel, etc.). The BIOS consists of simple routines, that:

- Display information onto the screen
- Send information to a printer (including print screen)
- Floppy disk interface.

The BIOS is also used to "bootstrap" the computer. This bootstrap is referred to as the Power-On-Self-Test (POST) program. The POST program consists of several routines which are executed during power-up. Some of these routines are initializing memory and performing a brief system diagnostic test.

The POST routine searches for optional ROMs that reside in memory at addresses between 0xC8000 and 0xF4000. These ROMs must be located on a 2KB boundary. Optional ROM blocks are identified by a signature of 0xAA55h contained in the first word of the ROM block. Optional ROMs include:

- Floppy disk controller
- Fixed disk controller
- BASIC language ROM
- NetWare** boot ROM
- IBM RPL boot ROM.

If POST locates an optional ROM, it jumps or far calls into the ROM's entry point. This gives the optional ROM control to initialize itself. Normally, the optional ROM returns control to the POST routine, and the next optional ROM is located.

2.2 IBM Boot ROM

IBM boot ROMs for the IBM Token-Ring, IBM Ethernet and IBM PC Network adapters can only be used in an IBM LAN environment. IBM Boot ROMs do not operate in the same fashion as NetWare boot ROMs.

When the POST routine jumps to the IBM Boot ROM entry point, the ROM attaches the workstation to the network and broadcasts a FIND frame on the network. This is repeated periodically until a RPL server responds with a FOUND frame to the issuing workstation. The workstation then transmits a SEND.FILE.REQUEST frame to the RPL server, which sends the RIPL image file TOKEN.RPL, ETHER.RPL or PCN2L.RPL back to the requesting workstation.

The IBM boot ROM accepts the appropriate *.RPL program from the file server and executes it. Once loaded, the node completes its bootstrap process. The *.RPL code is the same code as that used by the NetWare boot ROM.

Note: Certain IBM microchannel computers, such as the IBM PS/2 Models 56 and 57 SLC, have a BIOS image file associated with them. During cold boot, the BIOS update process looks for files with an extension of .IML to update the motherboard BIOS before the bootstrap loader routine is called. These .IML files come on the reference diskette for the computer. You MUST create a directory called \LOGIN\IBMLAN\DCDB\IMAGES and install ALL .IML files in this directory. After loading the IML files, the computer does another reboot.

On a RIPL workstation this means the IML files are loaded from the RIPL server during the first reboot, then the RIPL image is loaded during the second reboot!

2.3 NetWare Boot ROM

When POST jumps to the NetWare boot ROM's entry point, the ROM hooks itself into the BIOS routines, imitating a floppy disk drive. It accepts calls from POST as though it were a floppy drive controller. The media for this pseudo disk drive is generally a boot image file created by the NetWare DOSGEN utility. This file must be located in the SYS:LOGIN directory.

The boot image file is read, as required by POST, through the services provided by the NetWare boot ROM.

2.4 Boot ROM Detail

The following is a technical explanation of how the RIPL process from a NetWare RPL server is performed. It is geared toward people who understand NetWare well and have a good working knowledge of DOS.

2.4.1 What is a Boot ROM?

As the name implies, a boot ROM is a ROM that boots a computer. The ROM itself is an integrated circuit that plugs into the network interface card (NIC) of a workstation on the network. Booting usually refers to loading DOS from a floppy or hard disk, but when booting from ROM, it comes across the network.

The code in the ROM is executed during the boot sequence on the workstation. The ROM is responsible for establishing a communications session with the file server and getting the correct information back to the workstation.

2.4.2 Why Use Boot ROMs?

The advantages of using a boot ROM over a disk drive are as follows:

1. Cost Advantage

   With a boot ROM in a workstation, a disk drive is unnecessary. A ROM chip is much less expensive than a disk drive.

2. Physical Size Advantage

   A computer that boots from a network can be physically much smaller than a computer that must contain either a hard disk and a floppy disk drive.

3. Security Advantage

   This is possibly the most important and common use for medialess machines. If there is no floppy disk drive, information may be viewed on the workstation, but it may not be copied onto diskette and taken out of the system. Also, there is no chance of introducing viruses into the system.

2.4.3 How Does the Boot ROM Work?

Basically, the boot ROM emulates a floppy drive. It takes over the floppy drive interrupt (INT 13h). As far as the workstation is concerned, it then has an A drive with a write-protected bootable disk in it.

Since the workstation thinks it has a floppy drive, it requires all of the low-level data on a floppy disk. This includes the system sectors, FAT table and directory tables. The boot ROM obtains this information from a boot image file, created by the system supervisor using the DOSGEN utility. In order to create the boot image file, a diskette is set up with the necessary files required to perform whatever is required of the workstation. The NetWare DOSGEN utility is used to read all of the information from the diskette and transfer it to a boot image file.

The diskette consists of CONFIG.SYS and the necessary device drivers that are required for the desired configuration. It will also include AUTOEXEC.BAT and whatever terminate-and-stay-resident (TSR) programs are required. The network shell programs that allow the workstation to log into the file server will also be included. The AUTOEXEC.BAT file may also execute the LOGIN program.

This strategy gives a lot of flexibility. Whatever environment can be set up from a floppy can also be set up by the boot ROM. Also, on machines which only have 360KB floppy drives, the boot ROM can still use an image generated from a 1.44MB diskette drive. The workstation that boots from ROM does not necessarily have to be the same machine that created the boot image. This point is more obvious when considering medialess machines like the IBM PS/2 Model 8555-LTO and the IBM PS/2* Model 8555-LEO, which have no means to create a diskette image in the first place.

The boot image file is an exact image of the floppy that the workstation believes is in drive A. In order for the boot ROM to access this file at boot time, it must be stored on the network in the SYS:LOGIN directory.

With the boot disk image file in the proper directory, the boot ROM is ready to perform the function of remote initial program load. It broadcasts a message to find the nearest server. The reply may indeed come from the physically nearest server, however, the workstation attaches to the first server that actually replies. After attaching to the file server, a media-specific remote program load file is transmitted to the workstation. This file allows the workstation to request the relevant contents of the BOOTCONF.SYS file in the SYS: directory of the file server.

One of several things can then happen, depending on the revision of files being used, and the particular setup involved. In all cases, the workstation attempts to read a boot image file from the file server. Then, whenever a floppy read request is issued in the workstation, the boot ROM intercepts the request and converts it into a network read request. Instead of reading data from the floppy, it comes from the boot image file.

2.4.4 What Goes On Underneath

Perhaps the easiest way to understand the workings is to compare the diskless boot image with the already familiar boot from the floppy or hard disk.

- The following procedure describes a floppy disk boot sequence:

```
Initialize BIOS vectors
Scan for Boot ROMs     (and execute their functions)
INT 19h
Load and Execute Boot Sector
        Load DOS
        Execute CONFIG.SYS Commands
        Execute AUTOEXEC.BAT Commands
                Execute LSL.com
                Execute MLID
                Execute IPXODI.com
                Execute NETX.com
                Execute LOGIN.exe
                        Execute Login Script
        DOS Prompt>
        ...
```

- The following procedure describes a boot ROM sequence:

```
Initialize BIOS vectors
Scan for Boot ROMs     (and execute their functions)
INT 19h                 (hooked by Boot ROM)
        Initialize Boot ROM
        Initialize Network Interface Card
        Attach to nearest file server
        Find and Open the boot image file
        Load and Execute Boot Sector
        Load DOS
        Execute CONFIG.SYS Commands
        Execute AUTOEXEC.BAT Commands
                Execute LSL.com
                Execute MLID
                Execute IPXODI.com
                Execute NETX.com
                Execute LOGIN.exe
                        Execute Login Script
        DOS Prompt>
        ...
```

As can be seen, the boot ROM has to do everything that the floppy did, as well as handling the NIC. The differences are in the boot ROM initialization routines and exit routines.

2.4.5 Boot ROM Entry

The boot ROM entry is actually within the real mode addressable memory space of the workstation. Unless the boot ROM is built into the BIOS of the machine, it should be readable at some address between 0xC000:0h and 0xEE00:0h. The exact address depends on the configuration of the workstation and its NIC settings. Looking at the beginning of the boot ROM address in memory using DEBUG or a similar program, the following might be seen:

```
D200:0000  55 AA 10 50 06 33 C0 8E C0 26 A1 04 03 3D 6E 6A
```

The first two bytes, "55 AA", at the beginning is the "Optional ROM" stamp or signature. The next byte is the size byte. It denotes the number of 512 byte pages the ROM occupies. An 8KB ROM, for example has a size of 0x10h. The next byte is the entry point of the ROM. The very last byte on the ROM is the checksum byte. If the sum of all the bytes on the ROM is not the same as the checksum byte, then the POST issues a warning message.

2.4.6 Boot ROM Initialization

When the BIOS executes INT 19h, the boot ROM has total control. First it checks to see if there is a real floppy, and if there is, it checks to see if it contains a diskette. Next it checks to see if there is a hard disk present, and if there is, it checks for an active partition on the hard disk.

If there is no floppy, and the workstation does not boot from a hard disk, the boot ROM replaces the original INT 19h vector, then jumps to the replaced vector.

2.4.6.1 NetWare Boot ROM Initialization

NetWare Boot ROMs first relocate their RPL bootstrap code to RAM. Since DOS is not loaded when INT 19h is executed, DOS function calls cannot be used to allocate any memory. This leaves 20KB at the top of memory for the resident portion of COMMAND.COM. NetWare Boot ROMs locate their code 16KB below this. (These values have caused some problems with DOS 5.0, and have since been increased.)

Next, the RPL bootstrap code initializes the NIC. The ODI shells have not been loaded, so the RPL bootstrap code has to talk directly to the card. When the ODI shells have loaded, they take over the hardware, and the RPL bootstrap code has to communicate through the IPX stack instead of talking directly to the board. Until then, there is a small IPX emulator in the RPL bootstrap code with just enough functionality to complete the boot process.

The RPL bootstrap code then attempts to communicate through the LAN and establish a connection with a file server. To do this, the RPL bootstrap code broadcasts a GET.NEAREST.SERVER request (GNS request) and uses the source address from the first response that comes back.

If there are multiple servers on the same LAN, the NetWare RPL bootstrap code file normally has to be installed on all the servers the workstation may attach to. This is in the event that one server may respond faster than others. Because of the possibility that the workstation may connect to another file server at some time, it is important to have the RPL bootstrap code file on all relevant file servers.

There are currently some developments which simplify this situation and allow the workstation to connect to a particular server.

2.4.6.2 IBM Boot ROM Initialization

IBM boot ROMs first initialize the NIC, so they can broadcast a "FIND frame" request on the LAN. (This is normally done using the IEEE 802.2 protocol.) This is repeated periodically, until an RPL Server responds with a "FOUND frame" to the issuing workstation. The workstation then transmits a SEND.FILE.REQUEST frame to the RPL server, which sends a media-specific RPL bootstrap code file (TOKEN.RPL, ETHER.RPL or PCN2L.RPL) back to the requesting workstation containing the IBM boot ROM.

When the workstation receives the RPL bootstrap code, it is loaded into RAM and executed. Most of this code is relocated to near the top end of RAM. Since

DOS is not loaded when INT 19h is executed, DOS function calls cannot be used to allocate any memory. This leaves 20KB at the top of memory for the resident portion of COMMAND.COM. The RPL bootstrap code locates its code 16KB below that. (These values have caused some problems with DOS 5.0, and have since been increased.)

Since the ODI shells have not been loaded, the RPL bootstrap code has to talk directly to the card. When the ODI shells have loaded, they take over the hardware, and the RPL bootstrap code has to communicate through the IPX stack instead of talking directly to the board. Until then, there is a small IPX emulator in the RPL bootstrap code with just enough functionality to complete the boot process.

2.4.7 IPL from the RPL Bootstrap Code

After the RPL bootstrap code gets a valid attachment, it attempts to open the boot disk image file from which it can perform an IPL. If the system supervisor has not set up a BOOTCONF.SYS file (this is discussed later), the default name is assumed. This is NET$DOS.SYS (or IBM$DOS.SYS for NetWare 2.0a Boot ROMS). Since the RPL bootstrap code has connected, but has not logged in to the file server, the only place that it has access rights is in the SYS:LOGIN directory. That is why all boot image files must be located in the SYS:LOGIN directory.

Now the RPL bootstrap code intercepts the floppy disk interrupt INT 13h. While it is hooking into the interrupt vector table, it puts the "NetW" stamp in the INT F1h, so that the network shells will know they have been booted from ROM. Also, the old INT 13h vector is placed at INT F2h, the new INT 13h is placed at INT F3h, and the RPL bootstrap code disconnect vector is placed at INT F4h. The RPL bootstrap code then loads in the boot sector from the boot image file (just as the floppy boot would have done from the floppy disk) and executes it.

At this point, the RPL bootstrap code is a backdrop routine. It is only active when POST makes a call to the floppy drive. It reads the data image file and returns data to the requesting process, just as an operating floppy drive normally would. As far as DOS is concerned, it is illegally in memory, but DOS is not aware of this.

As long as no other processes disrupt the RPL bootstrap code's trapped interrupt vectors, do not try to use the "illegal" memory location, and do not try to access the NIC, the boot process handles most disk image file configurations. The boot process can also withstand a limited amount of interference from programs that access the NIC or reassign interrupt vectors.

2.4.8 The IPX Connection

The NIC is reset when either the MLID is executed (using ODI shells) or when IPX.COM is executed. After resetting, the RPL bootstrap code does not talk to the hardware directly. The boot ROM expects this, and is prepared. It stops talking directly to the NIC and starts talking through the newly installed code.

2.4.9 Terminating Service

When NETX.com is executed, it establishes its own connection with the server. Since the workstation now has real NetWare drives mapped to the file server, the boot process can be completed from a network drive. The RPL bootstrap code is no longer needed. In order to do this, three things need to happen:

1. NETX.com sees the "NetW" stamp in the INT F1h vector. This indicates that the node has been booted from a RPL bootstrap code.
2. NETX.com executes INT F4h, which cause the RPL bootstrap code to terminate its connection with the file server.
3. NETX.com replaces the INT 13h vector with the original. This allows the floppy drive to be used now RIPL has completed.

The RPL bootstrap code is no longer used. The executable image stays in memory, but no more calls are issued to that code. The memory occupied by the executable RPL bootstrap code image is now owned by DOS and is overwritten by DOS when the memory is allocated to an application.

2.4.10 Batch File Not Found

One of the common errors reported by COMMAND.COM during the boot phase is the error message "Batch File Not Found". This occurs when COMMAND.COM is processing a batch file, and after executing some program, the batch file no longer exists. This can happen when the ODI shells, standard shells, or LOGIN are executed from the AUTOEXEC.BAT batch file.

Whenever DOS is executing a batch file, it keeps a small block of memory with important data it needs to remember. This includes the name of the batch file, and the byte offset in that file, of the next command to execute.

In the case of AUTOEXEC.BAT, since DOS thinks it's booting from a floppy disk, the current batch file name is A:\AUTOEXEC.BAT. When NETX.COM is executed, the RPL bootstrap code's drive A connection to the boot disk image is terminated. This would cause the "Batch File Not Found" error if the RPL bootstrap code did not change the batch file name to be F:\AUTOEXEC.BAT. It does this by searching the DOS memory chain for the current batch file record, which it then changes. When NETX.COM completes executing, DOS resumes processing the AUTOEXEC.BAT batch file. It thinks it is executing the batch file from the SYS:LOGIN directory on the file server.

It is important when setting up the system for DOS RIPL, that a copy of the AUTOEXEC.BAT is placed in the SYS:LOGIN directory, so that these errors can be prevented.

If the login script also maps the current drive, a copy of the AUTOEXEC.BAT file must be placed at the newly mapped drive in order to prevent the same error occurring again.

If everything is done properly, DOS starts executing AUTOEXEC.BAT from the disk boot image file, transfers to executing it from the SYS:LOGIN directory, and possibly finishes executing it from the user's home directory.

2.4.11 Custom Disk Image Files

NetWare boot ROMs have the ability to select a customized boot disk image file for every workstation. Not every site has a need for this kind of configuration, but many do. There are various reasons why this may be an advantage.

For example:

- It may be necessary to boot using LAN Support Program for certain applications, while it is not required for others
- Access to the reference disk may be required
- A user may wish to choose between booting DOS or OS/2*
- Some application may require a Locally Administered Address (LAA), while with others, a Universally Administered Address (UAA) is preferred.

All of these options can be accommodated by specifying multiple boot images in a list which the user may choose from when he reboots his workstation.

The boot ROM handles this by way of a configuration file called BOOTCONF.SYS. This is simply a list of network and node addresses, coupled with the names of their respective image files. When the boot ROM attaches to the file server, it requests the current list of boot image files associated with the workstation node. If none is available, it tries the default boot image filename of NET$DOS.SYS. If that is not present, it looks for the file IBM$DOS.SYS.

2.4.12 IBM Network Adapters

IBM network adapters, such as IBM Token-Ring and IBM Ethernet, IBM PC Network II, have optional boot ROMs and operate differently from NetWare Boot ROMs. First of all, the IBM Boot ROMs are produced by IBM and are not NetWare specific. Instead of attaching to a NetWare file server, it simply sends out a special packet on the network requesting anyone who is listening to respond with an executable file. Pre-2.15 versions of the NetWare token-ring driver running on the file server were not designed to respond to this request.

Currently there are several NLMs for the NetWare 3.x file server, and a VAP for the NetWare 2.15 file server, NetWare 2.2 file server, and external routers that respond to this request. In either case, a RPL bootstrap code file, either TOKEN.RPL, ETHER.RPL or PCN2L.RPL, is sent to the requesting IBM adapter. This file basically contains the code from the NetWare Boot ROM that is copied into the workstation RAM during the POST phase of booting the workstation.

2.4.12.1 IBM Token-Ring

IBM Token-Ring Adapters present another situation when the IBM LAN Support Program drivers are used. When attaching to the server with a token-ring card and the LAN Support drivers are required (compared with native mode ODI or IPX shells), another step is introduced into the boot process.

- First the boot ROM talks directly to the card and the TOKEN.RPL module is loaded into memory. This then talks directly to the card.
- Next the DXMCxMOD.SYS opens the card, and the TOKEN.RPL must talk through the DXMCxMOD.SYS module.
- Lastly, when the IPX stack is loaded, TOKEN.RPL must use this to talk to the card.

Loading the LAN Support drivers can cause the RIPL sequence to be quite slow.

2.4.12.2 IBM Ethernet

Similar to the token-ring, the IBM Ethernet card broadcasts a generic file request. The file server responds with the ETHER.RPL remote program load file. The remote boot ROM on the Ethernet card and the ETHER.RPL file both talk to the file server using ETHERNET_802.2 frame types. This is different from standard ODI shells or IPX but is the same as LAN Support on Ethernet. This requires that support for both frame types be loaded on a NetWare 3.11 file server. The RPL.vp1 module for the NetWare 2.2 file server and external router automatically provide this support.

Chapter 3. RIPL from OS/2 LAN Server V2.0

OS/2 LAN Server V2.0 can remotely load an operating system into a workstation on a LAN. The workstations can be DOS or OS/2 workstations. Many versions of DOS can be initial program loaded, as well as OS/2 V1.3, and OS/2 V2.0.

To IPL a DOS workstation, the server sends down an ″electronic diskette″ containing the IBM LAN Support Program, DOS, and the DOS LAN Requester 2.0. This electronic diskette is created when you install the LAN Server program and configure for DOS RIPL support.

The IPL of an OS/2 workstation is different from the IPL of a DOS workstation. A minifile system is created and loaded into the OS/2 workstation.

3.1 Remote IPL Requirements

To run the RIPL service, OS/2 1.30.2 or OS/2 2.0 (only LAN Server Entry is supported) is required as the base operating system to install the server.

In addition, the following software is required:

- IBM LAN Server V2.0 Entry or Advanced
- For DOS RIPL support you require:
  - DOS

    Note: If you choose to use PC DOS 5.0, you need to create the DOS diskettes from the DOS installation disk. This process creates the following diskettes:

    1. Startup/Support
    2. Shell/Help
    3. Basic/Edit/Utility
    4. Supplemental
  - DOS LAN Requester V2.0 (included in LAN Server 2.0)
- OS/2 1.3 diskettes for OS/2 1.3 RIPL
- OS/2 2.0 diskettes for OS/2 2.0 RIPL
- LAN Support Program V1.25 (included in LAN Server 2.0)

  Note: The LAN Support Program is required for both DOS and OS/2 RIPL.

The hardware requirements for the RIPL server are:

- 80386** or 80486** based PS/2
- A minimum of 8MB of memory
- A minimum of 120MB disk space
- One of the following LAN adapters:
  - Token-Ring Adapter/A
  - Token-Ring 16/4 Adapter/A
  - Token-Ring 16/4 Busmaster Adapter/A

  - IBM PC Network Adapter/A (Broadband or Baseband)
  - IBM PS/2 Adapter/A for Ethernet
  - Western Digital EtherCard PLUS/A**
  - 3COM Etherlink**/MC Adapter.

The hardware requirements for the workstation are:

- 8088-based workstation (DOS only)
- 80286**, 80386, 80486 based workstation
- 6MB memory for OS/2 workstation (8MB is better)
- One of the following LAN adapters:
  - Token-Ring Adapter/A (with RIPL ROM)
  - Token-Ring Adapter (with RIPL ROM)
  - Token-Ring 16/4 Adapter/A (with RIPL ROM)
  - Token-Ring 16/4 Adapter (with RIPL ROM)
  - IBM PC Network Adapter II
  - IBM PC Network Adapter/A (Broadband or Baseband)
  - IBM PS/2 Adapter/A for Ethernet.

3.2 Installation of the RIPL Service - OS/2 V1.3

This installation assumes OS/2 V1.3.2 is the operating system installed on the server.

1. Install LAN Server 2.0 using the Advanced option
2. Configure "OS/2 Remote IPL Service"
   - When asked if you want to copy OS/2 1.3, select Yes

     Note: You are asked if you want to use the version of OS/2 1.3 that has already been installed on your drive C. If you answer Yes to this question, the LAN Server installation program makes a copy of the OS/2 1.3 that exists on your drive C. If you answer No then you have to install OS/2 1.3 later.
3. Configure "LAN Adapter and Protocol Support"
   - You need to install IEEE 802.2 for RIPL support
   - NetBIOS is required for the standard LAN Server functions
4. Complete the installation.

If your server is already installed and you want to add the RIPL support for OS/2:

1. Run the "OS/2 LAN Services Installation/Configuration" from the LAN Services Group
2. Choose "Install or Remove a component"
3. Select "OS/2 Remote IPL Service" and "Install"
4. Configure "OS/2 Remote IPL Service"
5. When asked if you want to copy OS/2 1.3, select Yes

Note: You are asked if you want to use the version of OS/2 1.3 that has already been installed on your drive C. If you answer Yes to this question, the LAN Server installation program makes a copy of the OS/2 1.3 that exists on your drive C. If you answer No, then you have to install OS/2 1.3 later.

6. Configure "LAN Adapter and Protocol Support"
   - You need to install IEEE 802.2 for RIPL support
   - NetBIOS is required for the standard LAN Server functions
7. Apply the changes

   Note: If your server is running, this process stops the server service.
8. Follow the instructions on the screen.

3.3 Installation of the RIPL Service - OS/2 V2.0

To support OS/2 2.0 RIPL from a server machine, you need to install OS/2 2.0 from the OS/2 2.0 diskettes. OS/2 2.0 diskette 7 contains a program RIPLINST that unpacks, installs, and sets up the RIPL subdirectories for OS/2 2.0 RIPL.

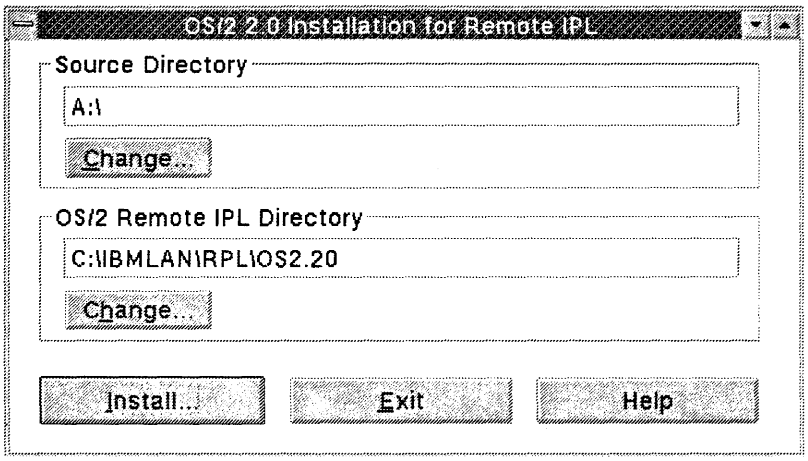
Since the diskette files are packed, you need to copy the UNPACK program from OS/2 2.0 diskette 2, unpack the RIPLINST program from diskette 7, and then run it.

1. Install LAN Server 2.0 using the Advanced path
2. Configure "OS/2 Remote IPL Service"
   - When asked if you want to copy OS/2 V1.3, select No
3. Configure "LAN Adapter and Protocol Support"
   - You will need to install IEEE 802.2 for RIPL support
   - NetBIOS is required for the standard LAN Server functions
4. Complete the installation
5. Make a temporary directory for the UNPACK program, because OS/2 1.3 also has an UNPACK command which is different from the OS/2 2.0 version

   ```
   MD C:\TEMP
   CD C:\TEMP
   ```
6. Insert diskette 2 of the OS/2 2.0 diskettes and type:

   ```
   COPY A:UNPACK.EXE C:\TEMP
   ```
7. Insert diskette 7 of the OS/2 2.0 diskettes and unpack the RIPLINST program:

   ```
   C:\TEMP\UNPACK A:RIPLINST
   ```
8. This will unpack two programs - RIPLINST.EXE and RIPLINST.HLP - into the C:\OS2\INSTALL directory
9. Run the RIPLINST program



OS/2 2.0 Installation for Remote IPL

Source Directory: A:\

OS/2 Remote IPL Directory: C:\IBMLAN\RPL\OS2.20

Figure 1. The RIPLINST Program

This program prompts you to insert the OS/2 2.0 diskettes.

Note

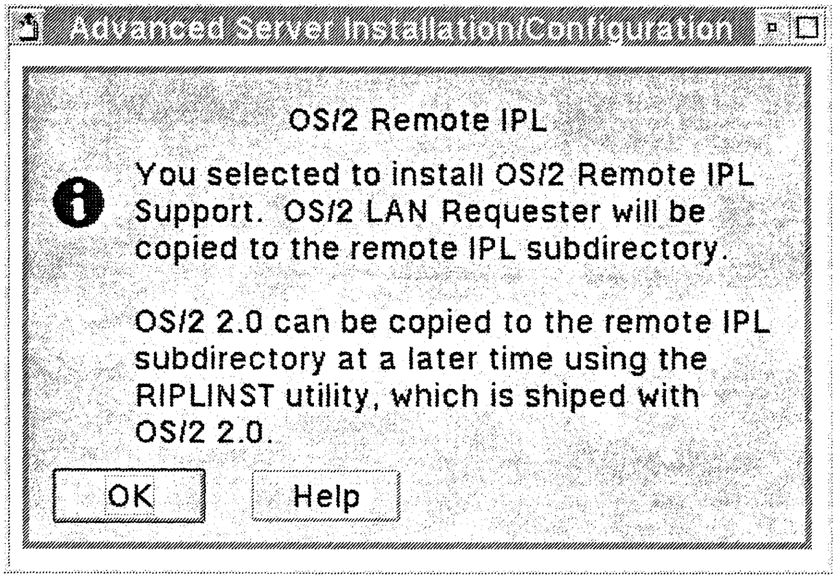
If you run the RIPLINST program and the program stops copying files from the OS/2 2.0 diskettes, appearing to hang, you may need to use the OS/2 1.3 UNPACK command. RPLINST internally uses OS/2 2.0 version of UNPACK command. From the OS/2 1.3 task list, select "End task" for the RIPLINST program, and start again. Make sure you are using the UNPACK.EXE from the OS/2 2.0 diskette.

10. When all the diskettes have been copied, see Section 3.5, *"The GETRPL Utility"*. move on to the GETRPL section.

3.4 Installing LAN Server 2.0 Entry on OS/2 2.0

The installation of LAN Server Entry on OS/2 2.0 is the same as installing on OS/2 1.3.

During the configuration process of the LAN Server installation, if you select OS/2 RIPL support, you see the following message box:



Advanced Server Installation/Configuration

OS/2 Remote IPL

You selected to install OS/2 Remote IPL Support. OS/2 LAN Requester will be copied to the remote IPL subdirectory.

OS/2 2.0 can be copied to the remote IPL subdirectory at a later time using the RIPLINST utility, which is shiped with OS/2 2.0.

Figure 2. Message Box Displayed for OS/2 2.0 Support

3.5 The GETRPL Utility

The GETRPL utility is run on RIPL servers after you install or reinstall the RIPL service.

The GETRPL program performs the following functions:

- Migrates any OS/2 LAN Server 1.2/1.3 RPL.MAP files
- Creates a group ID called RPLGROUP
- Creates Access Control Profiles (ACP) for remote boot
- Installs OS/2 SE 1.3 device drivers and display drivers
- Creates the default OS2.INI files for workstations.

The GETRPL program must be run after installing the remote oot service (or after reinstallation of the remote boot service) and before you use the remote boot service to RIPL workstations.

3.5.1 Using the GETRPL Program

1. If the server is not started, start it now.

   If the server service does not start due to an error, then you may need to edit the IBMLAN.INI file. Remove the remote boot service from IBMLAN.INI, start the LAN server, run the GETRPL utility, and put the remote boot service back in the IBMLAN.INI file.

   The line to change is:

   ```
   SRVSERVICES = lsserver,remoteboot,netlogon,alerter
   ```

   Change to:

   ```
   SRVSERVICES = lsserver,netlogon,alerter
   ```

   Then start the server.

2. If the remote boot service is running, then stop it as GETRPL won't run if the RIPL service is running.

   To see if the remote boot service is running, type:

   ```
   NET START
   ```

   This displays the running services. To stop the remote boot service, type:

   ```
   NET STOP RPL
   ```

   Note: Some NET commands do not work if the LAN Requester full screen interface (FSI) is running.

3. Log on to the server with an administrator's ID.

4. Run GETRPL from an OS/2 command line.

   The GETRPL program asks you to insert the diskettes for OS/2 1.3. This copies over any missing files that you don't have installed on your server (for example, different mouse drivers and printer drivers).

5. If OS/2 1.3 RIPL is required, insert the OS/2 1.3 diskettes as requested.

   If only OS/2 2.0 RIPL support is required, select Cancel if the GETRPL program asks for the OS/2 1.3 diskettes.

3.6 Defining RIPL Workstations Using the LAN Requester FSI

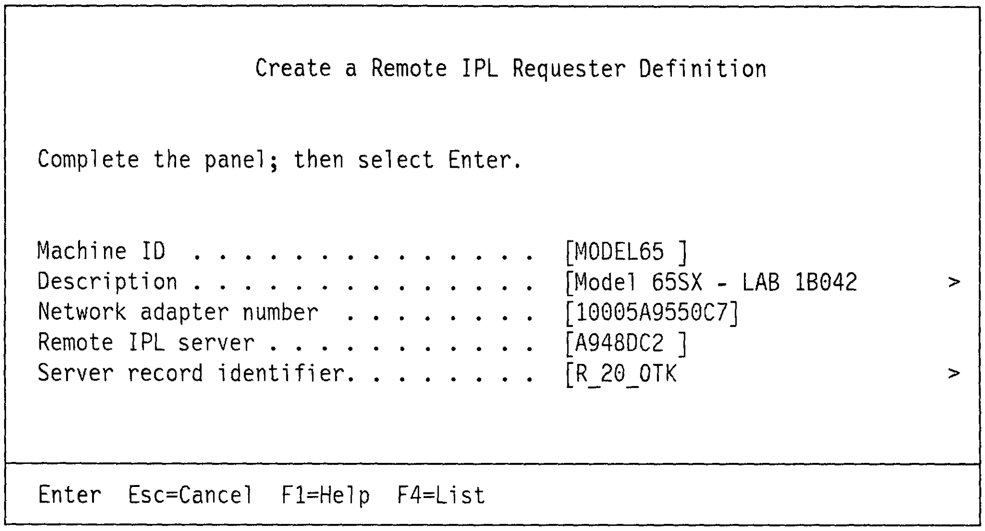
The LAN Requester full screen interface (FSI) is used to define:

- DOS diskette boot images
- RIPL servers
- RIPL workstations
- What each RIPL workstation can use

3.6.1 Defining OS/2 RIPL

With the LAN Server program installed, the OS/2 RIPL configured, and the GETRPL program completed, you can define the OS/2 RIPL for the OS/2 workstations. This is done using the LAN Requester FSI.

1. In the LAN Requester FSI, choose Definitions then Machine Parameters
2. Select --New--, Actions, Create, then Remote IPL Workstation.



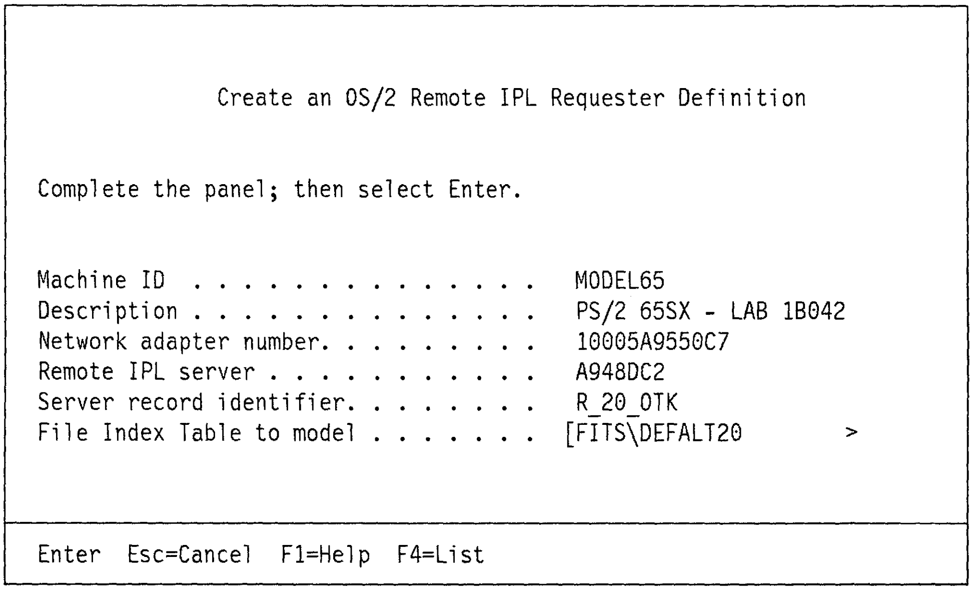
```
                 Create a Remote IPL Requester Definition


  Complete the panel; then select Enter.


  Machine ID . . . . . . . . . . . . . . .   [MODEL65 ]
  Description . . . . . . . . . . . . . . .  [Model 65SX - LAB 1B042       >
  Network adapter number  . . . . . . . .    [10005A9550C7]
  Remote IPL server . . . . . . . . . . .    [A948DC2 ]
  Server record identifier. . . . . . . .    [R_20_OTK                     >


  Enter   Esc=Cancel   F1=Help   F4=List
```

Figure 3. Remote IPL Requester Definition

The parameters shown in Figure 3 are as follows:

- The Machine ID is a unique name for the RIPL service.
- The Description should be meaningful (for example, the number of the building and room where the machine resides or the user's name and phone number).
- The Network Adapter Number is the network address of the workstation.
- The Remote IPL Server is the name of the server that will remote IPL this workstation.
- The Server Record Identifier identifies which boot record is loaded into the workstation.

  There are boot records for OS/2 1.3 over token-ring, OS/2 1.3 over Ethernet, OS/2 2.0 over token-ring, etc. Boot records are described in a later section.

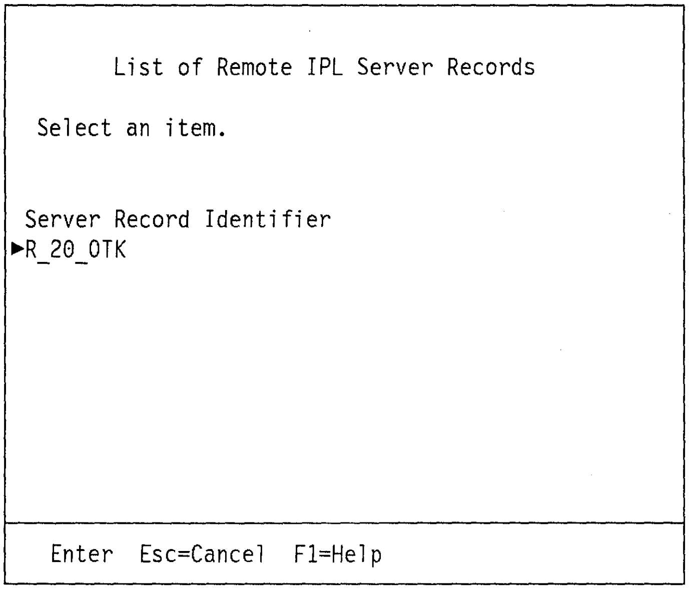


```
              Create an OS/2 Remote IPL Requester Definition


  Complete the panel; then select Enter.


  Machine ID . . . . . . . . . . . . . . .    MODEL65
  Description . . . . . . . . . . . . . . .   PS/2 65SX - LAB 1B042
  Network adapter number. . . . . . . . . .   10005A9550C7
  Remote IPL server . . . . . . . . . . .     A948DC2
  Server record identifier. . . . . . . .     R_20_OTK
  File Index Table to model . . . . . . .    [FITS\DEFALT20        >


  Enter   Esc=Cancel   F1=Help   F4=List
```

Figure 4. Remote IPL Requester Definition and FIT Entry

The File Index Table (FIT) is a file that describes where a workstation can find the files it needs. Each RIPL workstation has its own file index table file. Figure 4 and Figure 5 on page 20 illustrate how the FIT file is selected.

FIT files are described in greater detail in Section 3.6.3, *"The File Index Table (FIT)"*.



```
        List of Remote IPL Server Records

   Select an item.


  Server Record Identifier
►R_20_OTK









    Enter  Esc=Cancel  F1=Help
```

Figure 5. Remote IPL Server Records

The server record identifier for OS/2 2.0 RIPL is R_20_OTK.

3.6.2 Using the FSI to Create Machines from a Model Machine

The LAN Requester FSI can be used to create RIPL workstations, using a configuration that has already been built. If you do not use a model workstation, the time taken for each OS/2 2.0 workstation to IPL the first time can be up to 15 minutes due to the creation of desktop objects, etc. By using a model, the workstation powers up into a configuration you specified. This includes screen colors, folder placement, objects in folders, etc.

The process to create a workstation model is:

1. Create a model workstation:
   a. Use the FSI to create a RIPL workstation. Name it as a model.
   b. RIPL the workstation.
   c. Change the configuration, colors, folders, objects, etc.
   d. When finished, shutdown the workstation.
2. Create a workstation from the model:
   a. In the Manage Machine Parameters section of the FSI (under Definitions), select the model workstation.
   b. Select Actions and Create (do not select -New-).
   c. Type the relevant information for description and network address.
   d. The FIT file to model is already filled in.

e. Press Enter to create the workstation.

This gives the new workstation the same configuration as the model. In this manner, OS/2 2.0 RIPL workstations can be created quickly and configured in the same step.

3.6.3 The File Index Table (FIT)

The remote IPL of a DOS workstation is straightforward. An electronic diskette is passed down to the workstation and loaded.

OS/2 remote IPL (RIPL) requires a different mechanism to load the operating system since a complete working OS/2 system cannot be stored on one diskette. Instead, a mini file system is loaded, complete with CONFIG.SYS and all other files necessary for an OS/2 workstation.

The sequence of events that occur to RIPL an OS/2 workstation are:

- The workstation sends the RIPL request via the 802.2 layer.
- The server validates the workstation ID.
- The server then sends an OS/2 boot record to the workstation via 802.2.

  This sets up a NetBIOS session to the server using the LAN Support Program.
- Control is transferred to the OS/2 loader, OS2LDR.
- The OS/2 loader loads the OS/2 kernel, OS2KRNL.
- The OS/2 kernel then loads the LAN transport drivers.
- The normal IPL sequence continues.

A workstation normally loads OS/2 from the primary partition (although OS/2 2.0 can load off an extended partition). This is generally drive C. The OS/2 RIPL procedure gives the workstation a redirected drive C over the network to the RIPL server.

A local hard disk has its drive letters "pushed up" by one by the RIPL procedure. So what was the local drive C becomes drive C during RIPLing.

Note: The file SWAPPER.DAT can be located on the RIPL server or on the local workstation's drive D.

The File Index Table (FIT) maps workstation files and subdirectories to files and subdirectories on the RIPL server. When OS/2 references a file using open, close, read, or write commands, the LAN redirector uses the FIT file to translate the reference to the appropriate file or directory on the server. The LAN redirector than routes the request to the server using the FIT translated file name. Using this technique, the workstation treats the server as a single logical drive. The workstation requires no knowledge of the server drive and directory structure.

Below is an example of part of a FIT file:

```
; Read-only configuration files. (by workstation)
C:\CONFIG.SYS            MACHINES\MODEL80\CONFIG.20

; These OS/2 files must be writeable.
C:\AUTOEXEC.BAT          \\A948DC2\WRKFILES\MODEL80\AUTOEXEC.20
C:\OS2\OS2.INI           \\A948DC2\WRKFILES\MODEL80\OS2\OS2INI.20
C:\OS2\OS2SYS.INI        \\A948DC2\WRKFILES\MODEL80\OS2\OS2SYINI.20
C:\OS2\OS2.DTP           \\A948DC2\WRKFILES\MODEL80\OS2\OS2.DTP
C:\OS2\SYSTEM\SWAPPER.DAT \\A948DC2\WRKFILES\MODEL80\OS2\SYSTEM\SWAPPER.DAT
```

This is part of the OS/2 2.0 RIPL FIT file. The left side is the file that we need to load (for example C:\AUTOEXEC.BAT). The right part is *where the file actually gets loaded from.* So the C:\AUTOEXEC.BAT file gets mapped to \\servername\WRKFILES\MODEL80\AUTOEXEC.20.

The OS2.INI file is unique to each workstation, and the user is able to make changes to this file by performing actions such as changing the screen colors with the OS/2 control panel. As a result, each workstation has its own set of files that are changeable by the user, most indirectly, like the OS2.INI file.

3.6.4 Automatic NET SHARE by the Server

Two automatic NET SHARE commands are issued by the RIPL server at startup. These are for:

- The common code for all RIPL workstations (such as OS/2, LAN Requester):

  ```
  RPLFILES    C:\IBMLAN\RPL
  ```

- The specific files for each workstation (such as OS2.INI, CONFIG.SYS):

  ```
  WRKFILES    C:\IBMLAN\RPLUSER    Share for RIPL read/write area
  ```

These network names, WRKFILES and RPLFILES, are used in the FIT file to specify the location of the RIPL subdirectories.

As well as mapping specific files like CONFIG.SYS, the FIT file can also map entire subdirectories.

```
C:\SPOOL                \\A948DC2\WRKFILES\MODEL80\SPOOL
C:\OS2                  OS2.20\OS2
C:\IBMLAN               IBMLAN
C:\IBMCOM               IBMCOM
C:\                     \\A948DC2\WRKFILES\MODEL80
```

Wildcards are also supported in the FIT file.

```
C:\*.BIO                OS2.20\OS2
C:\OS2\*.INI            \\A948DC2\WRKFILES\MODEL80\OS2
C:\OS2\APPS\*.TMP       \\A948DC2\WRKFILES\MODEL80\OS2
C:\CMLIB\*.CFG          \\A948DC2\WRKFILES\MODEL80\CMLIB
```

The search order for finding files is:

1. Look for a specific match of the file that you want in the FIT file.
2. If no specific match is found, search the appropriate directory entry in the FIT file.

For example, if the following is typed:

```
DIR C:\
```

the FIT line used for the search is:

```
C:\                     \\A948DC2\WRKFILES\MODEL65
```

If the following is typed:

```
DIR C:\CONFIG.SYS
```

the FIT line used for this specific file search is:

```
C:\CONFIG.SYS              MACHINES\MODEL65\CONFIG.20
```

But how does the LAN Server program know what FIT file to load to a particular workstation?

3.6.5 The RPL.MAP File

The RPL.MAP file is a central file in the RIPL process. It resides in the C:\IBMLAN\RPL directory, and is responsible for ensuring the correct images are loaded to individual workstations.

RPL.MAP is created by the installation of the RIPL service. Like the FIT file, the RPL.MAP file is a plain ASCII file. The following example shows part of the RPL.MAP file:

```
; default workstation records
100FFFFFFFFF DEFAULT ~ imagefile    A948DC2 A948DOM2 ~ ~ ~ ,,, Z R_DTK ~ ~
1000FFFFFFFF DEFAULT ~ FITS\DEFAULT A948DC2 ~ ~ ~ ~ ,,, ~ R_OTK ~ ~
10005A9550C7 MODEL65 ~ FITS\MODEL65 A948DC2 ~ ~ ~ ~ ,,, ~ R_20_OTK ~ ~ ~
10005A22AA5A MODEL80 ~ FITS\MODEL80 A948DC2 ~ ~ ~ ~ ,,, ~ R_20_OTK ~ ~ ~
```

The first field contains the network address of the workstation. The second field is the machine name you entered using the LAN Requester FSI. The fourth field contains the location and name of the FIT file for the machine.

In this example, you can see that the machine MODEL65 has a FIT file associated to it of FITS\MODEL65.

When the workstation puts its network address on the network, and the server machine identifies the address as one it needs to IPL, the server sends down this FIT file to the workstation aloowing it to IPL the operating system.

The server cannot load a file to a workstation until a network interface has been loaded.

3.6.6 The Boot Block Configuration File

When a RIPL workstation is set up using the LAN Requester FSI (see Figure 5 on page 20), a server record identifier is specified. This identifies the boot block configuration file. In our example in Figure 5 on page 20, the server record identifier was R_20_OTK. The boot block configuration file boots the RIPL workstation and loads the LAN Support Program.

Looking at a different section of the RPL.MAP file:

```
; server records for OS/2
yyyyyyyyyyyy os2bbtr.cnf  3 10 N ~  OS2~TOKR           ~ ~ ,,, ~ R_OTK ~ ~
yyyyyyyyyyyy os2bbpc.cnf  3 10 N ~  OS2~PCNET          ~ ~ ,,, ~ R_OPC ~ ~
yyyyyyyyyyyy os2bbpc.cnf  3 10 N ~  OS2~PCNETA         ~ ~ ,,, ~ R_OPCA ~ ~
yyyyyyyyyyyy os2bbet.cnf  3 10 N ~  OS2~ETHRNET        ~ ~ ,,, ~ R_OET ~ ~
yyyyyyyyyyyy os220tr.cnf  3 10 N ~  OS2~20~TOKR        ~ ~ ,,, ~ R_20_OTK ~ ~
yyyyyyyyyyyy os220pc.cnf  3 10 N ~  OS2~20~PCNET      ~ ~ ,,, ~ R_20_OPC ~ ~
yyyyyyyyyyyy os220pc.cnf  3 10 N ~  OS2~20~PCNETA     ~ ~ ,,, ~ R_20_OPCA ~ ~
yyyyyyyyyyyy os220et.cnf  3 10 N ~  OS2~20~ETHRNET    ~ ~ ,,, ~ R_20_OET ~ ~
```

This shows that R_20_OTK points to the file, OS220TR.CNF. This file is the boot block configuration file. This ASCII file contains the network drivers to load into the workstation - the LAN Support Program. This is loaded onto the workstation to enable communication at the 802.2 level between the workstation and the server.

Below is an example of a boot block configuration file:

```
; OS/2 Boot Block Configuration (IBM Token-Ring)
;
RPL DOS\RPLBOOT.SYS
DAT OS2\MFSD20.SYS
ORG 1000H
LDR OS2.20\OS2LDR ~ OS2LDR UFSD.SYS MFD20.SYS
DAT OS2\UFSD.SYS
DRV C:\IBMLAN\DOSLAN\LSP\DXMT0MOD.SYS O=Y ~ ~
DRV C:\IBMLAN\DOSLAN\LSP\DXMC0MOD.SYS ~ ~ M
DRV C:\IBMLAN\DOSLAN\LSP\DXMA0MOD.SYS ~ ~ M
```

To summarize:

1. The workstation is powered on, inserts its token-ring address on the network and issues a FIND frame request.
2. The RIPL Server identifies the address and looks into the RPL.MAP file to see what operating system the workstation requires:

   ```
   10005A9550C7 MODEL65 ~ FITS\MODEL65 A948DC2 ~ ~ ~ ~ ,,, ~ R_20_OTK ~ ~ ~
   ```

3. The RIPL server looks at the end of the appropriate record entry to see what server record relates to that workstation. In this example, R_20_OTK is used.
4. The RIPL server then relates the server record to the boot block configuration file. In our example:

   ```
   yyyyyyyyyyyy os220tr.cnf  3 10 N ~  OS2~20~TOKR      ~ ~ ,,, ~ R_20_OTK ~ ~
   ```

   R_20_OTK relates to the file OS220TR.CNF.

5. The RIPL server reads the boot block configuration file to determine what configuration of the LAN Support Program to load to the workstation, and thus establish a low level of communication between the server and the workstation at an 802.2 level. This is why you need to select both NetBIOS *and* 802.2 interfaces during the LAN Server installation.

   The FIT file is automatically packaged as part of the boot record even though it is not defined in the .CNF file.

   In our example, the RIPL server packages the MODEL65 FIT into the boot record.

6. After the LAN Support Program is loaded into the workstation, the operating system is loaded, locating the files it needs through the FIT entries.

Figure 6 on page 25 illustrates this process:

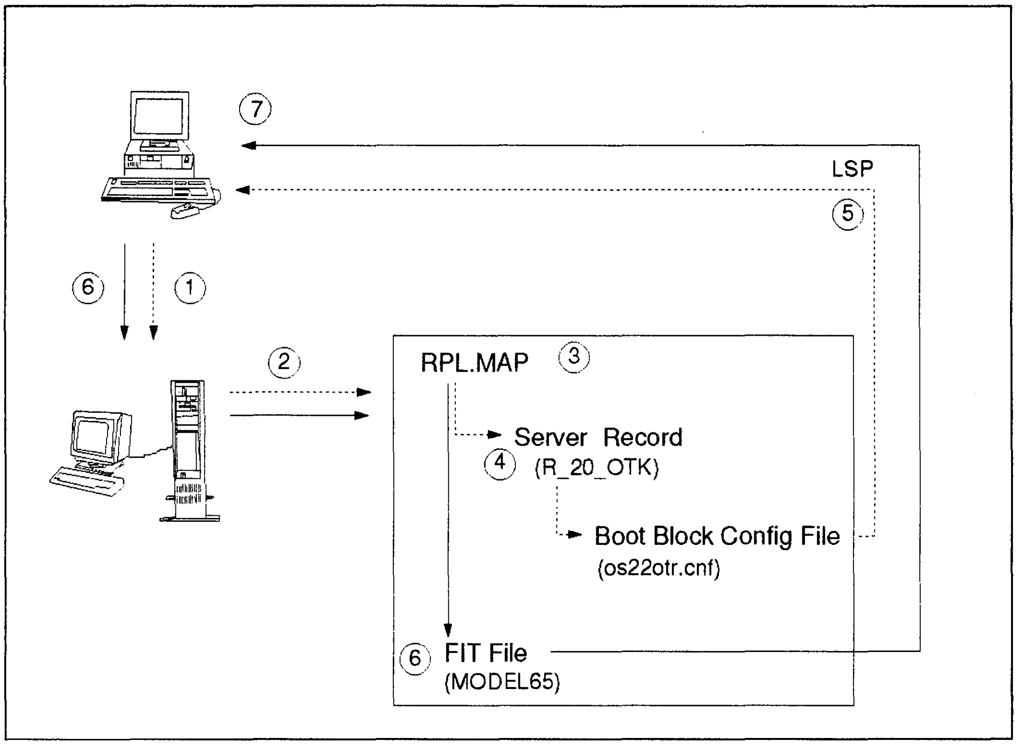


Figure 6. The RIPL Program Flow

3.6.7 Directory Structure

The following diagram shows the main directory structure for the RIPL support. This directory structure shown is that of the C:\IBMLAN directory.

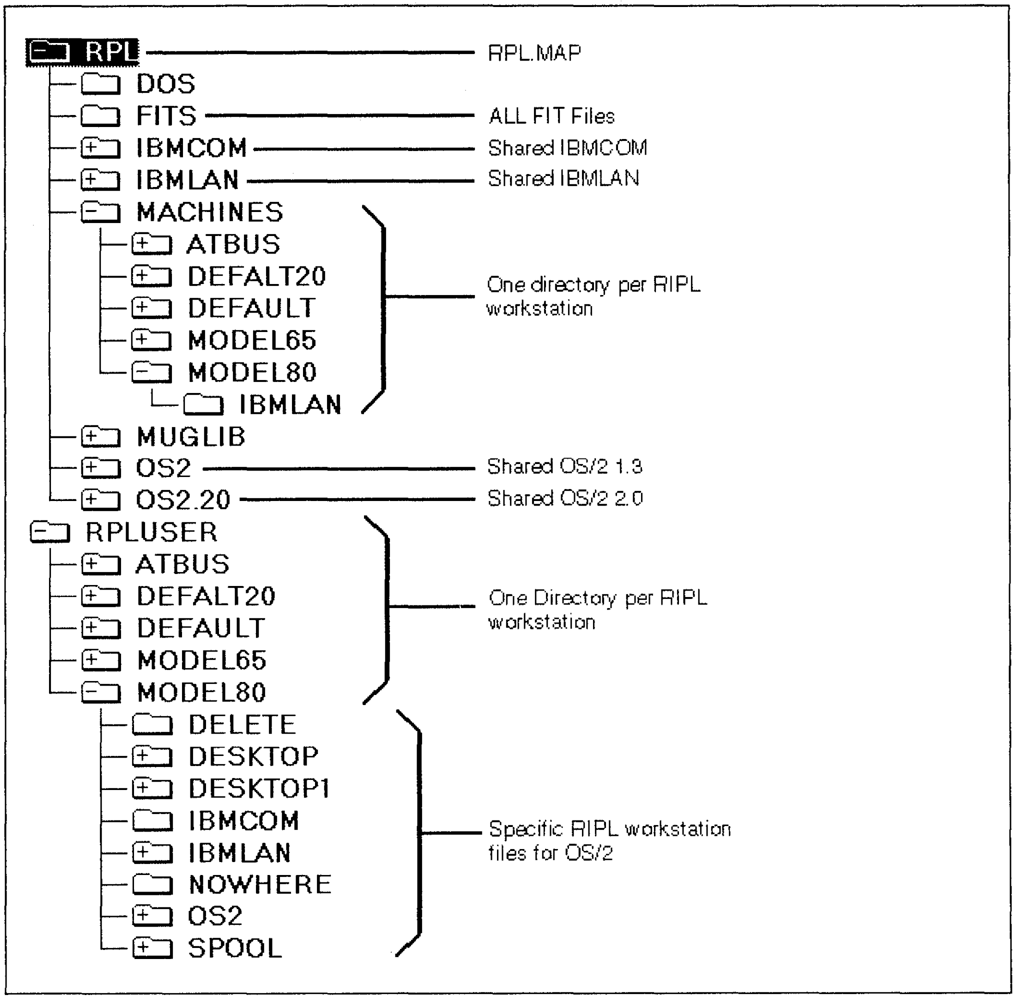


Figure 7. The RIPL Directory Structure

Each of the directories and their contents are described below:

- RPL contains the RPL.MAP file and the boot block configuration files.
- RPL\FITS contains the default FIT files, and the machine-specific FIT files.
- RPL\IBMCOM contains the shared communications drivers that the workstations use.
- RPL\IBMLAN contains the shared LAN requester code that the workstations use.
- RPL\MACHINES contains subdirectories for each machine that is defined using the LAN Requester FSI, and the default files for OS/2 2.0 (MACHINES\DEFALT20) and OS/2 1.3 (MACHINES\DEFAULT).
- RPL\MACHINES\machinename contains default read-only files for the workstation, like CONFIG.20 (CONFIG.SYS).
- RPL\MACHINES\machinename\IBMLAN contains the IBMLAN.INI file for the specific machine. This is a default IBMLAN.INI file, with the *computername* parameter set to the machine name.
- RPL\MUGLIB contains the shared User Profile Management.
- RPL\OS2 contains (if installed) the default shared copy of OS/2 1.3 for OS/2 1.3 RIPL workstations.

- RPL\OS2.20 contains (if installed) the default shared copy of OS/2 2.0 for OS/2 2.0 RIPL workstations.
- RPLUSER is the directory structure for individual RIPL workstations. Each workstation has a directory here, with read/write files for that workstation that may be modified (such as OS2.INI).

  When a RIPL workstation is created using the FSI, LAN Server creates the specific directory, and copies relevant files from the C:\IBMLAN\RPL\ directory structure.
- RPLUSER\DEFALT20 contains standard files which all OS/2 2.0 RIPL workstations require (such as OS2.INI and OS2SYS.INI). All files in this directory are copied to the RPLUSER\machinename directory by the LAN server when you create an OS/2 2.0 RIPL workstation.
- RPLUSER\DEFAULT contains standard files which all OS/2 1.3 RIPL workstations require (such as OS2.INI and OS2SYS.INI). All files in this directory are copied to the RPLUSER\machinename directory by the LAN Server when an OS/2 1.3 RIPL workstation is created.

3.6.8 Considerations When Using the LAN Requester FSI

The LAN Requester FSI should really only be used to *create* RIPL workstation definitions and not to modify them.

When a RIPL workstation definition is created, the system creates the C:\IBMLAN\RPLUSER\machinename directory structure (see Figure 7 on page 26). Any files that existed previously are overwritten. If unique OS2.INI files or CONFIG.SYS files were created, they are lost.

If the FSI is used to set up a machine for OS/2 1.3 RIPL, the directory structure is created for the machine, and files such as CONFIG.13, OS2.INI, etc., are copied to the machine's subdirectory. If the FSI is then used to set up the same machine for OS/2 2.0 RIPL, unique subdirectories are created for OS/2 2.0 files (CONFIG.20, OS2.INI, etc.). When the machine configuration is updated, the information is written to the RPL.MAP file so LAN Server can pass them to the workstation.

If the machine configuration is then updated to go *back* to OS/2 1.3 RIPL, the files that were copied earlier are not re-used but *re-copied* as if this was the first time you had set them up. So if specific CONFIG.SYS or OS2.INI files for a RIPL workstation had been created, they are lost when you update the machine configuration using the FSI.

3.6.9 Missing Windows

If the server has either an 8514/A or XGA adapter, and the server is being run in high resolution mode (1024 x 768), you may find that windows are either "missing", or off the screen on the RIPL workstation. This is illustrated in Figure 8 on page 28.

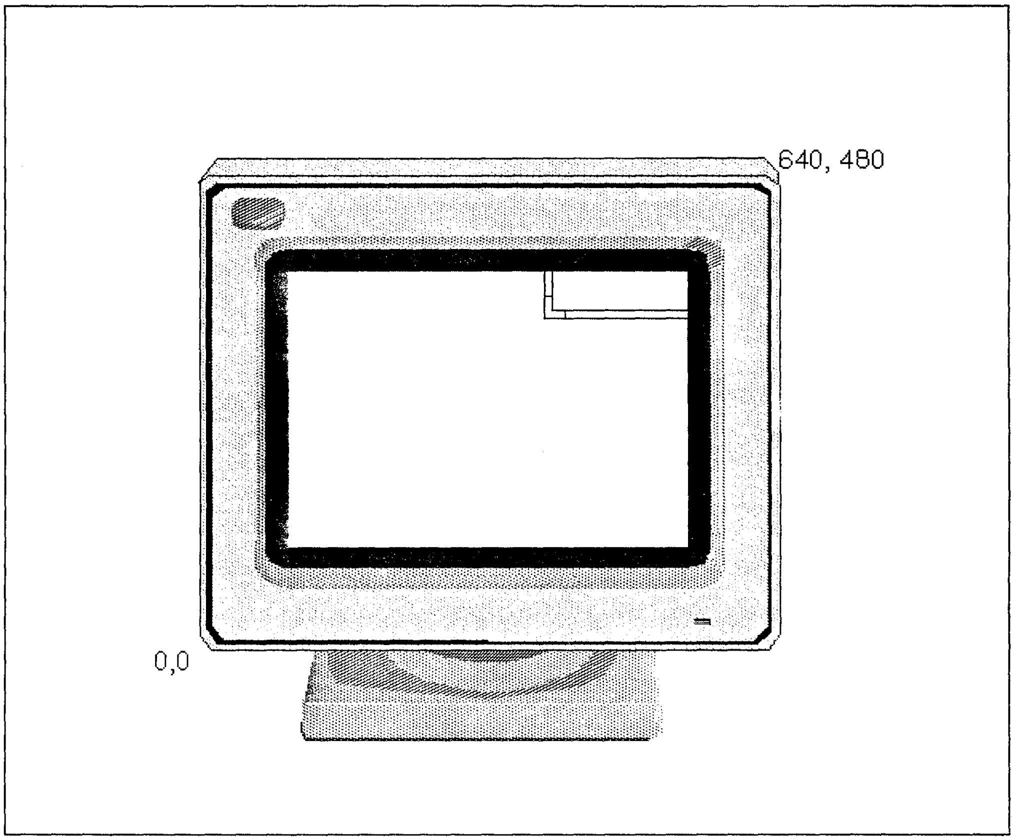


Figure 8. Missing Windows - VGA Display 640 x 480

This occurs because when OS/2 1.3 was copied from the server to the RIPL directory, the OS2.INI file was also copied. This file contains, among other things, the positions of the windows. On a high resolution monitor, if the windows are at the top of the screen, they may not completely display on a VGA workstation. Since the Presentation Manager coordinates start at the bottom left of the screen, a window at the top of an XGA screen is outside the coordinate space of a VGA display.

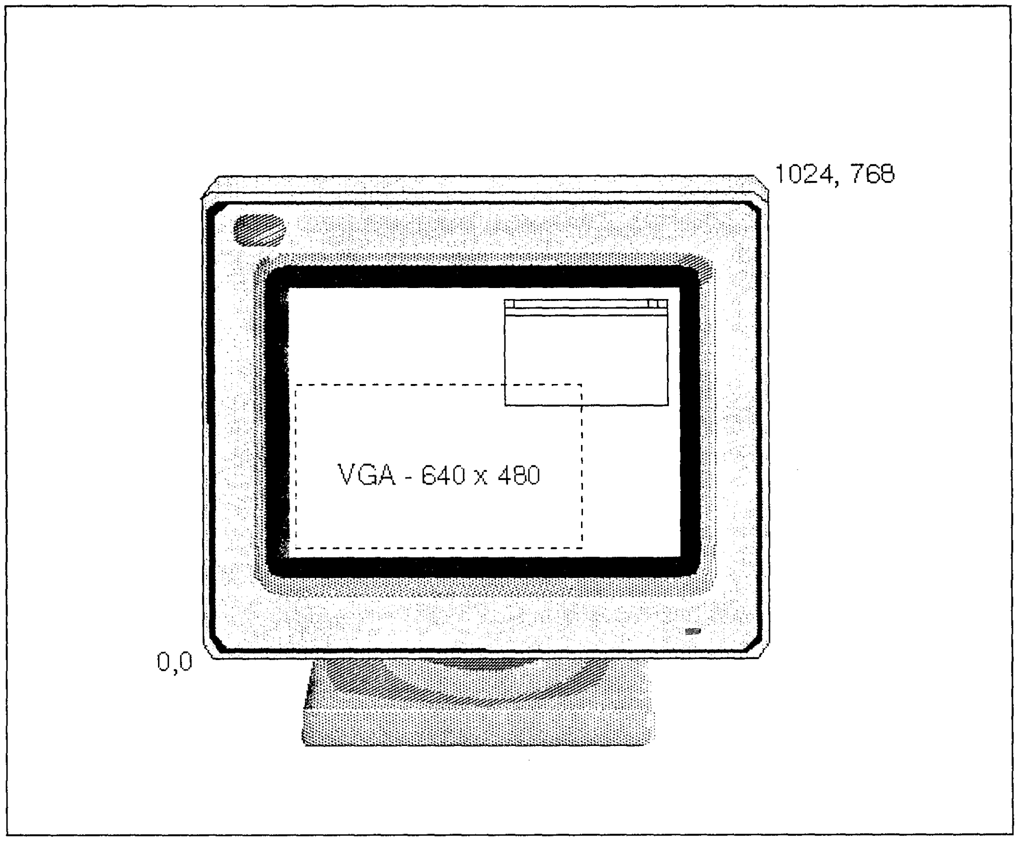


Figure 9. Missing Windows - XGA Display 1024 x 768

When an OS/2 workstation is RIPLed, if you find that upon opening a window it either does not display or the window border is not visible:

1. Press Ctrl + Esc to go to the Task List. Make sure the window you want is selected.
2. Select "Switch to" or double-click on the window/program you want to see.
3. Press Alt + F7. This is the window-move key sequence.
4. With either the mouse or the cursor keys, move the window down until you can see it.

3.6.10 Changing the Workstation Configuration

There are times when the hardware in a RIPL workstation needs to be changed (for example, users may put a different mouse on their workstation). This requires a change in the mouse driver that gets loaded into the workstation.

Changing device drivers requires three things:

- Making sure the physical driver exists on the RIPL server
- Making the driver available to the workstation
- Updating the CONFIG.SYS file for the workstation.

The CONFIG.SYS file by default has an access permission of read-only for the workstation. This can cause problems if the user installs software that needs to access the CONFIG.SYS file to change the LIBPATH or DPATH, or to install other device drivers.

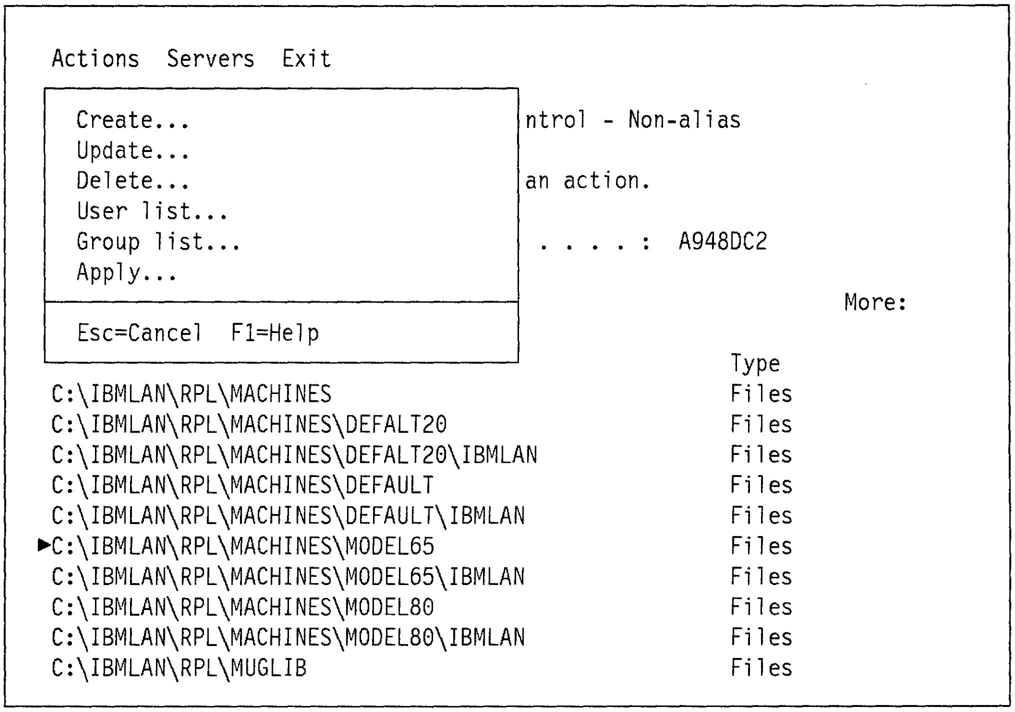
3.6.10.1 Giving the User Access to CONFIG.SYS

The access to the CONFIG.SYS file can be changed in two ways:

- Copy the CONFIG.SYS file to the user's WRKFILES directory on the server and change the FIT file to reflect the new location (which has an access profile of Read/Write), or
- Change the Access Control Profile for the directory that contains the CONFIG.SYS file.

To change the Access Control Profile for the workstation:

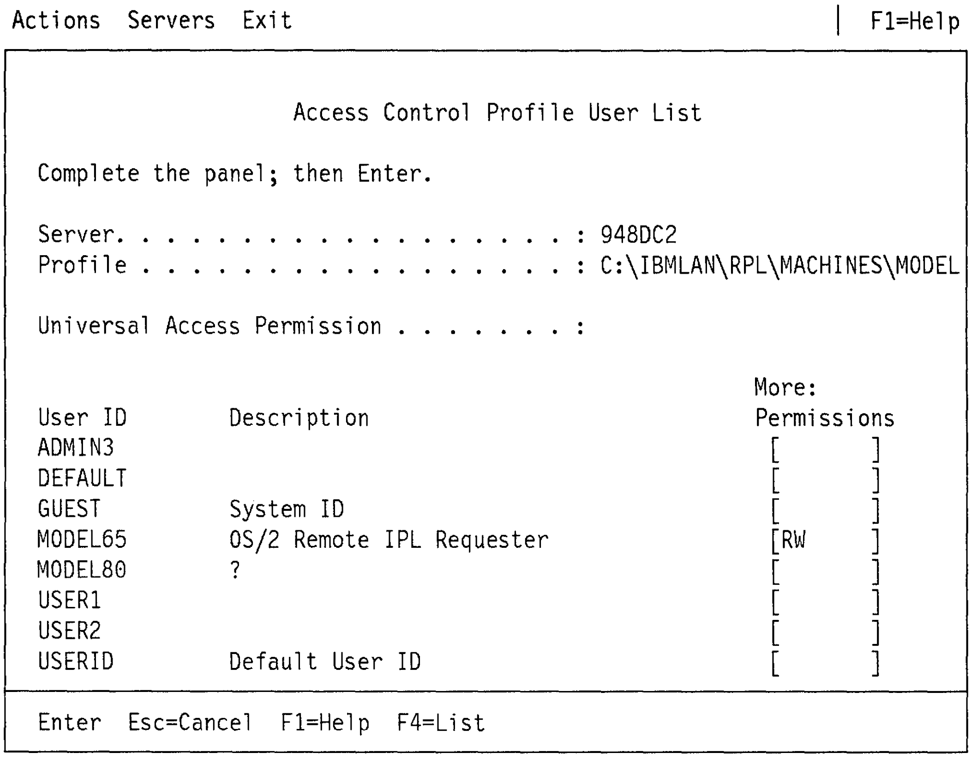
1. Using the LAN Requester FSI, select Definitions then Access Control.
2. As this is not an alias, select Servers and Display Profiles by Server.



```
Actions  Servers  Exit
┌──────────────────────────────────────┐
│ Create...                            │ntrol - Non-alias
│ Update...                            │
│ Delete...                            │an action.
│ User list...                         │
│ Group list...                        │ . . . . :  A948DC2
│ Apply...                             │
├──────────────────────────────────────┤                        More:
│ Esc=Cancel  F1=Help                  │
└──────────────────────────────────────┘             Type
C:\IBMLAN\RPL\MACHINES                               Files
C:\IBMLAN\RPL\MACHINES\DEFALT20                      Files
C:\IBMLAN\RPL\MACHINES\DEFALT20\IBMLAN               Files
C:\IBMLAN\RPL\MACHINES\DEFAULT                       Files
C:\IBMLAN\RPL\MACHINES\DEFAULT\IBMLAN                Files
►C:\IBMLAN\RPL\MACHINES\MODEL65                      Files
C:\IBMLAN\RPL\MACHINES\MODEL65\IBMLAN                Files
C:\IBMLAN\RPL\MACHINES\MODEL80                       Files
C:\IBMLAN\RPL\MACHINES\MODEL80\IBMLAN                Files
C:\IBMLAN\RPL\MUGLIB                                 Files
```

Figure 10. Display Profiles by Server

3. The profile name you want to select contains the machine name. For example, C:\IBMLAN\RPL\MACHINES\machine name. See Figure 10.
4. At the Manage Access Control screen select Actions then User List.
5. Change the permissions for the machine name, MODEL65 as an example, to RW. See Figure 11 on page 31.



```
Actions  Servers  Exit                                           | F1=Help

                      Access Control Profile User List

 Complete the panel; then Enter.

 Server. . . . . . . . . . . . . . . . . . : 948DC2
 Profile . . . . . . . . . . . . . . . . . : C:\IBMLAN\RPL\MACHINES\MODEL

 Universal Access Permission . . . . . . . :

                                                          More:
 User ID        Description                               Permissions
 ADMIN3                                                    [      ]
 DEFAULT                                                   [      ]
 GUEST          System ID                                  [      ]
 MODEL65        OS/2 Remote IPL Requester                  [RW    ]
 MODEL80        ?                                          [      ]
 USER1                                                     [      ]
 USER2                                                     [      ]
 USERID         Default User ID                            [      ]

 Enter  Esc=Cancel  F1=Help  F4=List
```

Figure 11. Access Control Profile User List

6. After pressing Enter, the user at the workstation will be able to modify the CONFIG.SYS file.

3.6.11 Creating a Default STARTUP.CMD File

In some instances, a STARTUP.CMD file may be required for all OS/2 2.0 RIPL workstations. This may contain a NET START command, and perhaps a LOGON command to display the LOGON dialog box from UPM.

To give each RIPL workstation a default STARTUP.CMD file, create a master STARTUP.CMD file, and each time you add a new RIPL workstation using the LAN Requester FSI, that machine will get the default STARTUP.CMD. By putting a STARTUP.CMD file in the C:\IBMLAN\RPLUSER\DEFALT20 directory, LAN Server will copy this directory and its contents (including STARTUP.CMD) when you create a new OS/2 2.0 RIPL workstation.

3.6.12 Giving Default Files to All New RIPL Workstations

The procedure outlined above for the STARTUP.CMD file, can be used to give default files to all new RIPL workstations created using the FSI. By putting default files in the C:\IBMLAN\RPLUSER\DEFALT20 directory, all new OS/2 2.0 RIPL workstations will receive these files. This enables users to have read/write access to these files on an individual basis.

An alternative procedure would be to create a common directory under the \RPL directory, give all users read access to this directory, and update the DEFALT20.FIT file to point to this new directory. This enables users to have read-only access to shared files.

Note: The appropriate access control profile would have to be created for the new directory before it is usable.

3.6.13 Enabling the IBM 8514/A Adapter - OS/2 2.0

The following procedure should be followed to allow access to an 8514/A adapter with the additional video RAM. This will allow the RIPL workstation to use the full 1024 x 768 resolution when using high resolution displays such as the 8514 and 8515.

Two areas need to be changed:

1. The driver statements in the CONFIG.20 file for the workstation
2. The FIT file to point to the correct DLL file

Note: When the RIPLINST program was run, all the drivers were already loaded on the server disk. No further unpacking of files is necessary.

The default display driver portion of the CONFIG.20 file in the \RPL\MACHINES\machine name directory is as follows:

```
DEVINFO=SCR,VGA,C:\OS2\VIOTBL.DCP
   :
REM Use the following 2 statements for workstations with VGA displays:
SET VIDEO_DEVICES=VIO_VGA
SET VIO_VGA=DEVICE(BVHVGA)

DEVICE=C:\OS2\MDOS\VVGA.SYS
```

This needs to be changed to:

```
DEVINFO=SCR,BGA,C:\OS2\VIOTBL.DCP
   :
REM Use the following 2 statements for workstations with 8514 displays:
SET VIDEO_DEVICES=VIO_8514A
SET VIO_8514A=DEVICE(BVHVGA,BVH8514A)

DEVICE=C:\OS2\MDOS\VVGA.SYS
```

Some of the statements in the FIT file for this workstation need to be changed so that the operating system can find the correct display.DLL file. A partial representation of the default FIT file for the workstation is:

```
; VGA Display support (default)
;C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\VGA.DLL
;C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.VGA
;C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.VGA
;C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.VGA
```

You can see that the DISPLAY.DLL points to ...\VGA.DLL. Since there is no entry for the 8514 DLL file, it must be added manually as shown:

```
; 8514/A Display Support
C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\8514.DLL
C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.BGA
C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.BGA
C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.BGA
```

The HELV, COURIER, and TIMES lines can be copied from the XGA section.

Make sure you comment out (;) the VGA display support driver.

3.6.14 Enabling the IBM XGA Display Adapter - OS/2 2.0

The CONFIG.20 file has the XGA commands included, but remarked out. To enable XGA support, in the FIT file for the machine, change:

```
REM Use the following 4 statements for workstations with XGA displays:
REM DEVICE=C:\OS2\XGARING0.SYS
REM DEVICE=C:\OS2\MDOS\VXGA.SYS
REM SET VIDEO_DEVICES=VIO_XGA
REM SET VIO_XGA=DEVICE(BVHVGA,BVHXGA)

REM Use the following 2 statements for workstations with VGA displays:
SET VIDEO_DEVICES=VIO_VGA
SET VIO_VGA=DEVICE(BVHVGA)
```

to:

```
REM Make sure VVGA.SYS comes BEFORE VXGA.SYS
DEVICE=C:\OS2\MDOS\VVGA.SYS
REM Use the following 4 statements for workstations with XGA displays:
DEVICE=C:\OS2\XGARING0.SYS
DEVICE=C:\OS2\MDOS\VXGA.SYS
SET VIDEO_DEVICES=VIO_XGA
SET VIO_XGA=DEVICE(BVHVGA,BVHXGA)

REM Use the following 2 statements for workstations with VGA displays:
REM SET VIDEO_DEVICES=VIO_VGA
REM SET VIO_VGA=DEVICE(BVHVGA)
```

The FIT file needs changing as well to allow XGA support.

Change:

```
; VGA Display support (default)
C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\VGA.DLL
C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.VGA
C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.VGA
C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.VGA
; XGA Display support
; C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\XGA.DLL
; C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.BGA
; C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.BGA
; C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.BGA
```

to:

```
; VGA Display support (default)
; C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\VGA.DLL
; C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.VGA
; C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.VGA
; C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.VGA
; XGA Display support
C:\OS2\DLL\DISPLAY.DLL   OS2.20\OS2\DLL\XGA.DLL
C:\OS2\DLL\HELV.FON      OS2.20\OS2\DLL\HELV.BGA
C:\OS2\DLL\COURIER.FON   OS2.20\OS2\DLL\COURIER.BGA
C:\OS2\DLL\TIMES.FON     OS2.20\OS2\DLL\TIMES.BGA
```

This is to allow the correct display DLL and font files to be loaded.

3.6.15 Enabling AT Bus Machines for OS/2 2.0 RIPL

The CONFIG.20 file that gets created for an OS/2 2.0 RIPL workstation has the base device drivers for Micro Channel* systems enabled. The base device drivers for AT machines are remarked out in the CONFIG.20 file.

After creating the RIPL machine definition using the LAN Requester FSI, you will need to edit the CONFIG.20 in the C:\IBMLAN\RPL\MACHINES\machine name directory.

Change:

```
REM Select either the Famliy 1 or PS/2 Base Device Drivers, but not both.
REM Base Device Driver Statements for IBM Family 1 and compatible computers:
REM BASEDEV=PRINT01.SYS
REM BASEDEV=IBM1FLPY.ADD
REM BASEDEV=IBM1S506.ADD

REM Base Device Driver Statements for IBM PS/2 computers only:
BASEDEV=PRINT02.SYS
BASEDEV=IBM2FLPY.ADD
BASEDEV=IBM2ADSK.ADD
BASEDEV=IBM2SCSI.ADD /LED
```

to:

```
REM Select either the Famliy 1 or PS/2 Base Device Drivers, but not both.
REM Base Device Driver Statements for IBM Family 1 and compatible computers:
BASEDEV=PRINT01.SYS
BASEDEV=IBM1FLPY.ADD
BASEDEV=IBM1S506.ADD

REM Base Device Driver Statements for IBM PS/2 computers only:
REM BASEDEV=PRINT02.SYS
REM BASEDEV=IBM2FLPY.ADD
REM BASEDEV=IBM2ADSK.ADD
REM BASEDEV=IBM2SCSI.ADD /LED
```

This will change the base device drivers from Micro Channel to PC/AT* drivers.

A line in the FIT file for the AT bus machine must be changed to point to the correct virtual DMA driver.

Change:

```
; PS/2 Machines
C:\OS2\MDOS\VDMA.SYS     OS2.20\OS2\MDOS\VDMAPS2.SYS
; AT Machines
; C:\OS2\MDOS\VDMA.SYS   OS2.20\OS2\MDOS\VDMAAT.SYS
```

to:

```
; PS/2 Machines
; C:\OS2\MDOS\VDMA.SYS     OS2.20\OS2\MDOS\VDMAPS2.SYS
; AT Machines
C:\OS2\MDOS\VDMA.SYS   OS2.20\OS2\MDOS\VDMAAT.SYS
```

Note that you must comment out (;) the PS/2 DMA driver line.

3.6.16 Systems with Serial Mice

The mouse driver for OS/2 2.0 supports PS/2 mouse port mice and serial type mice without changing the CONFIG.20 file. With the OS/2 2.0 mouse driver support for serial mice, you may get an error on IPL because the serial COM driver and the virtual COM driver (VCOM) are unable to load. If this is the case, then remark out (REM) the COM and VCOM device drivers in the CONFIG.20 file (C:\IBMLAN\RPL\machinename\CONFIG.20). This error may occur if you run out of serial ports on your machine.

The statements you may need to remark out in the CONFIG.20 file are:

```
DEVICE=C:\OS2\COM.SYS
DEVICE=C:\OS2\MDOS\VCOM.SYS
```

3.7 Guidelines for Installing Applications

Due to the secure nature of the RIPL process, there are some guidelines for installing applications from workstations to the server.

- Installing applications on the server:

  If at all possible, install applications at the server machine. This should be possible for most OS/2 applications. Logging on as an administrator will remove access problems to the server disk.

- Installing applications from a standard LAN requester workstation:

  Applications can be installed from an OS/2 workstation (not a RIPL workstation). Logging on as an administrator, you can access a shared disk on the server and install applications to the server.

- Installing applications from a RIPL workstation:

  Installing applications from a RIPL workstation can present problems. If applications try to change the CONFIG.SYS, they are unable to do so, as the CONFIG.SYS file is read-only to the workstation. The administrator can change this access profile however. Applications that try to copy files to the read-only directories on the server will fail. Some applications try to copy files to the \OS2\DLL directory. This is a read-only directory in the FIT file. Applications that create temporary files in directories may fail. Some applications create temporary files, install the application, and then erase the temporary files. If the files can not be mapped by the FIT file, then the installation programs will probably fail. To allow access to the Windows INI files and any other files the application needs to use for Windows applications, you can give the RIPL group RWCD permissions to the C:\OS2\MDOS\WINOS2 directory.

The best method of installing applications is on the server. The next best method is to install from an OS/2 (non-RIPL) requester.

3.8 Disk Space Requirements for RIPL Server

In addition to the disk space requirements for the LAN Server itself, there are disk space requirements when you RIPL OS/2 2.0 and 1.3. When installing RIPL support for OS/2 1.3, you have an entire copy of OS/2 1.3 in the C:\IBMLAN\RPL\OS2 directory structure. This one copy is shared between all OS/2 1.3 RIPL workstations. If you use the RIPLINST utility to install OS/2 2.0 on the server to support OS/2 2.0 RIPL, you install an entire copy (including all printer and device drivers) into the C:\IBMLAN\RPL\OS2.20 directory structure. This one copy is shared between all OS/2 2.0 RIPL workstations.

Each workstation has private files (OS2.INI, SWAPPER.DAT, etc.). So there is an overhead for each workstation configured. These figures provided below are approximate, and are based on current levels of operating system code.

Disk requirement for OS/2 1.3 shared code (one copy):

- 13MB

Disk requirement for each OS/2 1.3 RIPL workstation (one copy per workstation):

- 160KB (approx)

  Note: This figure does *not* include the SWAPPER.DAT file which may be on the RIPL workstation itself.

Disk requirement for OS/2 2.0 shared code (one copy):

- 34MB

Disk requirement for each OS/2 2.0 RIPL workstation (one copy per workstation):

- 160KB (approx)

  Note: This figure does *not* include the SWAPPER.DAT file which may be on the RIPL workstation itself.

There are also shared copies of the LAN Requester, and the LAN Transport for all OS/2 RIPL workstations:

Disk requirement for shared copy of IBMLAN (one copy):

- 5.6MB

Disk requirement for shared copy of IBMCOM (one copy):

- 1.0MB

3.9 Multiple Adapters and RIPL Support

Multiple adapters are supported in both servers and workstations. At server installation time, you specify the adapter(s) used to support RIPL to workstations.

For the RIPL workstation, multiple adapters are supported. However, only adapter 0 is used for the RIPL service.

3.10 IBMLAN.INI Entries for the RIPL Service

The following statements are the RIPL section of an IBMLAN.INI file:

```
[remoteboot]
  rpl1=rplnet1.dll rplnet2.dll rploem.dll 0
  maxthreads=6
  rpldir=C:\IBMLAN\RPL
```

Each statement is discussed as follows:

- RPL1 = RPLNET1.DLL RPLNET2.DLL RPLOEM.DLL 0

  This line is used to specify the DLL files used to support the RIPL adapter. There is one line per RIPL adapter installed in the server.

- RIPLDIR = C:\IBMLAN\RPL

  This specifies the directory where key RIPL files are located. The RPL.MAP file must reside in this directory.

- MAXTHREADS=6

  The MAXTHREADS parameter can be used to tune RIPL performance. This parameter specifies how many threads are used by the remote boot service to do asynchronous reading of the configuration files. The default is 6, and the maximum is the maximum number of threads the system allows.

  Note: The default of 6 is the recommended value. Values larger than 10 can impact RIPL performance.

The remote boot service is listed in the services section of the IBMLAN.INI file.

```
REMOTEBOOT = SERVICES\RPLSERVR.EXE
```

3.11 Problem Determination

This section is not designed to replace the manuals provided with the LAN Server 2.0 product, but rather offer some assistance in fault finding. As with all fault finding, start from a working base first, and resolve the problems sequentially. For example, if the RIPL workstation fails to boot, is the server functioning? Is the LAN Server running? It's no good checking the FIT file if the server can't start due to a fault in the system configuration.

3.11.1.1 Can't Start Remote Boot Service

- Use NET ERROR command and check the error log.
- Check the RPL.MAP file for errors. The remote boot service does not start if errors exist in the RPL.MAP file:
  - Make sure network adapter IDs are comprised of 12 digits
  - Make sure there are enabled records in RPL.MAP
  - Make sure there are server records in RPL.MAP
- Check the remote boot portion of the IBMLAN.INI file.

3.11.1.2 SYSxxxx Errors on an AT Bus RIPL Workstation

- Check the CONFIG.20 file to make sure the PS/2 DMA drivers are remarked out, and the AT DMA drivers are enabled.
- If the RIPL workstation is an AT bus machine, are the correct base device drivers enabled in the CONFIG.20 file?

3.11.1.3 RIPL Workstation Will Not Boot

Make sure the RIPL ROM is plugged correctly into the token-ring adapter.

If the RIPL workstation displays the RIPL information on its display, but will not boot:

- Is there an error displayed (flashing or in a highlighted field)?
- Check the network adapter address with the machine definitions in the LAN Requester FSI
- Check the network adapter address in the RPL.MAP file

Note: This needs to be checked if you have changed the network adapter in the RIPL workstation.

- Has the RIPL server done a NET SHARE of the following resources:
  - RPLFILES
  - WRKFILES
  - IMAGES
- Check cabling and connections
- Is the remote boot service running in the server?
- Is the network adapter a supported type?

3.11.1.4 The Workstation Gets Part Way Through the Boot

If the workstation gets part of the way through the boot, and stops, check the stop point.

- Did the LAN Support Program load?

  If not, check the boot block file area:

  - Is there a workstation record defined in the FSI?
  - Is there a workstation record defined in the RPL.MAP file?
  - Does the RPL.MAP file point to a valid boot block configuration file?
  - Is the boot block configuration file present in the RPL directory?
- Does OS/2 start to load (do you see the logo?) and stop?
  - Check the FIT file for the workstation
  - Check the CONFIG.20 file for the workstation
  - Does the workstation have enough memory?
  - If you have the SWAPPER.DAT file on the local workstation disk, is there enough space on the disk? Is the disk accessible?

Chapter 4. RIPL using NetWare from IBM

There are several RIPL configurations which NetWare supports. These include using the IBM RIPL Boot ROM. The following list provides the equivalent components to perform RIPL of a workstation with a token-ring NIC, up to the point of accessing the boot image file on a file server:

- Non-IBM Token-Ring NIC with a NetWare boot ROM
- IBM Token-Ring Adapter with IBM boot ROM plus TOKENRPL.nlm
- IBM Token-Ring Adapter with IBM boot ROM plus the TOKEN.RPL module from the SYS:LOGIN directory, plus RPL.nlm
- IBM Token-Ring Adapter with IBM boot ROM plus the TOKEN.RPL module from the SYS:LOGIN directory, plus RPL.vp1.

Each of the above configurations performs slightly different tasks in order to get the code necessary to IPL from a boot image on the file server. Once this RPL bootstrap code is addressable in the workstation memory, the RIPL process proceeds in the same manner, irrespective of the original configuration. These equivalences are shown in Figure 12. There are also similar sets of equivalent modules for Ethernet and PC-Network topologies.

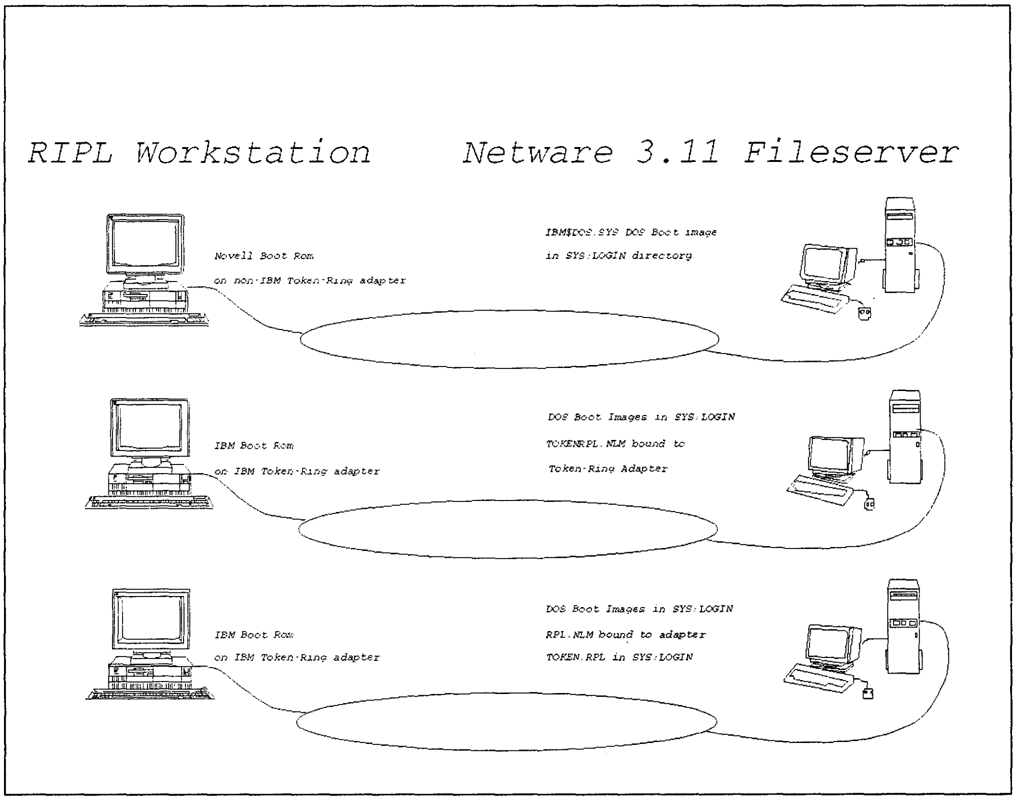


Figure 12. Equivalent NetWare RIPL Combinations

Since the beginning of 1991, many improvements have been made in the way in which the NetWare RPL server, running on a NetWare 3.11 file server provides RIPL capability. The most obvious of these have been to the NLM module(s) for the NetWare V3.11 file server. A generic RPL server NLM, "RPL.nlm" has been developed which supports RPL on all LAN media attached to the NetWare 3.11 file server. Also, the RPL.nlm now accepts command line parameters from the

″BIND RPL to Driver_name″ command at the NetWare 3.11 file server console, as well as taking parameter overrides from the SYS:LOGIN\BOOTCONF.SYS file.

Also, the SYS:LOGIN\BOOTCONF.SYS file accepts multiple images for each address, wildcards in the address fields and on-the-fly update of file server memory whenever the BOOTCONF.SYS file is modified.

4.1 NetWare RPL Boot ROMs versus IBM RPL Boot ROMs

Unlike NetWare boot ROMs, the IBM Token-Ring RPL ROM is not NetWare specific. In order to be able to boot from various systems, it uses a ″Staged Boot″ system. That means it sends out a generic ″Find Frame″ packet, and expects whichever kind of system it is on to be able to interpret and respond. It then asks for a file to be downloaded. On a NetWare network, this file (TOKEN.RPL, PCN2L.RPL, ETHER.RPL, etc.) will be the NetWare specific file that contains code to boot from a NetWare network.

In the past, the only way to get NetWare to respond to the RPL packets was to make the driver capable of recognizing these packets, and responding accordingly. This was mostly because the find frame is sent to a multicast address, and NetWare 286 didn′t support multicast addressing.

With the advent of AppleTalk Phase II drivers, VAPs can receive and respond to multicast addresses, making this the preferred way of doing things on NetWare 2.2 servers. Since NetWare 3.x servers use ODI, the NIC can support the multiple protocol stacks necessary to communicate with IPX packets and to receive and respond to multicast addresses.

When the workstation is connected to the network, it can either connect to a NetWare RPL server or to an OS/2 LAN Server. The following section describes how each of the various forms of RIPL are set up in a networking environment consisting of a NetWare file server, an OS/2 LAN Server, or both.

4.1.1 NetWare RIPL using a NetWare Boot ROM

When a non-IBM Network Interface Card, consisting of a NetWare Boot ROM is used in a workstation, the boot ROM will accept disk I/O calls from the workstation BIOS. These calls are then translated into network requests which access the SYS:LOGIN directory of the nearest file server for the boot image files. At this point the workstation has no way of knowing which file server will service its requests.

For this reason, all file server on the same local network as the workstation must be set up with each of the boot images required by all of the workstations capable of RIPL. This creates considerable redundancy as the same files must reside on each file server. It also creates considerably more administrative work maintaining this setup.

It is likely that this situation will change, and that Novell will provide a module which will make the NetWare boot ROMs appear to behave in a manner similar to the IBM boot ROMs.

4.1.2 NetWare RIPL using an IBM Boot ROM

IBM Network Interface Cards do not conform to the NetWare specification for Boot ROMs. This is due to the fact that they are required to RIPL in a variety of other Network environments besides NetWare.

Initially Novell extracted the card-specific code used by their boot ROMs, and coded this into the TOKEN.RPL, ETHER.RPL and PCN2L.RPL files, with some hooks to allow these files to be released from memory.

For NetWare V3.11, these were then incorporated into three separate NLMs, TOKENRPL.nlm, ETHERRPL.nlm and PCN2LRPL.nlm. At about the time DOS 5.0 was introduced, Novell introduced a field test version of the RPL.nlm which had the code common to each of the previous NLM modules, but did not have any of the media-specific code.

Table 1. NetWare Media RPL Bootstrap Code Modules - Overview

Filename	**Used in following type of RIPL**
TOKEN.RPL	Supports IBM RIPL over a token-ring
ETHER.RPL	Supports IBM RIPL over Ethernet
PCN2L.RPL	Supports IBM RIPL over PC Network

IBM network cards are able to RIPL from either a NetWare server or an OS/2 LAN Server. When an IBM Network Interface Card containing a RIPL ROM is used on a network with NetWare Servers, at least one of the NetWare file servers must be set up as a RPL server:

- If a NetWare 3.11 file server is set up to supply the boot image, it must have the **RPL.nlm** module loaded. Alternately, it may be set up with one of the older NLMs containing media-specific RPL bootstrap code.
- If a NetWare 2.2 file server,is set up to supply the boot image, it must have the **RPL.vp1** in the SYS:LOGIN directory of the file server.
- If an external (stand-alone) print server or an external router is set up to supply the boot image it must have the **RPL.vp1** in the same directory as the ROUTER.EXE program file.
- If a NetWare Lite Server is set up to supply the boot image, it must have the **RPL.com** program resident in memory.

Also, the RPL bootstrap code file(s) must be loaded on the file server SYS:LOGIN directory alongside the boot image files.

4.2 Contents of the LOGIN Directory

This directory contains the following files:

- A media-specific RPL bootstrap program file
- A DOS image file if DOS RIPL is required
- Optionally a BOOTCONF.sys file
- Optionally .IML files (necessary for RIPL of certain IBM microchannel computer models).

These files are summarized in Table 2 on page 42.

Table 2. NetWare RPL Bootstrap Code Modules - Detail

TOKEN.RPL	if RIPL is across token-ring using one of the following IBM Token-Ring cards in the workstation: • IBM Token-Ring Network PC Adapter • IBM Token-Ring Network PC Adapter II (long card) • IBM Token-Ring Network PC Adapter II (short card) • IBM Token-Ring Network 16/4 Adapter - with A33861C or higher • IBM Token-Ring Network Adapter/A - with A33861A or higher • IBM Token-Ring Network 16/4 Adapter/A - with A33861C or higher
ETHER.RPL	if RIPL is across Ethernet using an IBM Ethernet/A adapter
PCN2L.RPL	if RIPL is across IBM PC Network using an IBM PC Network adapter

BOOTCONF.SYS: If multiple images are supported, it is recommended that this file be used rather than using the default "NET$DOS.SYS" image file.

RIPL Image Files: This will be the DOS image files created using the DOSGEN utility or TOKENRPL.SYS if OS/2 RIPL V1.3 is required, or TOKEN.200 if OS/2 RIPL V2.0 is required.

IML Files: If the RIPL workstation is an IBM microchannel computer with BIOS image (.IML) files associated with it (such as the IBM PS/2 Models 56 and 57 SLC), then the .IML files must be copied to SYS:\LOGIN\IBMLAN\DCDB\IMAGES.

4.2.1 TOKEN.RPL

This is used for token-ring remote program load. This file is downloaded to the workstation after the IBM RPL boot ROM has issued a SEND.FILE.REQUEST frame to the NetWare RPL server. This file contains the RPL bootstrap code which is executed by the IBM boot ROM.

TOKEN.RPL must reside in the LOGIN directory!

When a file server or external router boots, and loads the RPL server code, this file is read into an area of RAM owned by the RPL server. This file is maintained in the RAM area of the RPL server, which can be any of the following:

- A NetWare 3.11 Server running the **RPL.nlm**.

  RPL.nlm connects internally to its host file server to search for SYS:LOGIN\TOKEN.RPL.

- A NetWare 2.2 Server running the **RPL.vp1** value-added process.

  RPL.vp1 connects internally to its host file server to search for SYS:LOGIN\TOKEN.RPL.

- An external NetWare router running the **RPL.vp1** value-added process.

  RPL.vp1 connects externally (out on the wire) to a server to find TOKEN.RPL. The first server on the wire to respond to RPL.vp1s connect request must have TOKEN.RPL in the SYS:LOGIN directory. The server can either be

NetWare V3.1x or V2.x and need not itself be a RPL server. TOKEN.RPL is then uploaded to the external router from the responding file server.

- A NetWare Lite file server running the **RPL.com** program.

  RPL.com searches the C:\LOGIN directory for the TOKEN.RPL file.

4.2.2 ETHER.RPL

This is used for IBM Ethernet remote program load. This file is downloaded to a workstation after the IBM RPL boot ROM has issued a SEND.FILE.REQUEST frame to the NetWare RPL server. This file contains the RPL bootstrap code which is executed by the IBM boot ROM.

ETHER.RPL must reside in the LOGIN directory!

When a file server or external router boots and loads the RPL server code, this file is read into an area of RAM owned by the RPL server. This file is maintained in the RAM area of the RPL server, which can be any of the following:

- A NetWare 3.11 Server running the **RPL.nlm**.

  RPL.nlm connects internally to its host file server to search for SYS:LOGIN\ETHER.RPL.

- A NetWare 2.2 Server running the **RPL.vp1** value-added process.

  RPL.vp1 connects internally to its host file server to search for SYS:LOGIN\ETHER.RPL.

- An external NetWare router running the **RPL.vp1** value-added process.

  RPL.vp1 connects externally (out on the wire) to a server to find ETHER.RPL. The first server on the wire to respond to RPL.vp1s connect request must have ETHER.RPL in the SYS:LOGIN directory. The server can be NetWare V3.1x or V2.x and need not itself be a RPL server. ETHER.RPL is then uploaded to the external router from the responding file server.

- A NetWare Lite file server running the **RPL.com** program.

  RPL.com searches the C:\LOGIN directory for the ETHER.RPL file.

4.2.3 PCN2L.RPL

This is used for IBM PC Network remote program load. This file is downloaded to a workstation after the IBM RPL boot ROM has issued a SEND.FILE.REQUEST frame to the NetWare RPL server. This file contains the RPL bootstrap code which is executed by the IBM boot ROM.

PCN2L.RPL must reside in the LOGIN directory!

When a file server or external router boots, and loads the RPL server code, this file is read into an area of RAM owned by the RPL server. This file is maintained in the RAM area of the RPL server, which can be any of the following:

- A NetWare 3.11 Server running the **RPL.nlm**.

  RPL.nlm connects internally to its host file server to search for SYS:LOGIN\PCN2L.RPL.

- A NetWare 2.2 Server running the **RPL.vp1** value-added process.

RPL.vp1 connects internally to its host file server to search for SYS:LOGIN\PCN2L.RPL.

- An external NetWare router running the **RPL.vp1** value-added process.

  RPL.vp1 connects externally (out on the wire) to a server to find PCN2L.RPL. The first server on the wire to respond to RPL.vp1's connect request, must have PCN2L.RPL in the SYS:LOGIN directory. The server can be NetWare V3.1x or V2.x and need not itself be a RPL server. PCN2L.RPL is then uploaded to the external router from the responding file server.

- A NetWare Lite file server running the **RPL.com** program.

  RPL.com searches the C:\LOGIN directory for the PCN2L.RPL file.

4.2.4 IML Files

Certain IBM microchannel computers, such as the IBM PS/2 Models 56 and 57 SLC, have a BIOS image file associated with them. During cold boot, the BIOS update process looks for files with an extension of .IML to update the motherboard BIOS before the bootstrap loader routine is called. These .IML files come on the reference diskette for the computer. You MUST create a directory called \LOGIN\IBMLAN\DCDB\IMAGES and install ALL .IML files in this directory. After loading the IML files, the computer does another reboot.

On a RIPL workstation this means the IML files are loaded from the RIPL server during the first reboot, then the RIPL image is loaded during the second reboot!

4.3 RIPL from a NetWare 3.11 Server

The RPL server function is performed by the RPL.nlm module on a NetWare V3.11 file server. RPL.nlm is a NetWare loadable module that acts as a protocol stack and responds to the IBM architected remote program load frames as defined in the *IBM Remote Program Load User's Guide*. RPL.nlm responds the IEEE_802.2 frame type packets transmitted by the IBM Boot ROMs on IBM Ethernet, IBM Token-Ring, and IBM PCN2 adapters. It is used in networks that have diskless workstations installed with the RPL BIOS Module. Currently, this is supported on the following network adapters:

IBM Ethernet Adapters

IBM PC Network Adapters

IBM Token-Ring Network Adapters.

Specifically, RPL.nlm will respond to the following frames:

Table 3. RPL Frame Types Responded to by RPL.nlm

FIND	RPL.nlm will respond with a **FOUND** frame
SEND.FILE.REQUEST	RPL.nlm will respond with a **FILE.DATA.RESPONSE** frame

RPL.nlm is intended to be a replacement for the following NetWare V3.11 modules:

Table 4 (Page 1 of 2). Modules Replaced by RPL.nlm

PCN2LRPL.nlm	For networks using the IBM PC Network Adapter
ETHERRPL.nlm	For networks using the IBM Ethernet Adapter

Table 4 (Page 2 of 2). Modules Replaced by RPL.nlm

TOKENRPL.nlm	For networks using the IBM Token-Ring Adapter

4.3.1 The NetWare 3.11 RPL-Server

In order to implement a RPL server on a NetWare 3.11 file server, the SYS:LOGIN directory must be set up as described in 4.2, "Contents of the LOGIN Directory" on page 41, and the RPL.nlm module must reside in the SYS:SYSTEM directory. The RPL.nlm module must be loaded either by the AUTOEXEC.NCF file at startup, or from the system console. After it has been loaded on the file server, it must be bound to the LAN drivers configured to support the IEEE 802.2 protocol. This provides the connection via the LAN to workstations which require attachment to a RPL server.

4.3.2 Features of RPL.nlm

RPL.nlm supports all of the BOOTCONF.sys extensions mentioned in 4.6, "The BOOTCONF.SYS File" on page 58. These include:

- Wildcard characters (* and ?) when specifying node addresses
- More than one disk image file name is allowed per node address
- Parsing BOOTCONF.sys at the NetWare Lite RPL server to minimize the amount of network traffic.

RPL.nlm also supports RPL of images using the IBM LAN Support Program, as well as allowing RPL across source routing bridges.

RPL.nlm will only work on a NetWare V3.11 Server. When RPL.nlm loads, it searches SYS:LOGIN for TOKEN.RPL, ETHER.RPL, PCN2L.RPL, and BOOTCONF.SYS files and copies them into file server RAM. These must be copied into the SYS:LOGIN directory prior to loading RPL.nlm.

RPL is allowed across a maximum of seven IBM bridges. As of September, 1991, RPL.nlm auto-updates the BOOTCONF.SYS image in RAM without unloading and reloading the RPL.nlm file.

RPL.nlm is capable of loading on a V3.10 NetWare server. This means that the modules TOKENRPL.nlm, ETHERRPL.nlm, and PCN2LRPL.nlm are no longer required.

The ability to RIPL across an IBM 8209 Ethernet to Token-Ring Bridge is also a feature of RPL.nlm. The NetWare File Server and RPL workstation can be on either side of the 8209 bridge. TOKEN.RPL and ETHER.RPL RPL bootstrap files will be properly downloaded to the Ethernet or token-ring RPL workstation from the NetWare File Server.

RPL.nlm also allows source-routing information to be enabled inside of TOKEN.RPL. This allows TOKEN.RPL to direct-connect across an IBM Source Routing Bridge to the NetWare Server with the IPX protocol.

4.3.3 Loading RPL.nlm on the NetWare Lite RPL-Server

To use RPL.nlm, the RPL boot ROM module must be installed on the network adapter board in the workstation. This module must be capable of sending the IBM architected RPL frame sequence. See the *IBM Remote Program Load User's Guide* for information on this architecture.

Implementing the RPL function consists of creating a disk image file and storing it in the SYS:LOGIN directory. (The disk image is created using the NetWare DOSGEN utility. A description of this process is given in 5.2, "DOSGEN" on page 63, as well as in the *NetWare Version 3.11 Installation* manual.) The SYS:LOGIN directory must also have the necessary RPL bootstrap code file(s) (see 4.2, "Contents of the LOGIN Directory" on page 41).

PL.nlm should be installed in the SYS:SYSTEM directory of the file server. It is loaded the same as any NetWare NLM:

```
LOAD RPL
```

at the file server command prompt. There are no parameters associated with loading RPL.nlm.

4.3.4 Binding RPL.nlm to the 802.2 Board

Since RPL.nlm is a protocol stack, it must be bound to any and all boards that have RPL clients attached to them:

```
BIND RPL to board [GNS],[NODEFAULT],[PROTECT],[TRO]
```

where board is the name of any NetWare LAN driver that is configured for IEEE 802.2 frame type.

The parameters specified by [..] are optional, not case sensitive, separated by blanks or commas, and may be entered in any order. They are described as follows:

Table 5 (Page 1 of 2). RPL.nlm BIND Time Parameters

ACK	Use this parameter if you wish to configure the RPL boot ROM module to acknowledge FILE.DATA.RESPONSE frames sent by RPL.nlm. By DEFAULT, RPL.nlm will send FILE.DATA.RESPONSE frames in a burst mode. This parameter allows pacing by the workstation if the adapter on the workstation cannot keep up with RPL.nlm.
GNS	This parameter specifies that you wish the workstation to do a Get Nearest Server request when the appropriate bootscrap program is downloaded. Normally, RPL.nlm will fill in the bootstrap program with the file server information, so that it does not need to do a Get Nearest Server request. Using this parameter may cause the workstation to find a server other than the one where RPL.nlm is located.

Table 5 (Page 2 of 2). RPL.nlm BIND Time Parameters

NODEFAULT	This parameter tells RPL.nlm not to respond to a find frame unless the node address of the workstation is found in the BOOTCONF.sys file. This is provided for security reasons. The workstation will not boot until the system administrator inserts into the BOOTCONF.sys file the node address and associated disk image file name(s) to use when booting the workstation. A further description of BOOTCONF.sys is given in 4.6, "The BOOTCONF.SYS File" on page 58. This parameter can also be used very effectively for load balancing purposes, so that not all workstations are accessing the same RPL server. It can also simplify system administration by only requiring that images are kept on the actual RPL server to which a workstation is going to attach. **Note:** At this time the workstation will try up to a maximum of five RPL servers when attempting to find its correct RPL server.
PROTECT	This parameter tells RPL.nlm to configure the bootstrap program so that it will protect itself in the workstation memory. It does this by adjusting the memory size variable in the BIOS data area (40:13) to reflect the amount of memory that it uses. Using this parameter will reduce the amount of memory that the workstation has available for DOS by about 12KB. It is recommended that this parameter not be used unless absolutely necessary.
TRO	This parameter specifies that you wish the bootstrap program to do a This Ring Only count of 3 on all broadcast frames. It is useful in a source routing environment and servers are available on the local ring.

4.3.5 Unique Boot Sequences using RPL.nlm

BOOTCONF.sys is an ASCII text file that allows you to specify a unique disk image file for each workstation that needs access to different files. You can create BOOTCONF.sys using your favorite text editor. The process of creating unique disk image files is given in 5.2, "DOSGEN" on page 63, as well as in the *NetWare Version 3.11 Installation* manual.

RPL.nlm parses the node address line of BOOTCONF.sys looking for these keywords. If an entry if found, but does not match one of the keywords, it is assumed to be a disk image file name. Therefore, you should not have a disk image file named the same as any of these keywords. Note that these parameters are optional and not case sensitive. They are separated by blanks, and may be entered in any order.

An example of a BOOTCONF.sys line using this parameters is:

```
    0x*1234 = NET$DOS.sys gns protect rep NODE=^^^^^|NODE=67890
```

In this case, **gns**, **protect** and **rep** will be interpreted as keywords and not boot image file names. In addition, the string ″**NODE=^^^^^**″ will be replaced with ″**NODE=67890**″ wherever it occurs in the disk image file.

4.3.6 BOOTCONF.sys Extensions

When RPL.com loads it will search the C:\LOGIN directory of the current drive for a BOOTCONF.sys file. If it finds it, it will read it into a memory buffer so that it can parse it when a find frame is received from a workstation. Note that the parsing of BOOTCONF.sys is done by RPL.com and not the bootstrap program to minimize the amount of traffic on the network during the RPL process. The extensions to BOOTCONF.sys are given in 4.6, "The BOOTCONF.SYS File" on page 58.

4.3.7 Changing BOOTCONF.sys

RPL.nlm reads BOOTCONF.sys into a memory buffer at load time. If the user changes it after BOOTCONF.sys is loaded, RPL.nlm will detect the change and re-load it automatically. There may be a five second delay from the time the changes are saved and the time RPL.nlm invokes the changes.

RPL.nlm will suspend processing of frames while BOOTCONF.sys is being loaded into memory.

4.4 RIPL from a NetWare 2.2 Server or a NetWare External Router

The RPL server function on a NetWare 2.2 Server or a NetWare External Router is provided by the RPL.vp1 module. RPL.vp1 is a value-added process that acts as a protocol stack and responds to the IBM-architected remote program load frames as defined in the *IBM Remote Program Load User's Guide*. RPL.vp1 responds the IEEE_802.2 frame type packets transmitted by the IBM boot ROMs on IBM Ethernet, IBM Token-Ring, and IBM PCN2 adapters. It is used in networks that have diskless workstations installed with the RPL BIOS module. Currently, this is supported on the following network adapters:

IBM Ethernet Adapters

IBM PC Network Adapters

IBM Token-Ring Network Adapters.

Specifically, RPL.vp1 will respond to the following frames:

Table 6. RPL Frame Types Responded to by RPL.vp1

FIND	RPL.vp1 will respond with a **FOUND** frame.
SEND.FILE.REQUEST	RPL.vp1 will respond with a **FILE.DATA.RESPONSE** frame.

On IBM Token-Ring LANs, where source routing is implemented, the source routing VAP (ROUTE.VP0) must be loaded first and the RPL.vp1 must be loaded next. That is why these files are named ROUTE.VP0 and RPL.vp1. Both external routers and NetWare 2.x file server load VAPs in an order dictated by the VAP's file extension.

The program RPCONFIG.COM is used to configure RPL.vp1 when it is used on a file server or router which has been configured for multiple types of Network Interface Cards.

Because each type of NIC requires a different RPL bootstrap code file in the SYS:LOGIN directory of the attached file server, this utility tells RPL.vp1 which file to load on each NIC. If the RPL.vp1 file is not configured with RPCONFIG.COM, it will use the first RPL bootstrap code file it finds in the SYS:LOGIN directory. This can cause a number of problems.

Similarly, if the RPL.vp1 file has been configured for one type of NIC and the file server or router configuration is changed, you must remember to reconfigure RPL.vp1.

4.4.1 The NetWare 2.2 and External Router RPL-Server

The RPL.vp1 module is required in order to implement a RPL server on a NetWare 2.2 file server or external router.

This is the remote program load VAP for the NetWare V2.x operating system or external router. To load properly, AppleTalk Phase-II LAN drivers must be linked into the 2.x server or external router. Before Novell developed the AppleTalk Phase-II drivers, the NIC could not respond to the "FIND frame" broadcast by the IBM boot ROM modules.

RPL.vp1 must be copied into the SYS:SYSTEM directory on a server, or, for external routers, the VAP may be copied onto the same directory where ROUTER.EXE resides.

RPL.vp1 requires that the SYS:LOGIN directory is set up with the appropriate bootstrap RPL code files as described in 4.2, "Contents of the LOGIN Directory" on page 41.

When RPL.vp1 loads (either in an external router, or on a NetWare 2.x file server), it sends out a request to "Get Nearest Server". The physically nearest server may be busy at this time, and another NetWare file server may reply quicker. The RPL.vp1 attaches, without logging in, to the first file server to reply to the Get Nearest Server Request. Because of this, it has read-only rights in the SYS:LOGIN directory, and therefore the *.RPL files are expected to be located in that directory. In the case of a NetWare v2.2 file server, this attachment occurs internally.

4.4.2 Features of RPL.vp1

RPL.vp1 (or RPL.VAP) supports RPL of images using the IBM LAN Support Program, as well as allowing RPL across source routing bridges.

RPL.vp1 does not fill in the file server information in the bootstrap program downloaded to the workstation. This forces the RPL bootstrap programs to use GNS calls. For this reason, on a network on which a NetWare 2.2 and external router RPL server is installed, all file servers must have their SYS:LOGIN directory set up as described in 4.2, "Contents of the LOGIN Directory" on page 41.

RPL.vp1 does not support any of the BOOTCONF.sys extensions mentioned in 4.6, "The BOOTCONF.SYS File" on page 58.

4.4.3 Installing RPL.vp1

RPL.vp1 must be loaded after ROUTE.VP0, if source routing is to be supported. RPL.vp1 supports three RPL bootstrap download files: TOKEN.RPL, ETHER.RPL, AND PCN2L.RPL.

In order to work with multiple LAN drivers, or multiple RPL bootstrap files, the RPL VAP must be configured. This is done by running RPCONFIG. RPCONFIG prints out a help screen and prompts for inputs.

When the RPL.vp1 comes up, it will load specified RPL bootstrap files, and connect them with specified LAN drivers. Then, when the VAP receives a find frame request, and subsequent SEND.FILE.REQUEST from a given IBM RPL boot ROM, it will respond with the proper RPL bootstrap file.

Since the VAP attaches without logging in, it only has read rights in the SYS:LOGIN subdirectory. Therefore, THE RPL bootstrap file must be located in SYS:LOGIN.

If RPL.vp1 hasn't been configured by RPCONFIG, it will default when it comes up. It will go out to SYS:LOGIN, find the first ?????.RPL file it can, and connect it with the first LAN driver available. This is generally not reliable for more than one RPL bootstrap file or more than one LAN driver. If in doubt, run RPCONFIG.

The server that responds to the find frame, and downloads the RPL bootstrap file, is not guaranteed to be the server that the workstation will attach to during the RPL sequence. This means that the BOOTCONF.SYS files, and boot disk image files (NET$DOS.SYS, etc.) will still need to be in SYS:LOGIN of every server that could respond to the Get Nearest Server request, not just the servers with RPL.vp1 loaded.

At this stage, RPL.vp1 does not support the BOOTCONF.sys file extensions mentioned in 4.6, "The BOOTCONF.SYS File" on page 58, nor does it support any runtime bind parameters as do RPL.nlm on the NetWare 3.11 server or RPL.com on the NetWare Lite server.

4.4.4 RPCONFIG.COM Utility

RPCONFIG.com is used to configure the RPL.vp1 VAP on file servers or external routers which possess multiple LAN drivers, or which have multiple media-specific RPL bootstrap loader (*.RPL) files in the SYS:LOGIN directory.

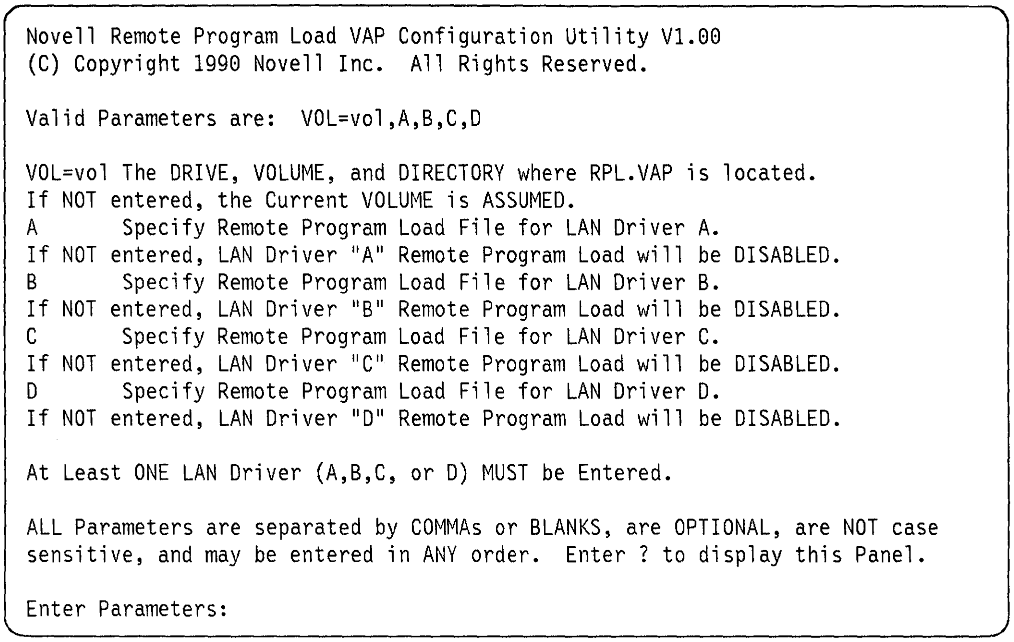
It may be run inside the SYS:SYSTEM directory where the RPL.vp1 file resides, or any other directory or on diskette as long as RPL.vp1 resides in the same directory as RPCONFIG.COM.

This utility configures two parameters on RPL.vp1:

1. To enable RPL on LAN A,B,C, or D, or any combination of these. Default: RPL is enabled on A,B,C, and D.
2. To set the name of the RPL file that is downloaded by the RPL VAP to the workstation.

This file is not the NET$DOS.SYS file. It is the remote program load file (for example, TOKEN.RPL). The default name is: *.RPL.

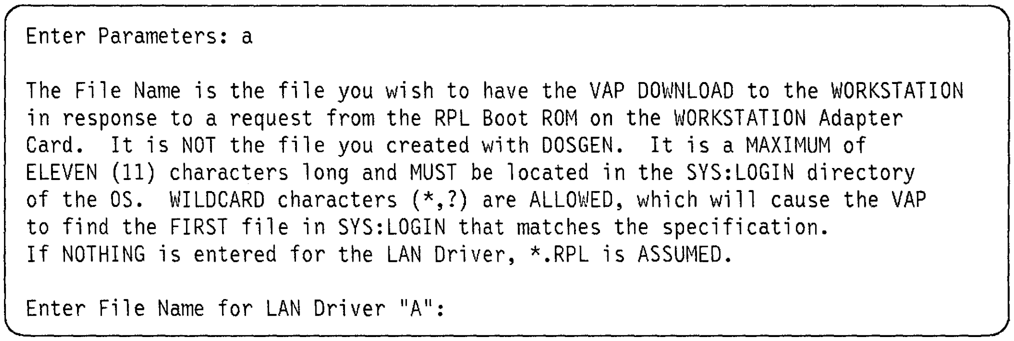
RPCONFIG.COM is menu driven. Just type RPCONFIG and it will help you along. ("*.rpl" refers to any file with a .rpl extension.) A sample of the screen presented by RPCONFIG.com is given in Figure 13 on page 51.



```
Novell Remote Program Load VAP Configuration Utility V1.00
(C) Copyright 1990 Novell Inc.  All Rights Reserved.

Valid Parameters are:  VOL=vol,A,B,C,D

VOL=vol The DRIVE, VOLUME, and DIRECTORY where RPL.VAP is located.
If NOT entered, the Current VOLUME is ASSUMED.
A       Specify Remote Program Load File for LAN Driver A.
If NOT entered, LAN Driver "A" Remote Program Load will be DISABLED.
B       Specify Remote Program Load File for LAN Driver B.
If NOT entered, LAN Driver "B" Remote Program Load will be DISABLED.
C       Specify Remote Program Load File for LAN Driver C.
If NOT entered, LAN Driver "C" Remote Program Load will be DISABLED.
D       Specify Remote Program Load File for LAN Driver D.
If NOT entered, LAN Driver "D" Remote Program Load will be DISABLED.

At Least ONE LAN Driver (A,B,C, or D) MUST be Entered.

ALL Parameters are separated by COMMAs or BLANKS, are OPTIONAL, are NOT case
sensitive, and may be entered in ANY order.  Enter ? to display this Panel.

Enter Parameters:
```

Figure 13. Initial Screen Presented by RPCONFIG.com Utility

After a parameter has been entered, the RPCONFIG.com utility responds with another prompt. This time, it is requesting the name of the RPL bootstrap code file which it will download to the workstation via the LAN connected to the selected NIC. This screen is shown in Figure 14.



```
Enter Parameters: a

The File Name is the file you wish to have the VAP DOWNLOAD to the WORKSTATION
in response to a request from the RPL Boot ROM on the WORKSTATION Adapter
Card.  It is NOT the file you created with DOSGEN.  It is a MAXIMUM of
ELEVEN (11) characters long and MUST be located in the SYS:LOGIN directory
of the OS.  WILDCARD characters (*,?) are ALLOWED, which will cause the VAP
to find the FIRST file in SYS:LOGIN that matches the specification.
If NOTHING is entered for the LAN Driver, *.RPL is ASSUMED.

Enter File Name for LAN Driver "A":
```

Figure 14. Screen Presented by RPCONFIG.com Utility

After the name of a RPL bootstrap code file has been entered, the RPCONFIG.com utility reconfigures the RPL.vp1 module as requested, and displays the following:

```
Enter File Name for LAN Driver "A": TOKEN.RPL
RPL.vp1 has been SUCCESSFULLY Configured.
```

4.5 RIPL from a NetWare Lite Server

The programs, RPL.com and BOOTNCP.com, in combination with the ODI drivers which support the IEEE 802.2 frame type, implement the RPL server function on any workstation on which they are executed. It is primarily for use in the NetWare Lite environment.

RPL.com is a DOS Terminate and Stay Resident (TSR) module that acts as a protocol stack and responds to the IBM-architected remote program load frames as defined in the *IBM Remote Program Load User's Guide*. RPL.com responds to the IEEE 802.2 frame type packets transmitted by the IBM Boot ROMs on IBM Ethernet, IBM Token-Ring, and IBM PCN2 adapters. It is used in networks that have diskless workstations installed with the RPL BIOS module. Currently, this is supported on the following network adapters:

IBM Ethernet Adapters

IBM PC Network Adapters

IBM Token-Ring Network Adapters.

Specifically, RPL.com will respond to the following frames:

Table 7. RPL Frame Types Responded to by RPL.com

FIND	RPL.com will respond with a **FOUND** frame
SEND.FILE.REQUEST	RPL.com will respond with a **FILE.DATA.RESPONSE** frame

In addition, the BOOTNCP program must be loaded on the NetWare Lite Server in order to respond to NetWare Core Protocol (NCP) requests made by the bootstrap program.

4.5.1 The NetWare Lite RPL-Server

In order to implement a RPL server on a workstation, the C:\LOGIN directory must be set up as described in 4.2, "Contents of the LOGIN Directory" on page 41, and the following programs executed:

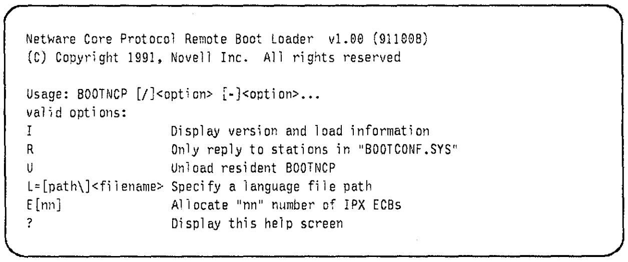
Table 8. Programs to be Executed on NetWare Lite RPL Server

LSL.com ODI Link Support Layer

MLID ODI multiple link interface driver, (for example, TOKEN.com, IBMODISH.com, NE1000.com, etc.)

ROUTE.com will also have to loaded next, if the MLID is TOKEN.com and source routing has been implemented due to the presence of a source routing bridge.

BOOTNCP.com This file provides the necessary protocol stack to enable the NetWare Lite RPL Server to respond to NCP requests. There are several options available on the BOOTNCP.com command line:



```
Netware Core Protocol Remote Boot Loader  v1.00 (911008)
(C) Copyright 1991, Novell Inc.  All rights reserved

Usage: BOOTNCP [/]<option> [-]<option>...
valid options:
I                    Display version and load information
R                    Only reply to stations in "BOOTCONF.SYS"
U                    Unload resident BOOTNCP
L=[path\]<filename> Specify a language file path
E[nn]                Allocate "nn" number of IPX ECBs
?                    Display this help screen
```

RPL.com This file provides the RPL protocol stack which directs the LAN requests to the RPL server. This file also provides all of the major functionality of the RPL server.

4.5.2 Features of RPL.com

RPL.com supports all of the BOOTCONF.sys extensions mentioned in 4.6, "The BOOTCONF.SYS File" on page 58. These include:

- Wildcard characters (* and ?) when specifying node addresses
- More than one disk image file name is allowed per node address
- Parsing BOOTCONF.sys at the NetWare Lite RPL Server to minimize the amount of network traffic.

RPL.com also supports RPL of images using the IBM LAN Support Program, as well as allowing RPL across source routing bridges.

4.5.3 Loading RPL.com on the NetWare Lite RPL-Server

To use RPL.com, the RPL boot ROM module must be installed on the network adapter board in the workstation. This module must be capable of sending the IBM architected RPL frame sequence. See the *IBM Remote Program Load User's Guide* for information on this architecture.

Implementing the RPL function consists of creating a disk image file and storing it in the C:\LOGIN directory. (The disk image is created using the NetWare DOSGEN utility. A description of this process is given in 5.2, "DOSGEN" on page 63, as well as in the *NOVELL NetWare Version 3.11 Installation* manual.) The C:\LOGIN directory must also have the necessary RPL bootstrap code file(s) (see 4.2, "Contents of the LOGIN Directory" on page 41).

To start the NetWare Lite Server, the AUTOEXEC.BAT contains the following (for a token-ring LAN using source routing):

```
PATH=C:\NETWARE
LSL
TOKEN
ROUTE
IPXODI
SERVER
```

To start the NetWare Lite RPL Server, the following needs to be appended to the AUTOEXEC.BAT:

```
BOOTNCP
RPL [ACK] [BIND board] [BUFFERS=nn]
     [CACHE SIZE=dd] [DEFAULT] [GNS] [NOACK] [NODEFAULT]
     [NOGNS] [NOPROTECT] [NOTRO] [PROTECT] [TRO] [U]
     [UNBIND board] [?]
```

where each of the parameters on the RPL.com command line are optional BINDing parameters for the RPL server. The parameters specified by [..] are optional, not case sensitive, separated by blanks or commas, and may be entered in any order. They are described as follows:

Table 9 (Page 1 of 3). RPL.com Command Line Parameters

ACK	Use this parameter if you wish to configure the RPL boot ROM module to acknowledge FILE.DATA.RESPONSE frames sent by RPL.com. By default, RPL.com will send FILE.DATA.RESPONSE frames in a burst mode. This parameter allows pacing by the workstation, if the adapter on the workstation cannot keep up with RPL.com.

Table 9 (Page 2 of 3). RPL.com Command Line Parameters

BIND	Use this parameter to bind RPL to a specific NetWare ODI board that is configured for the IEEE 802.2 frame type. Board may be specified by name, or optionally, by MLID board number (for example, BIND #n), where n is a decimal number. If multiple boards are to be bound, specify the bind parameter multiple times. If bind is not specified on the command line or in the NET.cfg file, RPL.com will search for the first 802.2 board that is installed and use it.
BUFFERS=nn	nn is a decimal number specifying the number of receive buffers to configure. The DEFAULT is 5.
CACHE SIZE=dd	dd is a decimal number specifying the maximum size of BOOTCONF.sys to load. If BOOTCONF.sys is larger than this value, RPL.com will not cache it. The bootstrap program will then request it over the network when it loads. Use this parameter when you wish to limit the resident memory size of RPL.com.
DEFAULT	This parameter will override the NODEFAULT parameter if it is specified on the bind command in NET.cfg.
GNS	This parameter specifies that you wish the workstation to do a get nearest server request when the appropriate RPL bootstrap program is downloaded. Normally, RPL.com will fill in the bootstrap program with the NetWare Lite Server information, so that it does not need to do a get nearest server request. Using this parameter may cause the workstation to find a server other than the one where RPL.com is located.
NOACK	This parameter will override the ACK parameter if it is specified on the bind command in NET.cfg.
NODEFAULT	This parameter tells RPL.com to not respond to a find frame request unless the node address of the workstation is found in the BOOTCONF.sys file. It is provided for security reasons. The workstation will not boot until the system administrator inserts into the BOOTCONF.sys file the node address and associated disk image file name(s) to use when booting the workstation. A further description of BOOTCONF.sys is given in 4.6, "The BOOTCONF.SYS File" on page 58. This parameter can also be used very effectively for load balancing purposes, so that not all workstations are accessing the same RPL server. It can also simplify system administration by only requiring that images are kept on the actual RPL server which a workstation is going to attach. **Note:** At this time the workstation will try up to a maximum of five RPL servers when attempting to find its correct RPL server.
NOGNS	This parameter will override the GNS parameter if it is specified on the bind command in NET.cfg.
NOPROTECT	This parameter will override the PROTECT parameter if it is specified on the bind command in NET.cfg.
NOTRO	This parameter will override the TRO parameter if it is specified on the bind command in NET.cfg.
PROTECT	This parameter tells RPL.com to configure the RPL bootstrap program so that it will protect itself in the workstation memory. It does this by adjusting the memory size variable in the BIOS data area (40:13) to reflect the amount of memory that it uses. Using this parameter will reduce the amount of memory that the workstation has available for DOS by about 12KB. It is recommended that this parameter not be used unless absolutely necessary.

Table 9 (Page 3 of 3). RPL.com Command Line Parameters

TRO	This parameter specifies that you wish the RPL bootstrap program to do a This Ring Only count of 3 on all broadcast frames. It is useful in a source routing environment and servers are available on the local ring.
U	This parameter will unload a previously installed RPL.com. All boards that are bound will be UNBOUND, and all memory used returned to DOS.
UNBIND	Use this parameter to UNBIND RPL from a specific NetWare ODI board. The board may be specified by name, or optionally, by MLID board number (for example, UNBIND #n), where n is a decimal number.
?	This parameter will display a list of all boards which RPL.com is currently bound.

4.5.4 Creating and using NET.CFG

The NET.cfg file is used by various ODI modules (including the LSL, LAN drivers, and protocol stacks) to obtain the network system configuration information at initialization time. RPL.com reads this file and parses it for a section describing the RPL configuration to use. Specifically, it searches for the following main section heading: (For more information on NET.CFG refer to the *NetWare V3.11 Installation* manual.)

```
PROTOCOL RPL
```

Note: The heading is not case sensitive, but the word "PROTOCOL" must begin in column one of the file.

After this heading is found, RPL.com looks for the following indented keywords to configure itself:

```
PROTOCOL RPL
    BIND board [ACK] [GNS] [NODEFAULT] [PROTECT] [TRO]
    BUFFERS nn
    CACHE SIZE dd
```

The parameters specified by [..] are optional, not case sensitive, separated by blanks, and may be entered in any order. They are described below:

Table 10 (Page 1 of 2). NET.CFG Protocol Section Statements

BUFFERS=nn	nn is a decimal number specifying the number of receive buffers to configure. The default is 5. Use this parameter to optimize performance.
CACHE SIZE=dd	dd is a decimal number specifying the maximum size of BOOTCONF.sys to load. If BOOTCONF.sys is larger than this value, RPL.com will not cache it. The RPL bootstrap program will then request it over the network when it loads. Use this parameter when you wish to limit the resident memory size of RPL.com.

Table 10 (Page 2 of 2). NET.CFG Protocol Section Statements

BIND	Use this parameter to bind RPL to a specific NetWare ODI board that is configured for the IEEE 802.2 frame type. Board may be specified by name, or optionally, by MLID board number (for example BIND #n), where n is a decimal number specifying the board to bind. If multiple boards are to be bound, specify the bind parameter multiple times, each on a different line in NET.cfg. If bind is not specified on the command line or in the NET.cfg file, RPL.com will search for the first 802.2 board that is installed and use it. The parameters specified with the bind command are optional and are described below:
ACK	Use this parameter if you wish to configure the RPL boot ROM module to acknowledge FILE.DATA.RESPONSE frames sent by RPL.com. By default, RPL.com will send FILE.DATA.RESPONSE frames in a burst mode. This parameter allows pacing by the workstation, if the adapter on the workstation cannot keep up with RPL.com.
GNS	This parameter specifies that you wish the workstation to do a get nearest server request when the appropriate bootstrap program is downloaded. Normally, RPL.com will fill in the bootstrap program with the NetWare Lite Server information, so that it does not need to do a get nearest server request. Using this parameter may cause the workstation to find a server other than the one where RPL.com is located.
NODEFAULT	This parameter tells RPL.com to not respond to a find frame request unless the node address of the workstation is found in the BOOTCONF.sys file. It is provided for security reasons. The workstation will not boot until the system administrator inserts into the BOOTCONF.sys file the node address and associated disk image file name(s) to use when booting the workstation. A further description of BOOTCONF.sys is given in 4.6, "The BOOTCONF.SYS File" on page 58. This parameter can also be used very effectively for load balancing purposes, so that not all workstations are accessing the same RPL server. It can also simplify system administration by only requiring that images are kept on the actual RPL server to which a workstation is going to attach. **Note:** At this time the workstation will try up to a maximum of five RPL servers when attempting to find its correct RPL server.
PROTECT	This parameter tells RPL.com to configure the bootstrap program so that it will protect itself in workstation memory. It does this by adjusting the memory size variable in the BIOS data area (40:13) to reflect the amount of memory that it uses. Using this parameter will reduce the amount of memory that the workstation has available for DOS by about 12KB. It is recommended that this parameter not be used unless absolutely necessary.
TRO	This parameter specifies that you wish the bootstrap program to do a This Ring Only count of 3 on all broadcasts frames. It is useful in a source routing environment and servers are available on the local ring.

4.5.5 Unique Boot Sequences using RPL.com

BOOTCONF.sys is an ASCII text file that allows you to specify a unique disk image file for each workstation that needs access to different files. BOOTCONF.sys is created using your favorite text editor. The process of creating unique disk image files is given in 5.2, "DOSGEN" on page 63, as well as in the *NOVELL NetWare Version 3.11 Installation* manual.

RPL.com parses the nde address line of BOOTCONF.sys looking for these keywords. If an entry if found, but does not match one of the keywords, it is assumed to be a disk image file name. Therefore, you should not have a disk image file named the same as any of these keywords. Note that these parameters are optional, not case sensitive, separated by blanks, and may be entered in any order.

An example of a BOOTCONF.sys line using this parameters is:

```
0x*1234 = NET$DOS.sys gns protect rep NODE=^^^^^|NODE=67890
```

In this case, gns and protect will be interpreted as keywords and not disk image file names. In addition, the string "NODE=^^^^^" will be replaced with "NODE=67890" wherever it occurs in the disk image file.

4.5.6 BOOTCONF.SYS Extensions

When RPL.com loads it will search the C:\LOGIN directory of the current drive for a BOOTCONF.sys file. If it finds it, it will read it into a memory buffer so that it can parse it when a find frame is received from a workstation. Note that the parsing of BOOTCONF.sys is done by RPL.com. and not the bootstrap program to minimize the amount of traffic on the network during the RPL process. The extensions to BOOTCONF.sys are given in 4.6, "The BOOTCONF.SYS File" on page 58.

4.5.7 Changing BOOTCONF.SYS

RPL.com reads BOOTCONF.sys into a memory buffer at load time. If the user changes BOOTCONF.sys after RPL.com is loaded, it must be unloaded by specifying:

```
RPL u
```

on the DOS command line. When RPL.com is loaded again, it will read the new copy of BOOTCONF.sys.

4.5.8 Memory Considerations

RPL.com will read all bootstrap programs with a .RPL extension it finds in the C:\LOGIN directory and caches them into memory when it loads. It is designed to provide multivendor support with any and all boards that use the IBM RPL architecture. Each RPL bootstrap program consumes anywhere from 10 to 15KB of memory.

To reduce the amount of resident memory RPL.com consumes, it is suggested that only the bootstrap programs that will actually be used are placed in the C:\LOGIN directory.

BOOTCONF.sys is the only other file that is cached during initialization time. This file is optional, so if it is not needed there is no reason to define it. It does, however, offer some powerful configuration options, so when and if you do define it, it is suggested that it be made as small as possible.

4.6 The BOOTCONF.SYS File

After a RPL server loads and connects to a file server, it will search the LOGIN directory of the file server for a BOOTCONF.sys file. If it finds BOOTCONF.SYS, it will read it into a memory buffer ready for parsing when a "find frame" is received from a workstation.

Note: Parsing of BOOTCONF.sys is done by the RPL server and not the bootstrap (*.RPL) program. This minimizes the amount of traffic on the network during the RPL process.

The extensions to BOOTCONF.sys are given in the following section.

4.6.1 Using Wildcard Characters in BOOTCONF.SYS

Wildcards are only recognized by the following RPL servers:

- RPL.nlm running on a NetWare 3.x file server
- RPL.com running on a NetWare Lite file server.

Wildcard characters (* and ?) are allowed in the line specifying the node address of the workstation. This will allow the system administrator more flexibility in building the BOOTCONF.sys file. The rules for these wildcard characters are:

Table 11. Wildcard Characters in BOOTCONF.sys

?	Use the question mark character to specify any digit in the node address. In the example above, the node address could be specified as 0x??????123456 which is equivalent to 0x*123456.
*	Use the asterisk character to specify a range of digits in the node address. For example, if the node address of the workstation is 10005A123456, it may be specified as 0x*123456 in BOOTCONF.sys. In this example, the RPL server will match the node address with any node address that ends in 123456. **Note:** Only one asterisk (*) may appear in the node address.

You may use wildcard characters to specify a default disk image file for all workstations on the network that do not have a specific disk image file. You do this by placing the line:

```
        0x* = DEFAULT.sys
or      0x???????????? = DEFAULT.sys
```

as the last line in BOOTCONF.sys. Either one of these lines will match on all workstation node addresses. The DEFAULT.sys (or any name you desire) disk image file is generated by DOSGEN, the same as any disk image file.

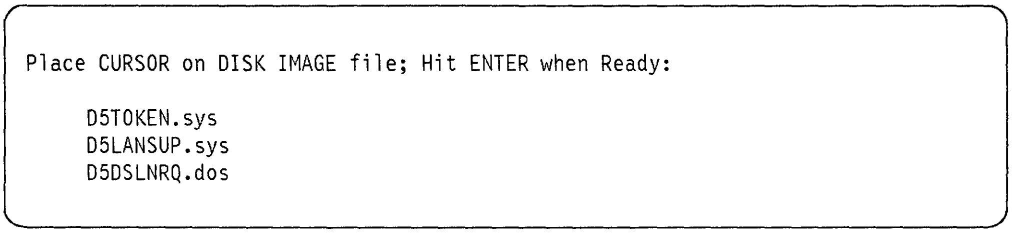
4.6.2 More than ONE Disk Image File per Node Address

Each line in BOOTCONF.sys that contains a node address may specify more than one disk image file name, separated by one or more blank characters. In this case, the bootstrap program will present the workstation user with a list of disk image files. He must then use the cursor to highlight the one he wishes to boot from.

For example, if a workstation's node address is 10005A123456, the line in BOOTCONF.SYS:

```
0x10005a123456 = D5TOKEN.sys D5LANSUP.sys D5DSLNRQ.dos
```

will cause the bootstrap program to present on the workstation screen:



```
Place CURSOR on DISK IMAGE file; Hit ENTER when Ready:

     D5TOKEN.sys
     D5LANSUP.sys
     D5DSLNRQ.dos
```

The bootstrap program will then use NCP calls to open the selected disk image file. If it does not exist, it will display the following message:

```
Unable to OPEN Disk Image File
```

and redisplay the list of images specified in BOOTCONF.SYS.

Up to 10 disk image file names may be entered for each node address in BOOTCONF.sys.

Note: They must be separated by one or more blank characters, and they must all fit on one line.

4.6.3 Multiple Lines per Node Address

The ASCII colon (:) can be used to allow for multiple lines when specifying a particular node address in BOOTCONF.sys. It is provided for convenience when specifying multiple parameters on the node address line.

To use this feature, place the ASCII colon (:) at the end of the line. Note that is must be preceded by at least one ASCII blank:

```
0x10005a460025 = D5TOKEN.sys D5LANSUP.sys :
                 D5DSLNRQ.sys
```

4.6.4 BOOTCONF.SYS BIND Override Parameters

When a RPL server parses BOOTCONF.sys, it allows the user to override the RPL server bind time parameters with parameters specific to a particular workstation that is being booted. By default, the parameters that were entered at bind time apply to all workstations that are attached to the particular board specified in the bind command. The following commands are allowed on a per node basis, which, if used, will override the bind time parameters:

Table 12 (Page 1 of 2). BOOTCONF.SYS BIND Override Parameters

ACK	Use this parameter if you wish to configure the RPL boot ROM module to acknowledge ″FILE.DATA.RESPONSE″ frames sent by the RPL server. By default, a RPL server will send FILE.DATA.RESPONSE frames in a burst mode. This parameter allows pacing by the workstation, if the adapter on the workstation cannot keep up with the RPL server.
GNS	This parameter specifies that you wish the workstation to do a Get Nearest Server (GNS) request when the appropriate bootstrap program is downloaded. Normally, the RPL server will fill in the bootstrap program with the file server information, so that it does not need to do a get nearest server request. Using this parameter may cause the workstation to find a server other than the one where the RPL server is located.

Table 12 (Page 2 of 2). BOOTCONF.SYS BIND Override Parameters

NOACK This parameter will override the ACK parameter specified on the bind command.

NOGNS This parameter will override the GNS parameter specified on the bind command.

NOPROTECT This parameter will override the PROTECT parameter specified on the bind command.

NOTRO This parameter will override the TRO parameter if specified on the bind command.

PROTECT This parameter tells the RPL server to configure the bootstrap program so that it will protect itself in the workstation memory. It does this by adjusting the memory size variable in the BIOS data area (40:13) to reflect the amount of memory that it uses. Using this parameter will reduce the amount of memory that the workstation has available for DOS by about 12KB. It is recommended that this parameter not be used unless absolutely necessary.

REP string1|string2 allows you to replace all occurrences of string1 with string2 in the disk image file. The '|' (ASCII 7Ch) delimiter is required to delimit the string values.

Use this parameter to dynamically re-configure a disk image file during the RPL process. It is useful for tailoring files such as AUTOEXEC.BAT or CONFIG.SYS to a specific workstation.

The rules for using REP are given as follows:

1. The search is case sensitive. The bootstrap program will search for string1 exactly as it is entered in BOOTCONF.sys.
2. All occurrences of string1 will be replaced with string2 in the disk image file.
3. string2 must be equal to or shorter than string1.
4. If string2 is shorter than string1, the disk image file will be padded with ASCII blanks when the substitution is made.
5. string2 must contain no embedded ASCII blanks. The first blank that is encountered is interpreted as the end of the string.

TRO This parameter specifies that you wish the bootstrap program to do a This Ring Only count of 3 on all broadcast frames. It is useful in a source routing environment and servers are available on the local ring.

A RPL server parses the node address line of BOOTCONF.sys looking for these keywords. If an entry if found, but does not match one of the keywords, it is assumed to be a disk image file name. Therefore, you should not have a disk image file named the same as any of these keywords. Note that these parameters are optional, not case sensitive, separated by blanks, and may be entered in any order.

An example of a BOOTCONF.sys line using this parameters is:

```
0x*1234 = NET$DOS.sys gns protect rep NODE=^^^^^|NODE=67890
```

In this case, gns and protect will be interpreted as keywords and not as disk image file names. In addition, the string "NODE=^^^^^" will be replaced with "NODE=67890" where ever it occurs in the disk image file.

4.6.5 Changing BOOTCONF.SYS

The RPL server reads BOOTCONF.sys into a memory buffer at load time. If the user changes it after BOOTCONF.sys is loaded, the RPL server must be unloaded then reloaded.

The exception to this is when RPL.nlm is running on a NetWare 3.11 file server. RPL.nlm will detect the change and reload it automatically. There may be a five second delay from the time the changes are saved to the time the RPL server invokes the changes.

The RPL.nlm will suspend processing of frames while BOOTCONF.sys is being loaded into memory.

Chapter 5. NetWare RIPL of DOS Images

In recent discussions with Novell, it has been made clear that they intend to phase out their original IPX shell (IPX.COM), in favor of their newer Open Data-Link Interface (ODI) shells. At this time, both shells are still common, and hence both types of setup are discussed. Generation of the older IPX program is not covered here due to Novell's intentions. There is also sufficient documentation elsewhere on this subject.

5.1 What you need

1. If you are installing diskless workstations on a network, you must install at least one workstation (temporarily) that boots from floppy diskette in order to generate the remote boot image file on the server.
2. To install remote boot image files on the server, you need:
   - The workstation configuration worksheet to record settings
   - A station with a floppy diskette drive
   - The boot diskettes for each remote boot station
3. Once the network board is ready for "Remote Reset", run DOSGEN on the station with a diskette drive and upload the required DOS boot image file to the host server.
4. If you have several servers on your network, and RIPL load balancing has not been implemented, copy the remote boot image files onto each server that may come up as the remote boot station's default server. For more information on load balancing, refer to the RPL-Server BIND parameters in Chapter 4, "RIPL using NetWare from IBM" on page 39.
5. If the default server is busy when a remote boot station boots, the next available server becomes the default server.
6. Just as you must create different boot diskettes for each network board configuration and DOS version used, you must create different boot image files on the server for each remote boot station that has different boot file requirements.

5.2 DOSGEN

Purpose: Allows workstations to boot from remote boot image files stored on the server's hard disk.

Usage: This is split into two different sections:

- Create one remote boot image file
- Create several remote boot image files

Prior to running DOSGEN, the diskette is set up to allow a regular workstation to boot up and perform all of the functions which will ultimately be performed by the medialess workstation. All of the information is then read from the diskette, using DOSGEN and is placed into the DOS image file. This includes the boot sector, the FAT and root directory, the boot files and all of the other files placed in the root directory of the diskette.

Note: DOSGEN cannot read single-sided disks. All images created by DOSGEN, must be created from double-sided 5.25 inch disks or 3.5 inch diskettes.

Also, There must be no subdirectories on the diskettes. DOSGEN is unable to process subdirectories and will report an error if it detects that the diskette it is processing contains subdirectories. All files must be in the root directory of the diskette.

At this time, only the root directory is supported for DOS images. Therefore a setup which requires the existence of subdirectories cannot be set up within the boot image and some sort of work-around must be employed. The boot image is read from an actual diskette using the DOSGEN utility.

5.3 Creating a Single Remote Boot Image File

Note: If the server already has a remote boot image file (NET$DOS.SYS) in SYS:LOGIN that is being used by someone else, you cannot create a new single remote boot image file. (See 5.4 "Create Several Remote Boot image files" on page 61.)

1. Boot a station from floppy or hard disk, and log in as supervisor
2. Insert the boot diskette for the remote boot station into drive A
3. Map drive F to SYS:SYSTEM. Type:

   ```
   MAP F:=SYS:SYSTEM
   ```

4. Map drive G to SYS:LOGIN. Type:

   ```
   MAP G:=SYS:LOGIN
   ```

5. Change to SYS:LOGIN. Type G:
6. Run DOSGEN (DOS Remote Image File GENeration):

   ```
   F:DOSGEN
   ```

   Note: DOSGEN creates a boot image file called NET$DOS.SYS (a copy of the files on the boot diskette) in the SYS:LOGIN directory.

   Your screen will look similar to the following:

   ```
   Floppy Type f9 = Quad Density, 15 Sectors per track
     Total Floppy Space 2400 Sectors
     Setting Up System Block.
     Setting Up FAT Tables.
     Setting Up Directory Structures.
     Traversing Directory Structures.
     Processing IBMBIO  COM
     Processing IBMDOS  COM
     Processing COMMAND COM
     Processing IPX     COM
     Processing NETX    COM
     Processing AUTOEXECBAT
     Transferring Data to "NET$DOS.SYS"
   ```

7. Copy the AUTOEXEC.BAT file from the boot diskette in drive A into the SYS:LOGIN directory
8. Copy the AUTOEXEC.BAT file from the boot diskette to the default directory specified in the user's login script (typically the user's home directory). If the default directory is SYS:LOGIN, you have already completed this step

Note: You may get a "Batch File Missing" error when you log in if the AUTOEXEC.BAT file isn't copied to SYS:LOGIN and the default directory.

9. Flag the NET$DOS.SYS file in SYS:LOGIN as shareable. Type:

   ```
   FLAG NET$DOS.SYS S
   ```

10. Grant the modify right to the remote boot user in SYS:LOGIN. Example: from SYS:LOGIN, type:

    ```
    GRANT M TO A_USER
    ```

5.4 Creating Several Remote Boot Image Files

1. Boot a station from floppy or hard disk, and log in as supervisor
2. Rename the AUTOEXEC.BAT file on the boot diskette:
   a. Insert a boot diskette for one of the remote boot workstations into drive A
   b. Rename the AUTOEXEC.BAT file on the diskette
   c. Give the AUTOEXEC.BAT file on each boot diskette a unique name and a .BAT extension

      For example, name the batch file A_USER.BAT for a workstation that A_USER will use
   d. For each renamed .BAT file (A_USER.BAT in our example), list the network addresses and node addresses for the workstations that will use it on the Workstation Configuration Worksheet
   e. You use this information when you create the BOOTCONF.SYS file
3. Copy the renamed .BAT file (A_USER.BAT, in this example) from the boot diskette to SYS:LOGIN
4. Copy the renamed .BAT file (A_USER.BAT) into the default directory specified in the login script:
   a. Typically this directory is the user's home directory
   b. If the default directory is SYS:LOGIN, you have already completed this step
   c. You may get a "Batch File Missing" error when you log in if the AUTOEXEC.BAT file is not copied to both the SYS:LOGIN directory and the default directory
5. Create a new AUTOEXEC.BAT file on the boot diskette that consists of the renamed batch file: (A_USER.BAT)
   - When each remote boot workstation boots, the operating system reads the AUTOEXEC.BAT file and goes to the renamed batch file (A_USER.BAT) to execute the boot commands
6. Map drives to the directories that DOSGEN writes to:
   a. Map drive F to SYS:SYSTEM. Type:

      ```
      MAP F:=SYS:SYSTEM
      ```
   b. Map drive G: to SYS:LOGIN. Type:

      ```
      MAP G:=SYS:LOGIN
      ```
   c. Change to the SYS:LOGIN directory. Type:

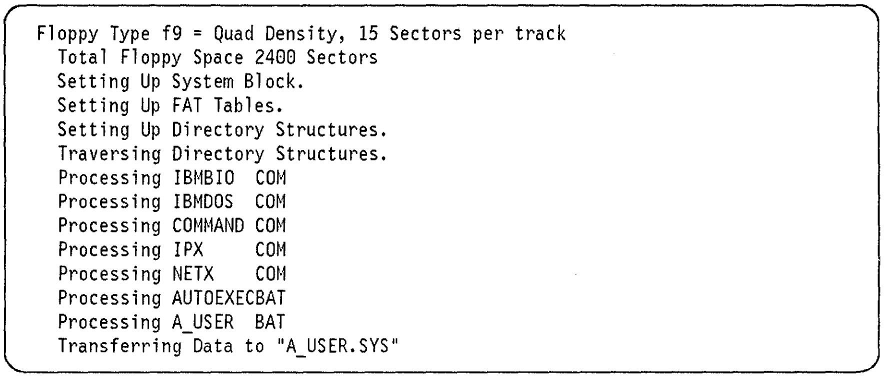
      ```
      G:
      ```

7. Run DOSGEN (DOS Remote Image File GENeration) and indicate the new name for the image file:

   a. From drive G (and with the boot diskette in drive A), type F:DOSGEN A: A_USER.SYS. Leave a space between A: and the name of the file.

   b. DOSGEN creates the new remote boot image file in SYS:LOGIN

      Your screen will look similar to the following:



```
Floppy Type f9 = Quad Density, 15 Sectors per track
  Total Floppy Space 2400 Sectors
  Setting Up System Block.
  Setting Up FAT Tables.
  Setting Up Directory Structures.
  Traversing Directory Structures.
  Processing IBMBIO  COM
  Processing IBMDOS  COM
  Processing COMMAND COM
  Processing IPX     COM
  Processing NETX    COM
  Processing AUTOEXECBAT
  Processing A_USER  BAT
  Transferring Data to "A_USER.SYS"
```

   c. Record the network number and node address of the station that will use the remote boot image file you just created

   d. You use this information when you create the BOOTCONF.SYS file

      For example, when you have finished running DOSGEN for two boot diskettes, your list would look similar to the following:

```
RED.SYS:  Network#=DOC20  Node=5a003b77
JANE.SYS: Network#=DOC20  Node=1b0276a3
```

   e. Repeat Steps 7a and 7b for each boot diskette

8. Create the BOOTCONF.SYS file

   Note: If the server already has a BOOTCONF.SYS file in SYS:LOGIN, you can't create another one. New entries can be added to the existing file using a DOS text editor.

   a. When you create multiple remote boot image files, you also need a BOOTCONF.SYS file in the SYS:LOGIN directory that lists:

      - All custom remote boot image files (not including the default NET$DOS.SYS file)

      - The network address and node address of each station that uses the customized boot image files

   b. Move to the SYS:LOGIN directory

   c. Use a DOS text editor to create the BOOTCONF.SYS file in the SYS:LOGIN directory. Include a line for each remote boot image file you created, using an entry format containing the following:

      - 0x (the number zero plus x)

      - The network address

      - A comma (,)

      - The node or station address

      - An equal sign (=)

      - The boot disk image filename

Our example for two boot diskettes looks like this:

```
0xDOC20,5a003b77=A_USER.SYS
0xDOC20,1b0276a3=JANE.SYS
```

9. Flag the .SYS files in SYS:LOGIN as shareable.

   Type commands such as those as follows:

   ```
   FLAG *.SYS S
   FLAG *.BAT S
   ```

10. Grant the modify right to the remote boot users in SYS:LOGIN.

    Move to the SYS:LOGIN directory and type a command similar to the following:

    ```
    GRANT M TO A_USER <Enter>
    ```

5.5 Using Locally Administered Addresses

Locally Administered Addresses (LAAs) are specified by parameters either in the NET.CFG file (ODI drivers) or within the CONFIG.SYS file (LSP drivers). Both of these files reside within the DOS image. When the RPL workstation initially attaches to a file server to download the RPL bootstrap code and then to download a particular DOS image, it has no way of knowing that it will eventually be using LAAs.

From this it is obvious that only the Universally Administered Addresses should be specified within the BOOTCONF.SYS file, because neither the RPL server, nor the workstation, are aware of anything else when the RPL server scans this file.

Also, this means that the RPL bootstrap program must be able to communicate with the RPL server before and after the workstation connection changes its address (from universal to local).

5.6 Bridging Considerations

Currently there are no problems with RIPL across IBM source routing bridges as long as source routing has been loaded on the token-ring side of the bridge. This includes:

- The 8209 Token-Ring to Token-Ring Bridge
- The 8209 Token-Ring to Ethernet-Ring Bridge

  (Must have ECA 001 applied to allow IPX to cross the bridge)
- The IBM Bridge Program V2.2.

  (If a remote bridge setup is being used, some timing problems may be experienced due to transmission delays)

A workstation will RIPL from a NetWare RPL server, when the bridge is on the same network. The RIPL workstation does not need to be on the same side of the bridge as the RPL server. The RIPL function will cross a maximum of seven bridges.

5.7 Troubleshooting Tips

1. If you get the error message "Error opening boot disk image file" or "Unable to open NET$DOS.SYS" you are probably attaching to another file server that does not contain the remote boot image file.

   Either log in to the other possible default file servers as supervisor and run DOSGEN on each, or copy the .SYS and .BAT files from the default file server to the other file servers on the network.

2. If you get the error "Batch file missing", make sure the AUTOEXEC.BAT file is in:

   Table 13. Batch File Missing Error Causes

SYS:LOGIN	For every file server you could possibly attach to
Default (or first) mapped drive	For the file server you normally log in to

3. If one user can log in but other users are unsuccessful when trying at the same time, make sure the .SYS files are flagged shareable.

4. If you are using a remote reset ROM on a token-ring network board and you can't boot a workstation, ensure that you have loaded the RPL loadable module (LOAD RPL.NLM) at the file server console before booting the workstation.

5. Use "Track On" at the server console and watch for get nearest server requests from the workstation.

   This will give you an idea whether the boot ROM on the workstation is sending packets.

6. Load "Monitor" at the server console and watch to see if the workstation opens the BOOTCONF.SYS file, the NET$DOS.SYS file, or other boot disk image files.

7. If a station using the boot ROM doesn't boot, and you have another station with a diskette drive configured the same as the first station (has the same type of network board using the same configuration options), see if the second station will boot with the boot diskette you used with DOSGEN.

   With the boot diskette on the second machine, it should be the same as booting from the server on the RPL workstation.

5.8 Examples of the Basic DOS Image

This section aims to provide a reference for those wishing to put together a DOS RIPL image. The following examples have been fully tested and are known to RIPL successfully.

Note: In all the token-ring examples, the ROUTE.COM module has been loaded. This was because in the testing environment, there was an IBM source routing bridge. If the LAN segment consisting of the workstation and RPL server does not connect to any IBM source routing bridges, ROUTE.COM may be omitted from the DOS image and the AUTOEXEC.BAT.

5.8.1 RIPL of ODI Drivers

5.8.1.1 Token-Ring

Directory of the files required in a DOS image for RIPL of ODI shells using an IBM Token-Ring Adapter:

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        49  3-20-92   2:12p
LSL      COM      7648 11-20-91   4:57p   ]  Novell V1.20 (911120)
TOKEN    COM     15663  6-14-91   4:10p   ]  Novell V1.12 (910614)
ROUTE    COM      4450  5-01-91   8:28a   ]  Novell V1.12 (910501)
IPXODI   COM     20903 11-20-91   4:57p   ]  Novell V1.20 (911120)
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.22 (910731)
```

AUTOEXEC.BAT file used to generate a DOS image for ODI shells for an IBM Token-Ring Adapter using either UAA or LAA:

```
@ECHO OFF
PROMPT $p$g
lsl
token
route
ipxodi
netx
```

If locally administered addresses are required, a NET.CFG file must be included in the image.

NET.CFG file used with ODI shells when the RIPLed DOS image uses an IBM Token-Ring Adapter and an LAA:

```
Link Driver TOKEN
  Node Address 400010010001
```

5.8.1.2 IBM Ethernet

Directory of the files required in a DOS image for RIPL of ODI shells using an IBM Ethernet Adapter/A:

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        54  3-20-92   2:12p
LSL      COM      7648 11-20-91   4:57p   ]  Novell V1.20 (911120)
IBMODISH COM     17023  06-28-91  4:53p   ]  W/D    V1.03 (910628)
IPXODI   COM     20903 11-20-91   4:57p   ]  Novell V1.20 (911120)
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.22 (910731)
```

AUTOEXEC.BAT file used to generate a DOS image for ODI shells for an IBM Ethernet Adapter/A using either UAA or LAA:

```
@ECHO OFF
PROMPT $p$g
lsl
ibmodish
ipxodi
netx
```

If Locally Administered Addresses are required, a NET.CFG file must be included in the image.

NET.CFG file used with ODI shells when the RIPLed DOS image uses an IBM Ethernet Adapter/A using an LAA:

```
Link Driver IBMODISH
  Node Address 400010010001
```

5.8.2 RIPL of Standard IPX

5.8.2.1 Token-Ring

Directory of the files required in a DOS image for RIPL of standard IPX shells for an IBM Token-Ring Adapter:

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        43  3-20-92   2:12p
IPX      COM     25342 12-13-91   3:41p   ]  IPX: v3.10 (911121),  TKN: v2.63 (91082
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.10 (911205)
```

AUTOEXEC.BAT file used to generate a DOS image for standard IPX shells for an IBM Token-Ring Adapter:

```
@ECHO OFF
PROMPT $p$g
ipx
route
netx
```

5.8.2.2 IBM Ethernet

Directory of the files required in a DOS image for RIPL of standard IPX shells for an IBM Ethernet Adapter/A:

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        36  3-20-92   2:12p
IPX      COM     27843  3-27-92  12:40p   ]  IPX: v3.10 (911121),  ETH: v1.12 (91042
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.10 (911205)
```

AUTOEXEC.BAT file used to generate DOS Image for standard IPX shells for an IBM Ethernet Adapter/A:

```
@ECHO OFF
PROMPT $p$g
ipx
netx
```

5.9 Examples of Images using DOS with LAN Support Program

5.9.1 RIPL of ODI Drivers

5.9.1.1 Token-Ring

Directory of the files required in a DOS image for RIPL of the ODI shells using LAN Support Program for an IBM Token-Ring Adapter:

```
IBMBIO   COM     33446 11-29-91  12:00p  ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p  ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p  ]  DOS 5.0 with UR36603
CONFIG   SYS       133  3-20-92   2:12p
AUTOEXEC BAT        58  3-20-92   2:12p
DXMA0MOD SYS      4736  1-23-92   8:44a  ]  Lan Support Program V1.25
DXMC0MOD SYS     28800  1-23-92   8:43a  ]  Lan Support Program V1.25
DXMT0MOD SYS     29696  1-23-92   8:43a  ]  Lan Support Program V1.25
NET      CFG        71  3-20-92   2:12p
LSL      COM      7648 11-20-91   4:57p  ]  Novell V1.20 (911120)
LANSUP   COM     14094 04-30-91  10:32a  ]  Novell V1.20 (910430)
ROUTE    COM      4450 05-01-91   8:28a  ]  Novell V1.12 (910501)
IPXODI   COM     20903 11-20-91   4:57p  ]  Novell V1.20 (911120)
NETX     COM     51201 07-31-91  10:47a  ]  Novell V3.22 (910731)
```

AUTOEXEC.BAT file used to generate a DOS image for ODI shells using LAN Support Program for an IBM Token-Ring Adapter using either UAA or LAA:

```
@ECHO OFF
PROMPT $p$g
lsl
lansup
route
ipxodi
netx
```

NET.CFG file used with ODI shells when the RIPLed DOS image uses LAN Support Program for an IBM Token-Ring Adapter using either UAA or LAA:

```
Potocol IPX
  Bind LANSUP

Link Driver LANSUP
  Frame TOKEN-RING
```

CONFIG.SYS file used with either ODI shells or standard IPX shells when the RIPLed DOS image uses LAN Support Program for an IBM Token-Ring Adapter using a UAA:

```
FILES=20
BUFFERS=40
DEVICE=DXMA0MOD.SYS 001
DEVICE=DXMC0MOD.SYS
DEVICE=DXMT0MOD.SYS
SHELL=COMMAND.COM /E:1024 /P
LASTDRIVE=G
```

Note: It is only recently that the LASTDRIVE command has been recognized within the CONFIG.SYS of a RIPL workstation.

5.9.1.2 IBM Ethernet

Directory of the files required in a DOS image for RIPL of ODI shells using LAN Support Program for an IBM Ethernet Adapter/A:

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        61  3-20-92   2:12p
CONFIG   SYS       179  3-20-92   2:12p
DXMA0MOD SYS      4736  1-23-92   8:44a   ]  Lan Support Program V1.25
DXME0MOD SYS     36736  1-23-92   8:45a   ]  Lan Support Program V1.25
DXMT0MOD SYS     29696  1-23-92   8:43a   ]  Lan Support Program V1.25
PROTMAN  DOS     10657  1-23-92   8:46a   ]  Lan Support Program V1.25
MACETH   DOS     16624  7-17-91  12:00p   ]  IBM Ethernet Adapter/A Options v1.01
PROTOCOL INI      5120  3-01-91  10:00a   ]  ASCII text file - USER Modifiable
PRO      MSG      1392  1-23-92   8:46a   ]  Lan Support Program V1.25
NETBIND  EXE     15639  1-23-92   8:46a   ]  Lan Support Program V1.25
LSL      COM      7648 11-20-91   4:57p   ]  Novell V1.20 (911120)
IBMODISH COM     17023  6-28-91   4:53p   ]       V1.03 (910628)
LANSUP   COM     14094  4-30-91  10:32a   ]  Novell V1.20 (910430)
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.22 (910731)
NET      CFG        71  3-20-92   2:12p
```

AUTOEXEC.BAT file used to generate a DOS image for standard IPX shells using LAN Support Program for an IBM Ethernet Adapter/A:

```
@ECHO OFF
PROMPT $p$g
netbind
lsl
lansup
ipxodi
netx
```

CONFIG.SYS file used with either ODI shells or standard IPX shells when the RIPLed DOS image uses LAN Support Program for an IBM Ethernet Adapter/A using a UAA:

```
FILES=20
BUFFERS=40
SHELL=COMMAND.COM /E:1024 /P
device=PROTMAN.DOS /I:A:\
device=MACETH.DOS
device=DXMA0MOD.SYS 001
device=DXME0MOD.SYS
device=DXMT0MOD.SYS
LASTDRIVE=G
```

PROTOCOL.INI file used with ODI shells when the RIPLed DOS image uses LAN Support Program for an IBM Ethernet Adapter/A using either UAA or LAA:

```
; ---------------------  Protocol Manager Definition  -----------------------

[PROTOCOL_MANAGER]
    DriverName = PROTMAN$

; -------------------  IBM Ethernet Protocol Definition  --------------------

[ETHERNET]
    DriverName = DXME0$
```

```
; -------------- IBM PS/2 Adapter for Ethernet Networks -----------------

[IBMAC]
    DriverName = MACETH$
;
; The following 3 parameters are read from the POS registers on the adapter.
; Therefore, they are not needed and will be ignored.
;
    IRQ = 3
    RamAddress = 0xC800
    IOBase = 0x200
    ReceiveBuffers = 16
    ReceiveChains = 16
    MaxRequests  = 10
    MaxTransmits = 10
    ReceiveBufSize = 256
```

NET.CFG file used with ODI shells when the RIPLed DOS image uses LAN Support Program for an IBM Ethernet Adapter/A using either UAA or LAA:

```
Potocol IPX
  Bind LANSUP

Link Driver LANSUP
  Frame TOKEN-RING
```

Note: Even though the workstation is using Ethernet, the fact that the LAN Support drivers are loaded means that the frame type must be specified as token-ring in the NET.CFG file.

If locally administered addresses are required, the "device=DXMEOMOD.SYS" line in the CONFIG.SYS file must be changed. If the trailing ",,1" parameter is omitted, the address bits will be swapped around.

```
device=DXME0MOD.SYS 400010010001,,1
```

5.9.2 RIPL of Standard IPX

5.9.2.1 Token-Ring

Directory of the files required in a DOS image for RIPL of standard IPX shells using LAN Support Program for an IBM Token-Ring Adapter:

```
IBMBIO   COM     33446 11-29-91  12:00p  ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p  ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p  ]  DOS 5.0 with UR36603
CONFIG   SYS       133  3-20-92   2:12p
AUTOEXEC BAT        43  3-20-92   2:12p
DXMA0MOD SYS      4736  1-23-92   8:44a  ]  Lan Support Program V1.25
DXMC0MOD SYS     28800  1-23-92   8:43a  ]  Lan Support Program V1.25
DXMT0MOD SYS     29696  1-23-92   8:43a  ]  Lan Support Program V1.25
IPX      COM     24520 03-02-92   9:10a  ]  IPX: v3.10 (911121),  LSP: v2.62 (910415)
ROUTE    COM      4450 05-01-91   8:28a  ]  Novell V1.12 (910501)
NETX     COM     51201 07-31-91  10:47a  ]  Novell V3.22 (910731)
```

AUTOEXEC.BAT file used to generate a DOS image for standard IPX shells using LAN Support Program for an IBM Token-Ring Adapter:

```
@ECHO OFF
PROMPT $p$g
ipx
route
netx
```

CONFIG.SYS file used with either ODI shells or standard IPX shells when the RIPLed DOS image uses LAN Support Program for an IBM Token-Ring Adapter using an LAA:

```
FILES=20
BUFFERS=40
DEVICE=DXMA0MOD.SYS 001
DEVICE=DXMC0MOD.SYS 400010010001
DEVICE=DXMT0MOD.SYS
SHELL=COMMAND.COM /E:1024 /P
LASTDRIVE=G
```

Note: It is only recently that the LASTDRIVE command has been recognized within the CONFIG.SYS of a RIPL workstation.

5.9.2.2 IBM Ethernet

Directory of the files required in a DOS image for the RIPL of standard IPX shells using LAN Support Program for an IBM Ethernet Adapter/A

```
IBMBIO   COM     33446 11-29-91  12:00p   ]  DOS 5.0 with UR36603
IBMDOS   COM     37378 11-29-91  12:00p   ]  DOS 5.0 with UR36603
COMMAND  COM     48006 11-29-91  12:00p   ]  DOS 5.0 with UR36603
AUTOEXEC BAT        61  3-20-92   2:12p
CONFIG   SYS       179  3-20-92   2:12p
DXMA0MOD SYS      4736  1-23-92   8:44a   ]  Lan Support Program V1.25
DXME0MOD SYS     36736  1-23-92   8:45a   ]  Lan Support Program V1.25
DXMT0MOD SYS     29696  1-23-92   8:43a   ]  Lan Support Program V1.25
PROTMAN  DOS     10657  1-23-92   8:46a   ]  Lan Support Program V1.25
MACETH   DOS     16624  7-17-91  12:00p   ]  IBM Ethernet Adapter/A Options v1.01
PROTOCOL INI      5120  3-01-91  10:00a   ]  ASCII text file - USER Modifiable
PRO      MSG      1392  1-23-92   8:46a   ]  Lan Support Program V1.25
NETBIND  EXE     15639  1-23-92   8:46a   ]  Lan Support Program V1.25
IPX      COM     24520  3-02-92   9:10a   ]  IPX: v3.10 (911121),  LSP: v2.62 (91041
NETX     COM     51201  7-31-91  10:47a   ]  Novell V3.10 (911205)
```

AUTOEXEC.BAT file used to generate a DOS image for ODI shells using LAN Support Program for an IBM Ethernet Adapter/A using either UAA or LAA:

```
@ECHO OFF
PROMPT $p$g
netbind
ipx
netx
```

CONFIG.SYS file used with either ODI shells or standard IPX shells when the RIPLed DOS image uses LAN Support Program for an IBM Ethernet Adapter/A using a UAA:

```
FILES=20
BUFFERS=40
SHELL=COMMAND.COM /E:1024 /P
device=PROTMAN.DOS /I:A:\
device=MACETH.DOS
device=DXMA0MOD.SYS 001
device=DXME0MOD.SYS
```

```
device=DXMT0MOD.SYS
LASTDRIVE=G
```

PROTOCOL.INI file used with ODI shells when the RIPLed DOS image uses LAN Support Program for an IBM Ethernet Adapter/A using a UAA or LAA:

```
; --------------------- Protocol Manager Definition ----------------------

[PROTOCOL_MANAGER]
    DriverName = PROTMAN$

; ------------------- IBM Ethernet Protocol Definition -------------------

[ETHERNET]
    DriverName = DXME0$

; -------------- IBM PS/2 Adapter for Ethernet Networks -----------------

[IBMAC]
    DriverName = MACETH$
;
; The following 3 parameters are read from the POS registers on the adapter.
; Therefore, they are not needed and will be ignored.
;
    IRQ = 3
    RamAddress = 0xC800
    IOBase = 0x200
    ReceiveBuffers = 16
    ReceiveChains = 16
    MaxRequests  = 10
    MaxTransmits = 10
    ReceiveBufSize = 256
```

If locally administered addresses are required, the "device=DXME0MOD.SYS" line in the CONFIG.SYS file must be changed. If the trailing ",,1" parameter is omitted, the address bits will be swapped around.

```
device=DXME0MOD.SYS 400010010001,,1
```

5.10 Dual DOS RIPL Requester Environment

It is possible to set up a DOS image containing both NetWare and DOS LAN requesters. The following points describe this process.

1. On the NetWare server, set up a DOS image which contains the LAN Support Program. An example of this is shown in 5.9.1.1, "Token-Ring" on page 71.
2. Bring up the workstation using the diskette version of this image.

   The image should be tested to ensure they RIPL correctly. At this point, do not RIPL the workstation. Use the diskette that the image was DOSGENed from.
3. Login to the NetWare server.

   The user ID used at this point must have sufficient access rights to set up applications on the NetWare server.
4. Determine the drive letter a RAMDISK would use and map this drive to the NetWare server. This drive will be the target for installation of the DOS LAN Requester and must be mapped as a root drive.

The range of local drives is defined by the "LASTDRIVE" statement in the CONFIG.SYS. (In the above examples, LASTDRIVE=G, and therefore the local drives are A: through G:.)

```
MAP ROOT C:=SYS:APPS
```

5. The system will issue a warning which should be ignored.

   ```
   Drive C is in use by a local drive.
   Do you want to assign it as network drive? (Y/N) Y
   ```

6. Install the DOS LAN Requester from OS/2 LAN Server V2.0 diskettes on to the NetWare drive (drive C: in this example).

7. Once the DLR installation is complete, copy the following files from the C:\DOSLAN directory to the boot diskette.

   ```
   INITFSI  BAT       596   3-24-92  8:40a
   NETWORK1 CMD     12451   3-14-92 11:04a
   NETWORK2 CMD     15907   3-14-92 11:04a
   NETWORK3 CMD      3427   3-14-92 11:04a
   NET      COM     13568   3-14-92 11:04a
   MSGPOPUP EXE      8671   3-14-92 11:04a
   MSGSRVR  EXE     51591   3-14-92 11:04a
   REDIR33  EXE    103564   3-14-92 11:04a
   REDIR40  EXE    104476   3-14-92 11:04a
   XSI1     EXE      6901   2-12-92  7:30a
   XSI2     EXE     43451   3-14-92 11:04a
   XSI3     EXE      3265   3-14-92 11:04a
   NETWORK  MSG     24540   3-14-92 11:04a
   DOSLAN   INI       152   4-15-92  2:54p
   ```

8. Copy the DOS "RAMDRIVE.SYS" RAM-disk device driver to the boot diskette and add a line to the CONFIG.SYS on the boot diskette, so as to create a RAMDISK of 500KB in extended memory.

   ```
   DEVICE=RAMDRIVE.SYS 500 /e
   ```

   This is required as a workaround, since DOSGEN cannot generate subdirectories within the DOS boot image file. The DLR files will be copied to this by the AUTOEXEC.BAT file.

9. Create a new AUTOEXEC.BAT file on the boot diskette as follows:

   ```
   @ECHO OFF
   PROMPT $p$g
   SET RIPL=YES
   if exist a:doskey.com DOSKEY
   md c:\doslan
   cd c:\doslan
   rem copy a:. c:\doslan > nul
   copy a:command.com c:\ > nul
   set comspec=c:\command.com
   copy net.com c:\doslan > nul
   copy network?.* c:\doslan > nul
   copy msg*.exe c:\doslan > nul
   copy redir*.exe c:\doslan > nul
   copy xsi?.exe c:\doslan > nul
   copy doslan.ini c:\doslan > nul
   copy initfsi.bat c:\doslan > nul
   copy netin.bat c:\
   c:
   net start
   call initfsi
   ```

```
    a:lsl
    a:lansup
    a:route
    a:ipxodi
    c:\netin
    ```

    From this AUTOEXEC.BAT file, it can be seen that the DOSLAN directory is created from the root on the RAMDISK. All the DLR files contained in the DOS image, are then copied to that directory. The DLR is also started from this directory, and finally, the NetWare requester is started.

10. Create a special NETIN.BAT file to avoid problems with the DOS error "Batch File not found". DOS transfers to this batch file from the AUTOEXEC.BAT.

    As can be seen in the AUTOEXEC.BAT above, the very last statement is NETIN.BAT. In the following example which lists NETIN.BAT, it is assumed that the NetWare user ID is USER1 and that the login script maps drive Z: to a directory on the same NetWare volume that the DOS LAN Requester was installed (in step 5 above).

    Also, the following example assumes that the DLR was installed off the SYS:\APPS directory on that volume.

    ```
    @ECHO OFF
    a:netx
    h:login user1
    z:\apps\c_root
    ```

11. Copy NETIN.BAT to the boot diskette.

12. Create the C_ROOT batch file which branches from the NETIN.BAT batch file. This batch file performs the final step of replacing the temporary DLR files on the RAMDISK, with the actual files installed previously. The following shows the contents of the C_ROOT.BAT file:

    ```
    @ECHO OFF
    MAP ROOT C:=Z:\APPS
    C:
    cd \doslan
    ```

13. Lastly use the DOSGEN utility to generate an image from the boot diskette used throughout this procedure. Store this image in the SYS:LOGIN directory, make it read-only and shareable.

You should now be able to RIPL from the newly created image and log on to the OS/2 LAN Server, then to the NetWare server.

If more than one user requires this functionality, the REP statement (4.6, "The BOOTCONF.SYS File" on page 58) can be used to modify the machine name within the DOSLAN.INI file. The REP statement forces the RIPL DOS Image to be modified as it is downloaded to the workstation.

Chapter 6. NetWare RIPL of OS/2 V1.30.2 Images

This chapter discusses how to set up a NetWare server to RIPL an OS/2 V1.30.2 image.

6.1 Setting up an OS/2 RIPL Image on a NetWare Server

The method of setting up RIPL for OS/2 V1.30.2 is quite different from that used to set up RIPL for OS/2 V2.0. The final results, in terms of file server directory structure and the files set up on the file server, are very similar. The main difference between the two procedures is that with the RIPL of OS/2 V1.30.2, all the setting up is done manually. For the RIPL of OS/2 V2.0, the set up procedure has been completely automated.

Note: There are currently several restrictions associated with RIPL of OS/2 V1.30.2 from a NetWare server. For more information on these, refer to 6.12, "Known Restrictions to OS/2 V1.30.2 RIPL" on page 90.

6.1.1 RIPL of OS/2 V1.30.2 from a NetWare Server

There are two versions of the *Novell NetWare for OS/2 Requester Guide*. The instructions for setting up remote boot are different in each.

Table 14. Versions of NetWare for OS/2 Requester Guide

100-000921-002 April 1991 Edition	This manual contains good information, much of which is repeated in the following section.
183-000287-001 March 1991 Edition	This manual contains information which does not permit OS/2 to successfully RIPL.

The remote initial program load capability is designed for NetWare networks that have diskless DOS or OS/2 workstations. It also operates successfully on normal workstations which have a hard disk that is not the active partition, as set by FDISK.

In order to set up remote program load, you must first install the requester on a workstation and the OS/2 NetWare utilities on the file server. Each step is detailed in the following sections.

Plan ahead: The OS/2 Utilities occupy about 3.5MB of disk space on the SYS: volume. The files which comprise the RIPL OS/2 image fill about another 20MB of the SYS: volume. The SWAPPER.DAT files are also created by OS/2 remote boot users on the SYS: volume.

Be sure to allow for plenty of room on the SYS volume for all these files. If a small local hard disk is available which is large enough for the SWAPPER.DAT file, it could be used rather than the SYS: volume on the network. This would also help to cut down network traffic.

The following gives the prerequisites for a token-ring workstation using RIPL:

- IBM Token-Ring Adapter (AT bus or Micro Channel)
- The universal adapter address of the Token-Ring Adapter

- IBM Token-Ring RIPL ROM.

The software used must be OS/2 V1.30.2 or a previous version of OS/2 V1.3 which has had CSD5050 applied. Also, the NetWare requester for OS/2 should have been installed and the NetWare Service Diskette, *NSD004*, should have been applied.

When these requirements have been met, the steps that must be followed to install the RIPL procedure are as follows. (Detailed procedures for each of these follows in the respective sections.)

1. Install OS/2 1.30.2 on the workstation
2. Install the NetWare OS/2 Requester on workstation and apply *NSD004*
3. Install the OS/2 Utilities on the file server
4. Copy OS/2 to the file server
5. Prepare the OS/2 RIPL image on the file server.

6.2 Installing OS/2 V1.30.2 on a Workstation

Using the instructions supplied with OS/2 V1.30.2, install OS/2 on the workstation. You may also install an earlier version of OS/2 V1.3 and apply CSD WR05050.

Note: Do not install Communications Manager or LAN Requester.

Follow the prompts in the install program to install OS/2 Standard Edition V1.30.2.

6.3 Updating the NetWare Requester for OS/2 V1.3 Diskette

In order to install the NetWare requester for OS/2 on the workstation, the following steps must be completed.

Note: It is not necessary to install the NetWare OS/2 Requestor code from the original NetWare diskettes. Instead, an updated NetWare Requester diskette can be made:

1. Make a diskcopy of the original diskette. This copy must have the volume label "Requester".

2. Obtain a copy of the packed *NSD004.zip* or *NSD004.exe* (or later) file from Netwire or HONE Library.

3. Unpack the NSD004 file over the copy of the NetWare OS/2 Requester diskette using the DOS command:

   ```
         C:\>PKUNZIP -od NSD004.zip a:\ *.*
   or
         C:\>NSD004.exe -od a:\ *.*
   ```

   Note: There are spaces between the a:\ and the *.* in both commands.

This procedure creates an updated NetWare requester for OS/2 diskette or NSD004 Requester diskette.

6.4 Installing the NetWare Requester on the Workstation

In order to install the NetWare requester for OS/2 on the workstation the following steps must be performed:

1. Boot the workstation with OS/2.
2. Double-click on "OS/2 Window" or "OS/2 Full Screen" in the Group-Main window to bring up a command prompt.
3. Insert the NSD004 REQUESTER diskette in drive A.
4. Type the following:

   ```
   [C:\]a:install
   ```

   The Requester Installation window will be displayed showing four options. Each option should be selected in turn.

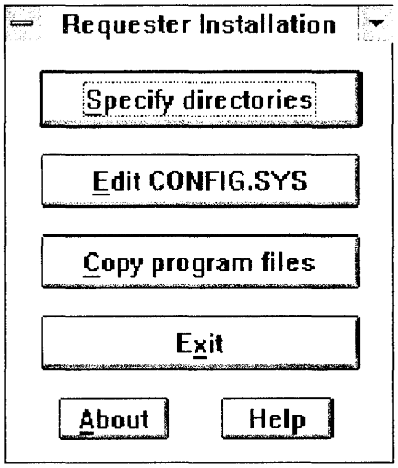
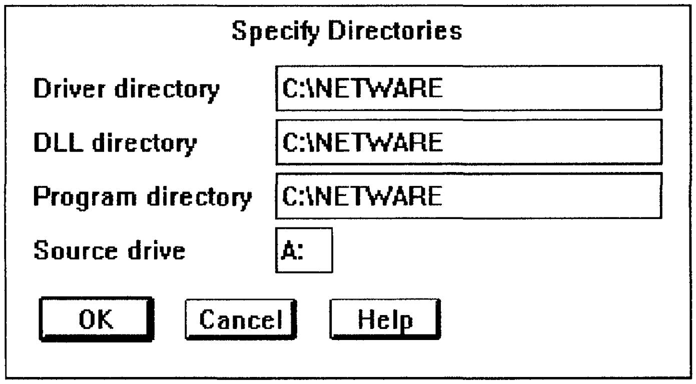


Figure 15. NetWare NSD004 Requester Installation: Initial Window

Procedures for each option are discussed in the sections that follow. When each option has been selected and completed, the program exits to the "OS/2 Window" command prompt. At this point, reboot the workstation.

6.4.1 Specify Program-File Directories



Specify Directories

Driver directory: C:\NETWARE

DLL directory: C:\NETWARE

Program directory: C:\NETWARE

Source drive: A:

Figure 16. NetWare NSD004 Requester Installation: Target Directories

The target directories specified during the installation are created if they do not already exist. The directory C:\NETWARE is the default, and **must** be used if RIPL is to be supported. The normal usage of each of these directories is shown in the following table:

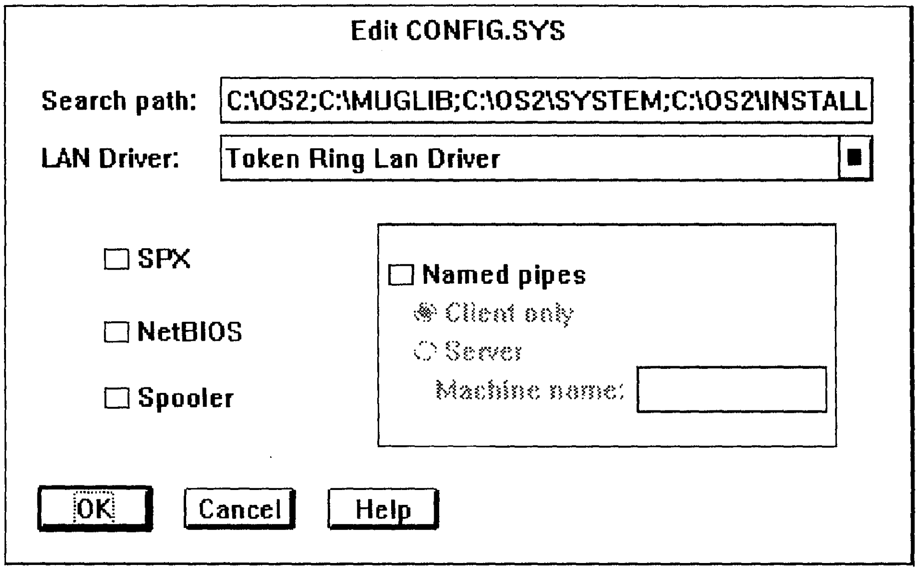
Table 15. Directory Usage for RIPL Support

Directory	Usage
Driver Directory	The NetWare requester device drivers (*.SYS) are placed in this directory. All NetWare Device Driver statements added to CONFIG.SYS have this as their path.
DLL Directory	The NetWare DLL files are placed in this directory. This is automatically appended to the LIBPATH statement in the CONFIG.SYS.
Program Directory	All of the NetWare requester *.EXE files are placed in this directory. It is automatically appended to the DPATH statement in the CONFIG.SYS. All NetWare Program daemons run by the CONFIG.SYS have this as their path.

6.4.2 Modifying CONFIG.SYS

The following steps must be completed to modify the CONFIG.SYS:

The directories you specified in the previous section (see 6.4.1, "Specify Program-File Directories") are automatically added to the .DLL path (LIBPATH) and Data path (DPATH). A device driver must be selected, and the CONFIG.SYS saved by clicking on the "OK" button.



Edit CONFIG.SYS

Search path: C:\OS2;C:\MUGLIB;C:\OS2\SYSTEM;C:\OS2\INSTALL

LAN Driver: Token Ring Lan Driver

□ SPX

□ NetBIOS

□ Spooler

□ Named pipes

● Client only

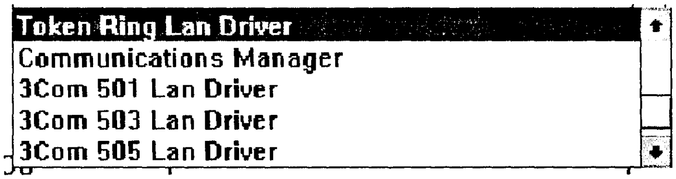
○ Server

Machine name:

Figure 17. NetWare NSD004 Requester Installation: Modify CONFIG.SYS

1. Click on the "Edit CONFIG.SYS" button.
2. The Edit CONFIG.SYS window allows you to include additional Search Path commands.

   It is recommended that the OS/2 login script maps a drive to the SYS:PUBLIC directory. If this is drive Z:, you should append the string "Z:\OS2" to your PATH statement. This allows access the OS/2 utilities on the file server. Any other similar mappings to file server utilities should also be appended to the search path at this time.
3. Select the LAN driver for the network interface board in the workstation. (Click on the arrow to the right of the LAN Driver box to access a list of driver names.)

   Token Ring Lan Driver
   Communications Manager
   3Com 501 Lan Driver
   3Com 503 Lan Driver
   3Com 505 Lan Driver

   Figure 18. NetWare NSD004 Requester Installation: LAN Driver Selection

   LAN driver is the only option that must be specified. The driver selected depends on the hardware installed in the workstation. At present only the IBM Token-Ring card is supported for OS/2 RIPL, and the IBM Token-Ring driver must be selected.

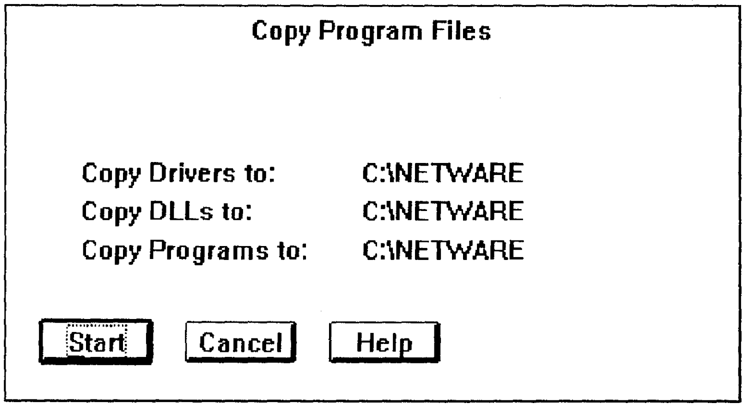
   Enable or disable features associated with the Requester including SPX, NetBIOS, OS/2 Named Pipes, and Spooler. These items in the window are optional and depend on your network configuration as well as the applications to be run on the workstation.
4. Press OK to exit the Edit CONFIG.SYS window.

   When you exit the Edit CONFIG.SYS window, the program asks for a file name to save the new CONFIG.SYS to. If you select the file CONFIG.SYS, the program saves the previous CONFIG.SYS as CONFIG.BAK. If errors occur during processing of the new CONFIG.SYS, during reboot of the system, this backup copy may be used to bring up the system in its state, prior to loading the NetWare requester.

6.4.3 Copy the Requester Program Files to Your Hard Drive

To complete installing the requester code on your workstation, select "Copy Program Files" from the installation main menu, and start copying the files.

The installation program prompts with a confirmation screen prior to actually copying the requester files.

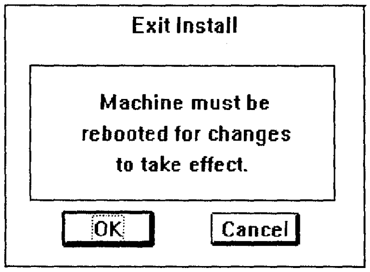


Copy Program Files

Copy Drivers to: C:\NETWARE
Copy DLLs to: C:\NETWARE
Copy Programs to: C:\NETWARE

Figure 19. NetWare NSD004 Requester Installation: File Transfer

1. Click on the "Copy program files" button
2. Click on "Start" to begin copying the requester files to the specified destination at the workstation
3. Follow the prompts until installation is complete.



Exit Install

Machine must be rebooted for changes to take effect.

Figure 20. NetWare NSD004 Requester Installation: Exit Screen

6.4.4 Starting the Requester

The first step is to reboot the workstation. This ensures that:

a. The NetWare requester has been properly configured

b. To allow access to a NetWare server.

6.4.5 Installing NetWare Utilities For OS/2 on the File Server

The procedure in this section explains how to install NetWare OS/2 utilities on the file server so that they can be accessed by the workstation.

Each workstation must be able to access the OS/2 compatible NetWare utilities. You can copy these utilities to your hard disk, but we recommend you put them on the file server. Use the preferred server option in your NET.CFG so the file server you first attach to will have these utilities installed. After the utilities have been installed, copy the utilities from the SYS:LOGIN\OS2 directory to your C:\NETWARE directory.

OS/2 cannot use DOS utilities. Consequently, NetWare utilities written for DOS do not work for a workstation running OS/2.

1. Boot the OS/2 workstation if necessary
2. Double-click on "Main" in the Desktop Manager window
3. Double-click on "OS/2 Full Screen" in the Group-Main window.

   A prompt similar to the following appears:

   ```
   [C:]
   ```
4. Insert the OS2UTIL-1 diskette in drive A. If you have already installed the NetWare for OS/2 utilities in a directory on another file server or hard disk, you can also map a drive to that directory.
5. Type the command as follows:

   ```
   A:LOGIN server_name\supervisor
   ```

   Replace server_name with the name of the file server on which you want to install the NetWare utilities for OS/2. For example, if the name of the server were "NETWARE-311_SERVER", you would type the following:

   ```
   A:LOGIN NETWARE-311_SERVER\supervisor
   ```

   The default LOGIN SCRIPT maps drive D: to the SYS: volume.
6. Create a SYS:LOGIN/OS2 directory on the file server by typing:

   ```
   md D:\login\os2
   ```
7. Create a SYS:PUBLIC/OS2 directory on the file server by typing:

   ```
   md D:\public\os2
   ```
8. Map drive L to SYS:LOGIN/OS2 by typing:

   ```
   MAP L:=SYS:LOGIN/OS2
   ```
9. Map drive P to SYS:PUBLIC/OS2 by typing:

   ```
   MAP P:=SYS:PUBLIC/OS2
   ```
10. Change to the A drive containing the OS2UTIL-1 diskette and type the following:

    ```
    servinst
    ```
11. Follow the prompts to install the OS/2 utilities.
12. Assign shareable and read-only rights to the utilities in SYS:LOGIN/OS2 by typing the following command:

    ```
    flag L:*.* sro
    ```

13. Assign shareable and read-only rights to the utilities in SYS:PUBLIC/OS2 by typing the following command:

    ```
    flag P:*.* sro
    ```

14. Use the SYSCON utility to add the following mapping to the system login script to provide access to the OS/2 utilities for anyone who uses OS/2 workstations on the server:

    ```
    map L:=sys:public
    ```

6.5 Copying OS/2 to the File Server

Use the following steps to copy OS/2 from the workstation where you just installed it, to the file server:

1. Use File Manager to clear the "HRS" flags on the copy OS2KRNL and OS2LDR files
2. Boot the workstation from a DOS diskette
3. Load the DOS NetWare requester shells (IPX.com, and NETX.com)
4. Log in to the file server as supervisor
5. From the DOS prompt, map a drive to the SYS: volume by typing a command similar to the following:

    ```
    map N:= server_name\sys:
    ```

6. Create an RPL directory on the file server by typing a command similar to the following:

    ```
    md N:rpl
    ```

    Note: During the requester's installation on the hard disk, program files must have been copied to the default C:\NETWARE directory. If the program files were copied to a destination other than the C:\NETWARE directory, the RIPL of the OS/2 image does not work.

7. Copy all the files (and subdirectory structure) from the workstation's root directory (C:) to the file server's SYS:RPL directory.

    ```
    xcopy C:\*.* N:\RPL /s/e
    ```

8. From the OS/2 Installation Diskette, copy the ABIOS.SYS file and all the files with the extension of *.BIO.

    ```
    COPY A:\ABIOS.SYS N:\RPL
    COPY A:\*.BIO N:\RPL
    ```

6.6 Preparing the File Server

1. Map a drive to the SYS:LOGIN directory on the file server by typing a command similar to the following:

    ```
    map o:= server_name\sys:login
    ```

2. Insert the NSD004 Requester diskette in the A: drive and type the following:

    ```
    copy a:\rpl\tokenrpl.sys o:
    copy a:\rpl\mini.ifs n:\rpl
    ```

3. Create a RPL\COMPUTER directory on the file server by typing the following:

    ```
    md n:rpl\computer
    ```

4. In SYS:RPL\COMPUTER, create a subdirectory for each workstation using RIPL.

   The name of each subdirectory must be based on the node address. For example, if a workstation has an address of 10005A123456, you would type a command as follows:

   ```
   md n:rpl\computer\0005A123.456
   ```

   The "1" in the address is omitted so that the name conforms to the 8-character limit for directory names.

5. In the subdirectory for each station, create an ASCII text file named CONFIG.WSS. The purpose of this file is to specify a user name and provide file location information.

   The following is an example of a CONFIG.WSS file:

   ```
   USERNAME RPLUSER
   c:\config.sys  c:\user\rpluser\config.sys
   c:\os2\os2.ini c:\user\rpluser\os2.ini
   c:\os2\os2sys.ini c:\user\rpluser\os2sys.ini
   ```

   Note: USERNAME RPLUSER is case sensitive.

   The first line in CONFIG.WSS specifies the user name. Each station has a user name associated with it. In our example, it's RPLUSER. The remaining lines specify the location of the files listed. This ensures that each workstation accesses the desired files, such as those constituting the workstation's OS/2 environment.

6. For each station/user, create a directory for the files referenced in the CONFIG.WSS file:

   ```
   md n:\rpl\user
   md n:\rpl\user\rpluser
   ```

   If at some later time, some other application requires non-sharable rights to some files or directories, these may also be added to CONFIG.WSS. The CONFIG.WSS acts as a general-purpose redirection specification.

7. Copy the files into that directory by typing a command as follows:

   ```
   copy n:\rpl\config.sys n:\rpl\user\rpluser
   copy n:\rpl\os2\o*.ini n:\rpl\user\rpluser
   ```

8. Edit the CONFIG.SYS file in the user subdirectory. Change the SWAPPATH statement to reference the user subdirectory:

   ```
   SWAPPATH=C:\USER\RPLUSER 512
   ```

   Note: Do not include the SYS:\RPL in the SWAPPATH statement.

9. Move to the SYS:LOGIN directory

10. Use a text editor to create the BOOTCONF.SYS file in the SYS:LOGIN directory.

    The BOOTCONF.SYS file, located in the SYS:LOGIN directory, provides the file name of the boot image for each station that remote boots. For each station, a line should exist containing the LAN address (network number) and the station address (universal address). Any station not listed in the BOOTCONF.SYS file will default to the file NET$DOS.SYS.

    IMPORTANT: The boot image for OS/2 is TOKENRPL.SYS. You do not create this file; it was copied from the requester diskette. For example, station 10005A123456, requires a LAN address. Since this number comes from the server connected to the station, see the configuration information about the file server for this number. In this example, the network number bound with IPX to the TOKEN driver is 00001B00. The line in the BOOTCONF.SYS is:

```
0x00001B00,10005A123456=TOKENRPL.SYS
```

Note: If you have multiple file servers on your network, copy the remote boot image files onto each file server that may come up as the remote boot workstation's default server. If the default server is busy when a remote boot workstation boots, the next available file server becomes the default server.

If the file server already has a BOOTCONF.SYS file in SYS:LOGIN, you can't create another one. Add the new entries to the existing file through your text editor.

In BOOTCONF.SYS, include a line for each remote boot station that you have, using a entry format consisting of the following:

- Ox (the number zero plus x)
- The network address
- A comma (,)
- The node or station address
- An equal sign (=)
- The boot disk image file name (TOKENRPL.SYS).

A line for a token-ring remote boot image file looks similar to the following:

```
0x00001B00,10005a123456=TOKENRPL.SYS
```

11. At the file server console, type the following:

```
load rpl.nlm
bind rpl to token
```

6.7 NetWare Rights

1. Flag the *.SYS files in SYS:LOGIN as shareable by typing the following command:

```
FLAG *.SYS S
```

2. Use SYSCON to create a user account named RPL. Grant RF rights to the RPL user name for the SYS:RPL directory:

```
SYS:RPL (R F)
```

3. Use SYSCON to create a user ID for each user name in the CONFIG.WSS files. There is a CONFIG.WSS file for each station. For each user, grant the following rights:

```
SYS:RPL\USER\user_name (ALL RIGHTS)
SYS:RPL (R F)
SYS:RPL\COMPUTER\0005A123.456 (ALL RIGHTS)
          .
          .
          .
          etc...
```

Replace User_name with the workstation's user name specified in the CONFIG.WSS file.

6.8 Finishing Off

If the workstation on which you installed the requester has a hard drive, run RIPLON.EXE, which can be found on the OS/2 requester diskette in the RPL subdirectory. This clears the active partition on the hard drive and keeps the workstation's hard drive from booting. The hard drive may be reactivated using the FDISK program to set the active partition once again.

To ensure that everything is in the correct place, refer to Figure 21 which gives an overview of the directory tree on the file server, and the new files that have been copied or created.

```
SYS:───┬────LOGIN\
       │      ┌BOOTCONF.SYS
       │      ├TOKENRPL.SYS
       │      └TOKEN.RPL
       │
       ├────SYSTEM\
       │      ┌TOKEN.LAN
       │      └RPL.NLM
       │
       └────RPL\──────────┬MINI.IFS
                          ├*.BIO
                          ├COMPUTER\─┬0005A123.456\
                          │          │        CONFIG.WSS
                          │          └0005A123.457\
                          │                   CONFIG.WSS
                          │
                          ├MODEL\────┬8555\
                          │          │    ABIOS.SYS
                          │          └8560\
                          │               ABIOS.SYS
                          │
                          ├NETWARE\
                          │
                          ├USER\──────  RPLUSER\
                          │               ┌ CONFIG.SYS
                          │               │ OS2.INI
                          │               └ OS2SYS.INI
                          │
                          └OS2\   (Image of C:\OS2 Directory tree
                            .        withfiles from on workstation.)
                            .
                            .
```

Figure 21. The RIPL Directory Structure on a NetWare Server

6.9 Setting up Multiple OS/2 Images

A file server can only be set up to allow RIPL of one model of PS/2. This is due to the fact that the device driver "MINI.IFS" which redirects files is loaded after the ABIOS.SYS file. Because of this, the ABIOS.SYS file must be in the SYS\RPL directory on the file server. Since only one such file can reside in this subdirectory, this imposes the restriction on the number of PS/2 models which can simultaneously be RIPLed.

To set up the file server to RIPL different models of PS/2, all of the BIOS patch files must be copied to the SYS:RPL from the OS/2 installation diskettes and CSD install diskettes. The ABIOS.SYS file can then be edited for the required PS/2 model.

Refer to Appendix B, "BIOS Patch Files Used by OS/2" on page 117 for a table which shows which modules are listed in each of the ABIOS.SYS files for each IBM system.

6.10 Using Locally Administered Addresses

The OS/2 RIPL image uses two connections to the file server. The first connection always uses the universally administered address. This is the connection the RIPL process starts from. Once the RIPL process has completed, and the workstation is operating, a user can log in using the second connection.

According to Novell, locally administered addresses are supported on this second connection. It has been found that this feature depends on the versions of LAN drivers, RPL bootstrap code, and TOKENRPL.SYS modules in use. It has been shown to work.

With the revisions of code quoted in Appendix A, "Software Revision List" on page 113 however, this feature does not work.

The LAA is set by specifying a node address parameter in the link driver section within the SYS:RPL\NET.CFG. file.

```
Link Driver TOKEN
    NODE ADDRESS 400010010001
```

6.11 Bridging Considerations

There is currently a fault with the ROUTE.SYS module which prevents it from being loaded on a RIPLed workstation. Because of this, RIPL of an OS/2 V1.30.2 image cannot be carried out across an IBM source routing bridge.

6.12 Known Restrictions to OS/2 V1.30.2 RIPL

The following list gives the currently known restrictions on RIPL of OS/2 V1.30.2 from a NetWare server. This list is likely to change as more restrictions become known, or as Novell fixes some of these problems:

- Only OS/2 V1.30.2 Standard Edition with the "NSD003" or later, NetWare requester (or later) for OS/2 is supported. Nothing else works, as yet.
- All NetWare requester drivers, DLLs and programs must be installed in the default C:\NETWARE drive.
- Source routing is not supported.
- IBM Ethernet cards are not supported.
- Only one model of PS/2 may be RIPLed at a time. Multiple PS/2s can simultaneously RIPL OS/2, but they must all be of the same type. Only one ABIOS.SYS file is accessible.
- If SPX connections are required, the SPS.SYS device driver must be loaded after the NWREQ.IFS device driver.

This restriction is due to the fact that the PSX.SYS driver has similar problems as the ROUTE.SYS driver when they are used in a RIPL workstation.

6.13 Troubleshooting

Occasionally, if you have an older version of OS/2, some files (such as NETAPI.DLL) may not copy during installation. If this happens, you may need to boot up DOS and copy the file or files manually. If your workstation will only boot in OS/2, then delete the LIBPATH references to the requester in the CONFIG.SYS file, reboot the machine, and install the requester again.

You may want to copy the ATTACH, LOGIN, MAP, and SLIST utilities to your hard disk in case you attach to a server that does not have OS/2 utilities. If you want to use only one server, install the OS/2 utilities on that server and set up the preferred server option on your workstation (see page 32 of the *NetWare Requester for OS/2* manual).

There are several ways in which problems can arise when attempting to RIPL OS/2 V1.3. The first item to check is that all of the pieces used in the RIPL process are at the correct revisions to allow the operation to be carried out.

Appendix A, "Software Revision List" on page 113 gives the current known revisions of each of the components which are known to work.

Chapter 7. NetWare RIPL of OS/2 V2.0 Images

This chapter discusses how to set up a NetWare server to provide RIPL support for OS/2 V2.0.

> **Note**
>
> Because the RIPL of OS/2 v2.0 was not final at the time this book was sent to the printer, please be sure to check the readme files on the next OS/2 2.0 CSD and NetWare Requester for OS/2 NSD for new and changed information.

7.1 Setting up an OS/2 RIPL Image on a NetWare Server

The method of setting up RIPL for OS/2 V1.30.2 is quite different from that used for setting RIPL for OS/2 V2.0. The final results, in terms of file server directory structure and the files set up on the file server, are very similar. The main difference between the two procedures is that with RIPL of OS/2 V1.30.2 all of the setup is done manually. For RIPL of OS/2 V2.0, the setup procedure has been mostly automated.

7.1.1 RIPL of OS/2 V2.0 from a NetWare Server

The remote initial program load capability is designed for NetWare networks that have diskless DOS or OS/2 workstations. It also operates successfully on normal workstations which have a hard disk that is not the active partition, as set by FDISK.

In order to set up remote program load, you must first install the requester on a workstation. Each step is detailed in the following sections.

The files which comprise the OS/2 RIPL image are copied to the SYS:RPL2 directory on the selected file server, from the C:\, the C:\OS2 and the C:\NETWARE directories of the workstation used to install the image. These directories contain all of the OS/2 system files, all the requester files, and all of the remote boot files. Depending on your OS/2 configuration and the contents of your hard drive, this may be 15-30MB worth of files. Each RIPL workstation's SWAPPER.DAT files are also created on the SYS: volume.

Be sure to allow for sufficient disk space on the SYS volume for all these files. If a small local hard disk is available which is large enough for the SWAPPER.DAT file, it could be used rather than the SYS: volume on the network. This would also help to cut down network traffic.

The following list details the requirements for a token-ring workstation using RIPL:

- IBM Token-Ring PC Adapter (AT bus or Micro Channel)
- The universal address of the token-ring adapter
- IBM Token-Ring RIPL ROM.

When these requirements have been filled, the following list outlines the steps that must be followed to install RIPL. Detailed procedures for each of these are provided in the sections that follow.

1. Install OS/2 V2.0 on workstation
2. Install the NetWare Requester for OS/2 V2.0 on the workstation
3. Copy OS/2 to the file server
4. Prepare the OS/2 RIPL image on the file server.

7.2 Installing OS/2 V2.0 on a Workstation

Using the instructions supplied with OS/2 V2.0, install OS/2 on the workstation.

7.3 Installing the NetWare Requester on the Workstation

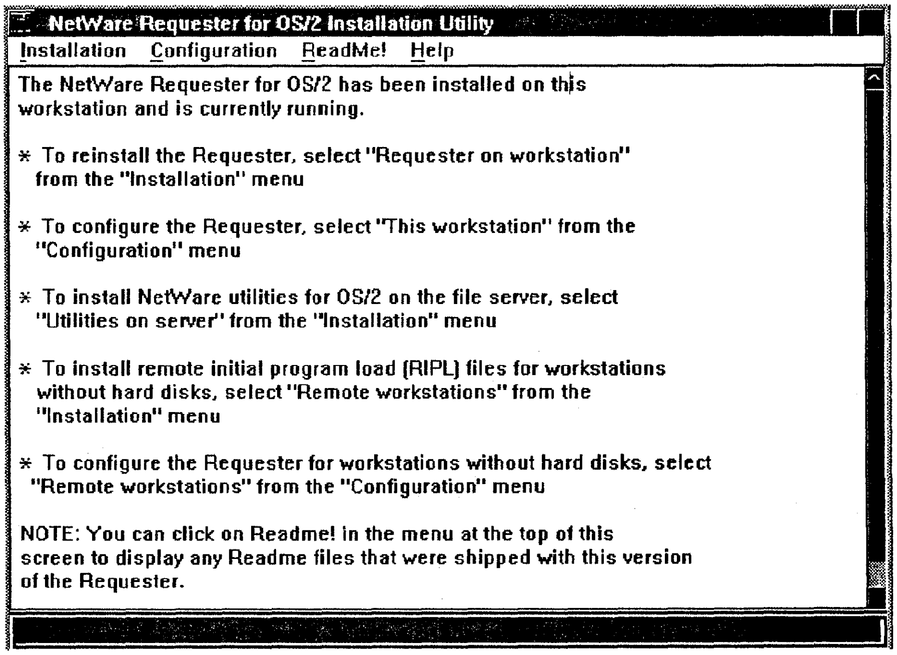
7.3.1 The OS/2 V2.0 NetWare Installation Utility

In order to install the NetWare Requester for OS/2 V2.0 on the workstation all steps in this section must be completed.

1. Boot the workstation with OS/2
2. Open an "OS/2 Window" or "OS/2 Full Screen" to bring up a command prompt
3. Insert the NetWare Requester for OS/2 V2.0 diskette in drive A
4. Type the following:

   ```
   [C:\]a:install
   ```

   The install utility will then bring up the installation main menu screen as shown in Figure 22.


NetWare Requester for OS/2 Installation Utility
Installation Configuration ReadMe! Help

The NetWare Requester for OS/2 has been installed on this workstation and is currently running.

* To reinstall the Requester, select "Requester on workstation" from the "Installation" menu

* To configure the Requester, select "This workstation" from the "Configuration" menu

* To install NetWare utilities for OS/2 on the file server, select "Utilities on server" from the "Installation" menu

* To install remote initial program load (RIPL) files for workstations without hard disks, select "Remote workstations" from the "Installation" menu

* To configure the Requester for workstations without hard disks, select "Remote workstations" from the "Configuration" menu

NOTE: You can click on Readme! in the menu at the top of this screen to display any Readme files that were shipped with this version of the Requester.

Figure 22. NetWare Requester Installation

5. From this screen, select the "Installation" item from the action bar to obtain a pull-down menu of selection options:
   - Requester on workstation

- NSD on workstation
- Remote workstations...
- NetWare for OS/2

6. The installation program will guide you through the steps required to install the requester on the workstation. Installing the requester requires three steps:

   a. Select the target and source drives for the requester files as described in 7.3.2, "Select Target and Source Drives for Requester Files" on page 96.

   b. Edit CONFIG.SYS and copy files, described in 7.3.3, "Edit CONFIG.SYS and Copy Files" on page 96.

      In the CONFIG.SYS file, you specify NIC drivers, select protocols, and construct the search path.

   c. Copy the requester files.

      All requester files are copied to the destination you specified. The files for the NetWare user tools and the RPRINTER utility are also copied to this destination.

   When the requester is installed, its core components and LAN drivers are automatically loaded in the CONFIG.SYS file. The CONFIG.SYS, LIBPATH and DPATH and PATH variables are also modified to include the directory containing requester files. You can customize the installation to load ″Non-Core Components″.

Non-Core Components of NetWare Requester

- Network Interface Card driver:

  Click on the arrow at the right of the LAN driver box and select a driver with the same name as the network interface card in your workstation. To install a third-party driver not shipped with the requester, click in the LAN driver text entry field and type the file name of the driver. You will be prompted for a location to install the driver from.

- SPX support:

  Click on this box if you want to use network printing, named pipes, or applications that use the SPX protocol.

- NetBIOS support:

  Click on this box if you want to use applications that use the NetBIOS protocol. Do not click on this box if you are already running IBM NetBIOS on this workstation.

- MVDM support:

  Click on this box if you want to access a NetWare network from a virtual DOS or Windows session. Also click on this box if you want support for the IPX protocol in a virtual DOS or Windows session.

- Named Pipes support:

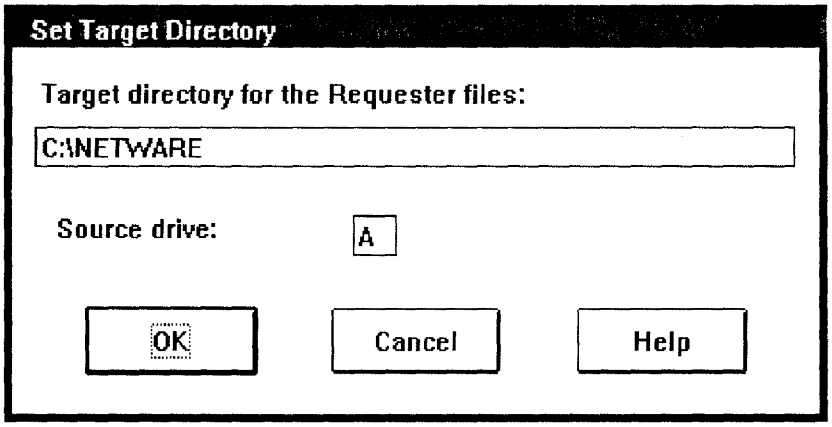
  Click on this box if you want to use applications that use the named pipes protocol. Click on the client-only box if you want your workstation to be a named pipes client. Click on server box and type a 1-16 character name if you want your workstation to be a named pipes server.

After the code has been installed, the program returns to the Install Utility main menu screen. From here you may return to the "OS/2 Window" command prompt, and then reboot the workstation.

7.3.2 Select Target and Source Drives for Requester Files

1. Select the "Installation" item from the action bar of the main installation menu to obtain a pull-down menu of selection options.
2. Select "Requester on Workstation..." from the pull-down menu.

   The installation utility displays the following screen:



Set Target Directory

Target directory for the Requester files: C:\NETWARE

Source drive: A

Figure 23. OS/2 V2.0 NetWare Requester Installation: Target Directories

3. Accept the default target directory of C:\NETWARE.

   By default, requester files are copied to the C:\NETWARE directory.

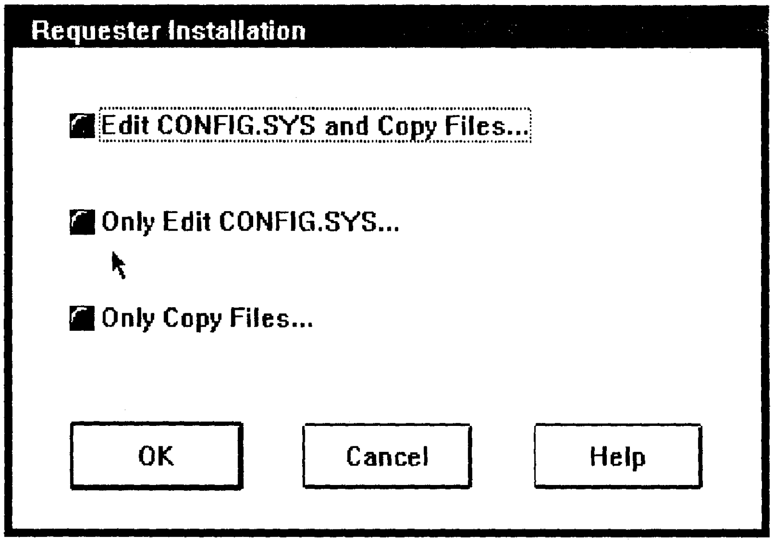
   Note: Because the remote initial program load files are being installed from this workstation, the default target directory (C:\NETWARE) for the requester files must be selected.

4. Make sure the source drive shown is the one you want to copy from. If the source drive is not correct, type a new drive letter.

   If the source you are installing from is a network drive, the directory structure of the network drive must be exactly the same as the directory structure on the requester and utilities diskettes. Specify the network drive as the source drive.

7.3.3 Edit CONFIG.SYS and Copy Files

After selecting the target and source directories, the install program will display a menu asking for the type of installation required (see Figure 24 on page 97).


Requester Installation

● Edit CONFIG.SYS and Copy Files...

● Only Edit CONFIG.SYS...

● Only Copy Files...

Figure 24. OS/2 v2.0 NetWare Requester Installation Selection

1. EDIT CONFIG.SYS AND COPY FILES

   This selection is used for a complete installation of a NetWare requester under OS/2 including all updates of the appropriate parameters in the CONFIG.SYS for example, the PATH statement, DEVICE=, etc.

2. EDIT CONFIG.SYS

   This selection is only used for updating the CONFIG.SYS file, without any files being installed on the hard disk. This is useful in the event of changing installed NetWare requester features such as MVDM Support.

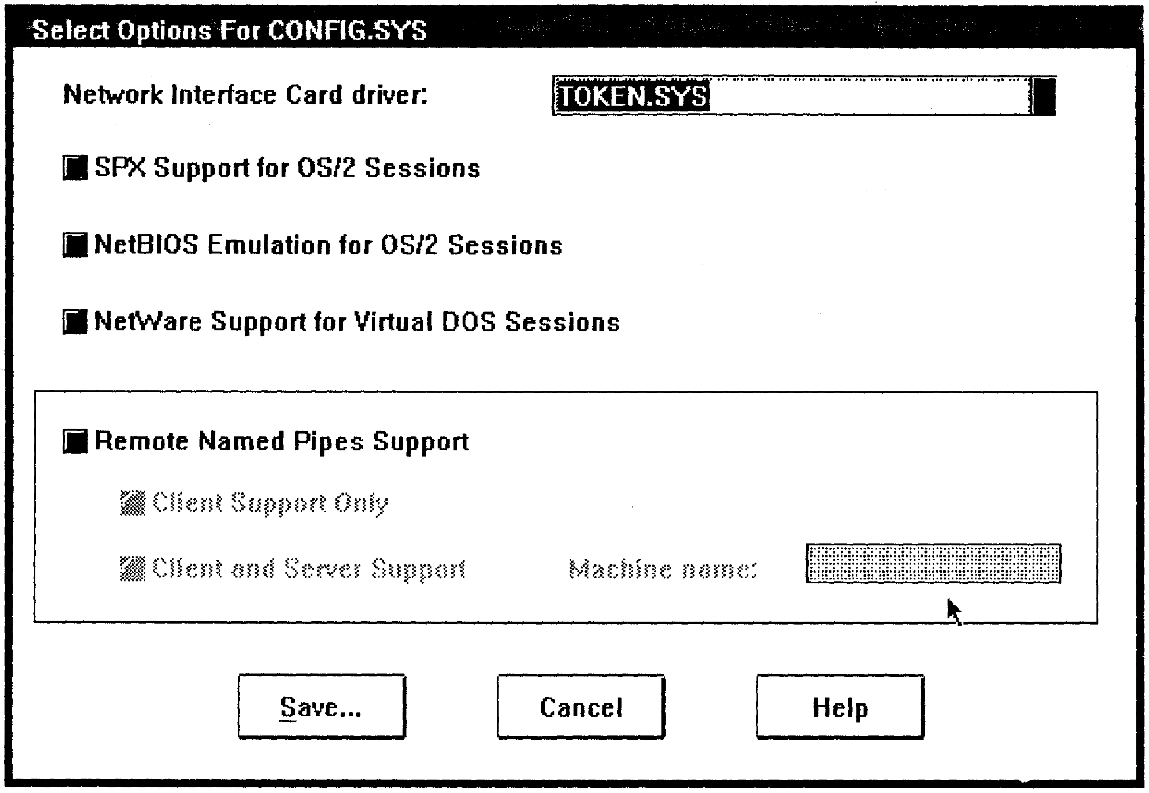
3. COPY FILES

   This selection simply copies all NetWare files from the source drive onto the target without changing any definition parameters for the requester.

7.3.3.1 Install Procedure

For a workstation with no NetWare requester previously installed the following procedure should be followed:

1. Click on the "Edit CONFIG.SYS and Copy Files..." button. This brings up the screen shown in Figure 25 on page 98.



Select Options For CONFIG.SYS

Network Interface Card driver: TOKEN.SYS

■ SPX Support for OS/2 Sessions

■ NetBIOS Emulation for OS/2 Sessions

■ NetWare Support for Virtual DOS Sessions

■ Remote Named Pipes Support

▨ Client Support Only

▨ Client and Server Support Machine name:

Figure 25. OS/2 v2.0 Select Options for CONFIG.SYS

2. Select the TOKEN.SYS LAN driver as the network interface card driver for the workstation. (Click on the arrow to the right of the LAN Driver box to access a list of driver names. See Figure 26.)

3C501.SYS
3C503.SYS
3C505.SYS
3C523.SYS
EXOS205T.SYS
EXOS215T.SYS
LANSHARE.SYS
NE2-32.SYS
NE2.SYS
NE1000.SYS
NE1500T.SYS
NE2000.SYS
NE2100.SYS
NE3200.SYS
PCN2L.SYS
TOKEN.SYS
TRXNET.SYS
TRXNET2.SYS

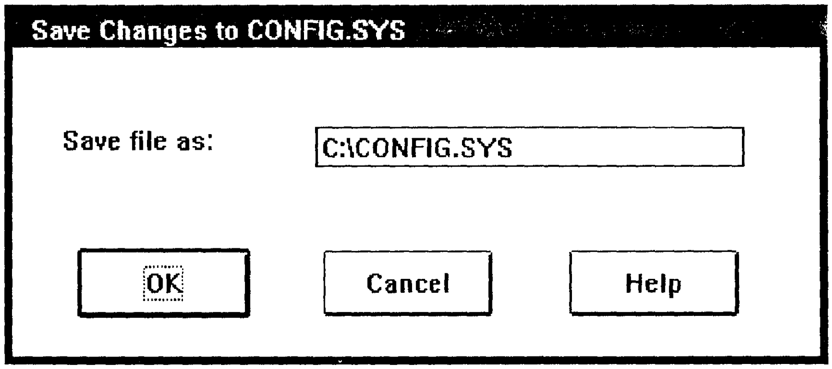
Figure 26. NetWare Requester NIC Drivers Available for OS/2 V2.0

Network interface card driver is the only option that must be specified. The driver selected depends on the hardware installed in the workstation. At present the only IBM adapter supported for OS/2 V2.0 RIPL is the IBM Token-Ring card, hence the TOKEN.SYS driver must be selected.

3. Enable or disable features associated with the requester including SPX, NetBIOS, OS/2 named pipes, and spooler function. These items in the window are optional and depend on your network configuration as well as the applications to be run at the workstation.

4. Click on "Save" to exit the Select Options for the CONFIG.SYS window.

5. When you save the CONFIG.SYS options, the program asks for a file name to save the new CONFIG.SYS (see Figure 27). Accept the default name, C:\CONFIG.SYS.



Save Changes to CONFIG.SYS

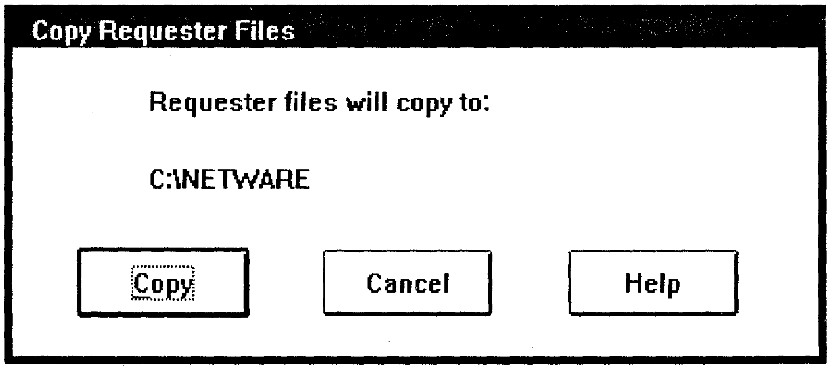
Save file as: C:\CONFIG.SYS

Figure 27. OS/2 V2.0 NetWare Requester CONFIG.SYS Name

If you select the file CONFIG.SYS, the program saves the previous CONFIG.SYS as CONFIG.BAK. If errors occur during the processing of the new CONFIG.SYS during reboot of the system, this backup copy may be use ' to bring up the system to its state prior to loading the NetWare requester.

6. The Installation utility then prompts (see Figure 28 on page 100) for confirmation that you wish to proceed and copy the requester files to the hard disk.

   Click on the "Copy" option.



Copy Requester Files

Requester files will copy to:

C:\NETWARE

Figure 28. OS/2 V2.0 NetWare Requester Target Directory Confirmation

The installation program then copies all of the files from the source to the target directory.

7. The workstation must now be rebooted. This ensures that:

   a. The NetWare requester has been properly configured

   b. Access is allowed to a NetWare server.

7.3.3.2 Installation Hints

1. Install NetWare Requester for OS/2.
2. Check that the following changes have been made to your CONFIG.SYS file:
   - The LIBPATH statement points to the directory where the NetWare requester has been installed (Default=C:\NETWARE).
   - The PATH statement points to the L:\OS2 subdirectory. The L: drive is the default drive where the NetWare OS/2 utilities are installed on the NetWare server.

   The following is a modified and annotated CONFIG.SYS file used for a NetWare requester under OS/2 V2.0.

```
LIBPATH=.;C:\OS2\DLL;C:\OS2\MDOS;C:\;C:\OS2\APPS\DLL;C:\NETWARE;

SET PATH=C:\OS2;C:\OS2\SYSTEM;C:\OS2\MDOS\WINOS2;C:\OS2\INSTALL;
 :\;C:\OS2\MDOS;C:\OS2\APPS;L:\OS2;C:\NETWARE;
                                        .
                                        .
REM --- NetWare Requester statements BEGIN ---

DEVICE=C:\NETWARE\LSL.SYS
```

The LSL driver lays the foundation for the other ODI drivers and must be loaded before any other NetWare driver.

```
RUN=C:\NETWARE\DDAEMON.EXE
DEVICE=C:\NETWARE\TOKEN.SYS
```

The TOKEN.SYS is the LAN device driver and must match the installed LAN adapter.

```
DEVICE=C:\NETWARE\ROUTE.SYS
```

ROUTE.SYS is the driver used in conjunction with the token-ring driver to allow access to servers via a bridge.

```
DEVICE=C:\NETWARE\IPX.SYS
```

This IPX driver must be loaded right after the ODI LAN driver.

```
DEVICE=C:\NETWARE\SPX.SYS
```

This SPX.SYS driver is optional, but must be loaded if you want to use LAN printing facilities and named pipes.

```
RUN=C:\NETWARE\SPDAEMON.EXE
rem DEVICE=C:\NETWARE\NMPIPE.SYS
```

This is the named pipe driver for client only. It must be loaded directly after the SPX driver.

```
rem DEVICE=C:\NETWARE\NPSERVER.SYS
```

This is the driver for named pipe servers. It is loaded together with the NMPIPE.SYS driver.

```
rem RUN=C:\NETWARE\NPDAEMON.EXE NP_COMPUTERNAME
```

The NPDAEMON.EXE must be run for the configuration of named pipes. If it is configured as a named pipes server, specify a server name.

```
DEVICE=C:\NETWARE\NWREQ.SYS
```

This NWREQ.SYS is the NetWare requester driver and must be loaded after IPX, SPX and named pipes.

```
IFS=C:\NETWARE\NWIFS.IFS
```

NWIFS.IFS is the installable file system for NetWare and must be loaded after the NWREQ driver.

```
RUN=C:\NETWARE\NWDAEMON.EXE
rem DEVICE=C:\NETWARE\NETBIOS.SYS
```

This is the NetBIOS driver for NetWare. Do not load this driver if you are running in an Extended Services or OS/2 LAN Server environment.

```
rem RUN=C:\NETWARE\NBDAEMON.EXE
rem DEVICE=C:\NETWARE\VIPX.SYS
```

This VIPX.SYS driver is optional and must be loaded if the DOS shell is required in a DOS session.

```
RUN=C:\NETWARE\NWSPOOL.EXE
```

This driver is used for printing to a NetWare printer queue.

```
REM --- NetWare Requester statements END ---
```

3. A NET.CFG file and a PROTOCOL.INI file have not been defined. There is no need for a NET.CFG and a PROTOCOL.INI file in an OS/2 2.0 base environment.

7.4 Installing the OS/2 Image on the Server

This section describes how to set up the NetWare file server for OS/2 V2.0 RIPL.

As a prerequisite, a workstation must already have been set up with both OS/2 V2.0 base code installed and the NetWare Requester for OS/2 installed on top of that. The workstation must also have been rebooted to allow it to log into the file server on which the RIPL image has to be installed.

When installing support for remote workstations on a NetWare file server, the install utility on the NetWare requester diskette (in drive A:) must be used if support for all PS/2 models is required. If PS/2 model support is not required, the install utility available from within the NetWare folder (Figure 29) can also be used. The following section assumes that support for all PS/2 models is required.

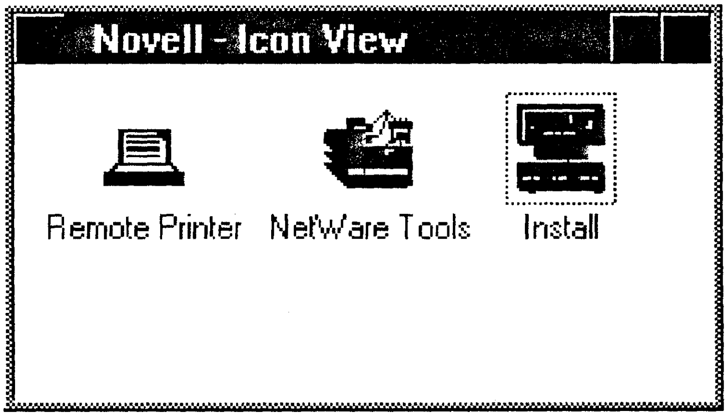


Figure 29. NetWare Folder Contents

7.4.1 Install Procedure

To install the OS/2 image on the server:

1. Open an OS/2 Window, and at the command prompt type:

   ```
   [C:\]a:install
   ```

   The install utility will then bring up the installation main menu screen shown in Figure 22 on page 94.

2. From this, select the "Installation" item from the action bar to obtain the menu of selection options:

   - Requester on workstation...

- NSD on workstation...
- Remote workstations...
- NetWare for OS/2

3. Select ″Remote workstations...″.

   This brings up a screen shown in Figure 30.

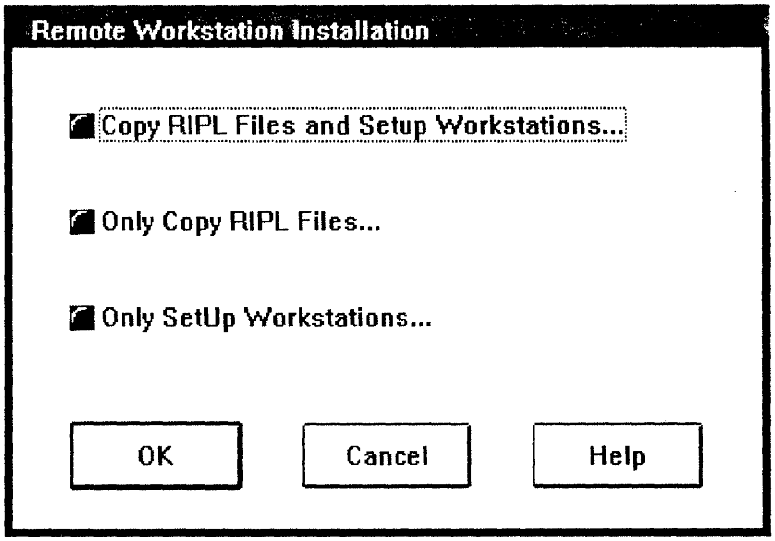

Remote Workstation Installation
Copy RIPL Files and Setup Workstations...
Only Copy RIPL Files...
Only SetUp Workstations...
OK
Cancel
Help

Figure 30. Remote Workstation Installation

4. Select the ″Copy RIPL Files and Setup Workstation...″ option.

   The other two options are:

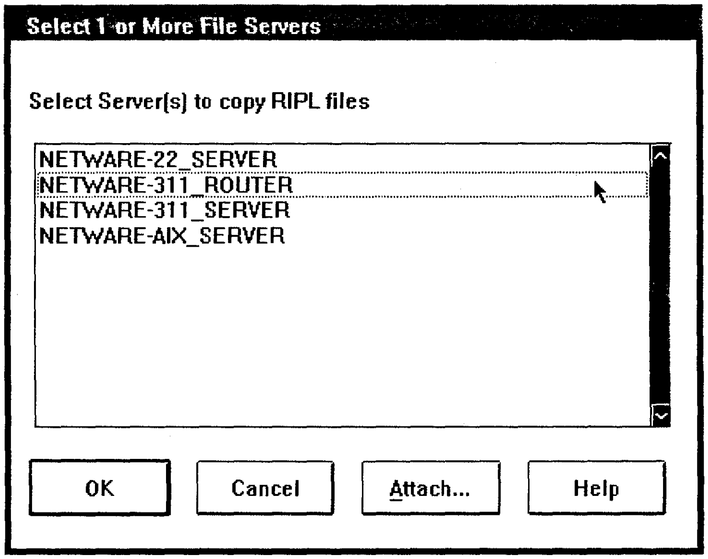
   - Only Copy RIPL Files...

     This is for upgrading the image on the server.

   - Only Setup Workstation...

     This is for adding new nodes which are to be RIPLed.

   The ″Copy RIPL Files and Setup Workstation...″ option brings up a screen (Figure 31 on page 104) from which one or more file servers may be selected.



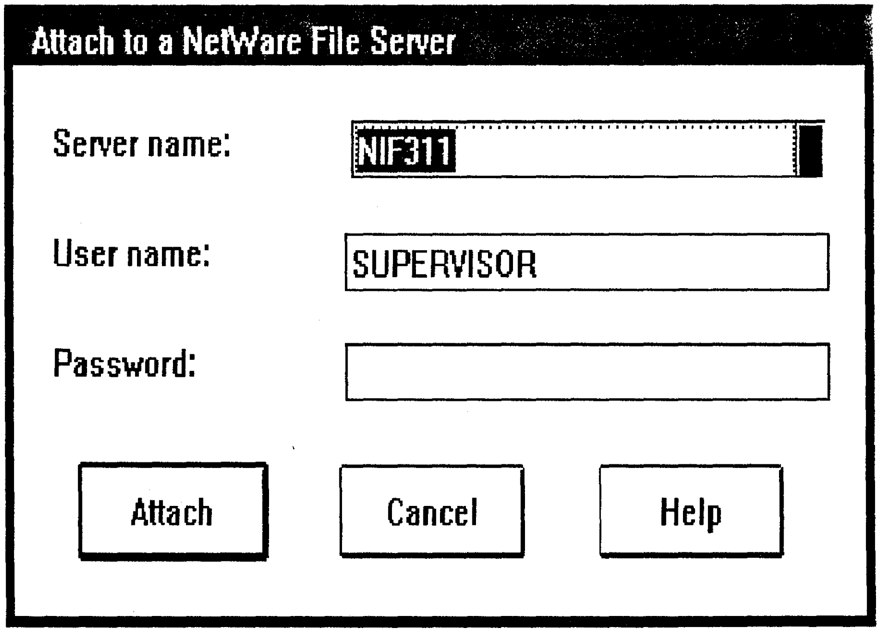
Select 1 or More File Servers

Select Server[s] to copy RIPL files

NETWARE-22_SERVER
NETWARE-311_ROUTER
NETWARE-311_SERVER
NETWARE-AIX_SERVER

Figure 31. Available File Servers

Each file server selected will have the OS/2 V2.0 image installed on it in the SYS:RPL2 directory. If the desired file server is not shown, it is possible to attach to it from this window. To do this, double click on the "Attach" button and the screen illustrated in Figure 32 is shown.



Attach to a NetWare File Server

Server name: NIF311

User name: SUPERVISOR

Password:

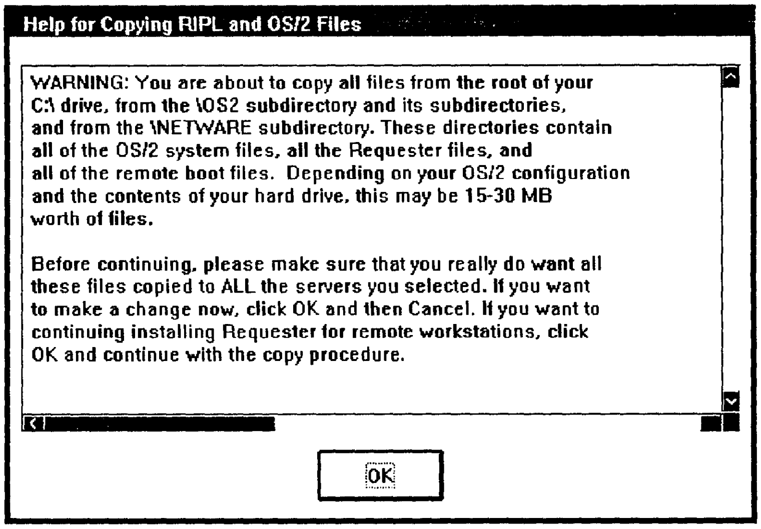
Figure 32. Attach to a New File Server

If you do not know the exact name of the file server, the pull-down button may be used to provide a list of all file servers on your network. From this you may select the required server by double clicking on its name, or by highlighting its name and pressing Enter. The program automatically fills in the user's name in Figure 32 as "Supervisor". It is best to leave it as this, because of the rights required to perform the install, and also to mark the owner of the files within the image as the supervisor.

In Figure 31, if more than one file server has to have the OS/2 image installed on it, then the space bar or mouse right button may be used to toggle which servers are selected.

5. After selecting the required file server(s), click on the "OK" button to continue.

6. The Installation program displays a conformation screen (Figure 33) from which it is possible to back out of the procedure.



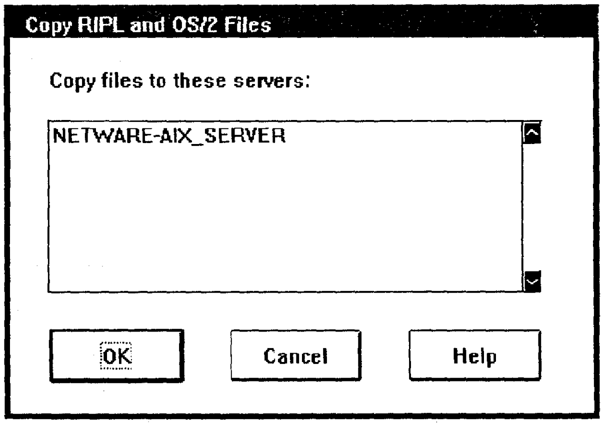
Help for Copying RIPL and OS/2 Files

WARNING: You are about to copy all files from the root of your C:\ drive, from the \OS2 subdirectory and its subdirectories, and from the \NETWARE subdirectory. These directories contain all of the OS/2 system files, all the Requester files, and all of the remote boot files. Depending on your OS/2 configuration and the contents of your hard drive, this may be 15-30 MB worth of files.

Before continuing, please make sure that you really do want all these files copied to ALL the servers you selected. If you want to make a change now, click OK and then Cancel. If you want to continuing installing Requester for remote workstations, click OK and continue with the copy procedure.

Figure 33. RPL Install - First Confirmation

It then verifies the servers that have been selected for the installation to take place (Figure 34).



Copy RIPL and OS/2 Files

Copy files to these servers:

NETWARE-AIX_SERVER

Figure 34. RPL Install - File Server Confirmation

7. Select "OK" to start the actual installation of the files on the file server.

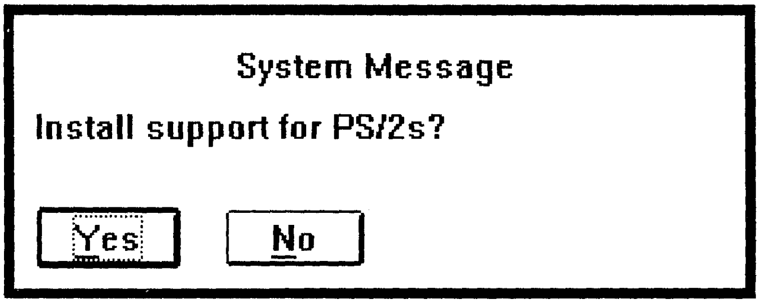
   The installation utility now creates the SYS:RPL2 directory on the selected file server then copies all of the files from the directories:

   C:\
   C:\OS2

```
C:\NETWATE
```

to the SYS:RPL2 directories on the selected file server. This can take some time.

8. The installation procedure now asks if PS/2 model support is required (see Figure 35). If RIPL of more than one type of PS/2 is required, PS/2 support must be installed.

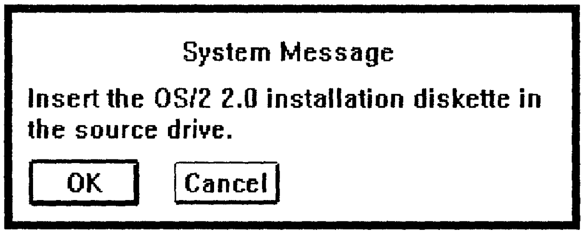


System Message

Install support for PS/2s?

Figure 35. Install PS/2 Support

If PS/2 model support is required, the OS/2 V2.0 Install diskette must be placed in the drive. This is the drive that the installation utility was started from. This is the reason why the install utility must be started from the A: drive.



System Message

Insert the OS/2 2.0 installation diskette in the source drive.

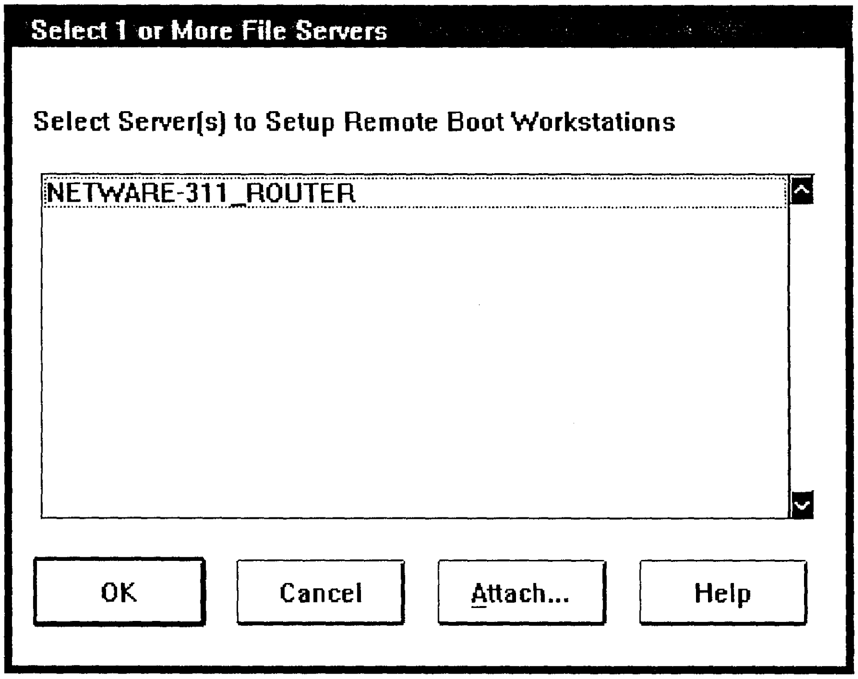
Figure 36. Insert OS/2 Install Diskette

The BIOS patch files for all PS/2 models will be copied from the OS/2 V2.0 Install diskette to the SYS:RPL2\OS2 subdirectory.

7.4.1.1 Adding Remote Boot Workstation

Before a workstation can remote boot OS/2 V2.0 from a NetWare file server, the server must be made aware of the node address of the workstation, the NIC it will use to attach to the file server and the user name that will be used to log in at the remote workstation.

The installation utility displays the list of currently attached file servers (Figure 37 on page 107) from which one or more may be selected.



Select 1 or More File Servers

Select Server(s) to Setup Remote Boot Workstations

NETWARE-311_ROUTER

Figure 37. Select Servers to Set Up for Remote Boot of Workstations

Each file server selected will have the remote boot facility installed on it. If the desired file server is not shown, it is possible to attach to it from this window. To do this, double click on the "Attach" button and the screen shown in -- Fig 'BNC5D16' unknown -- is shown.

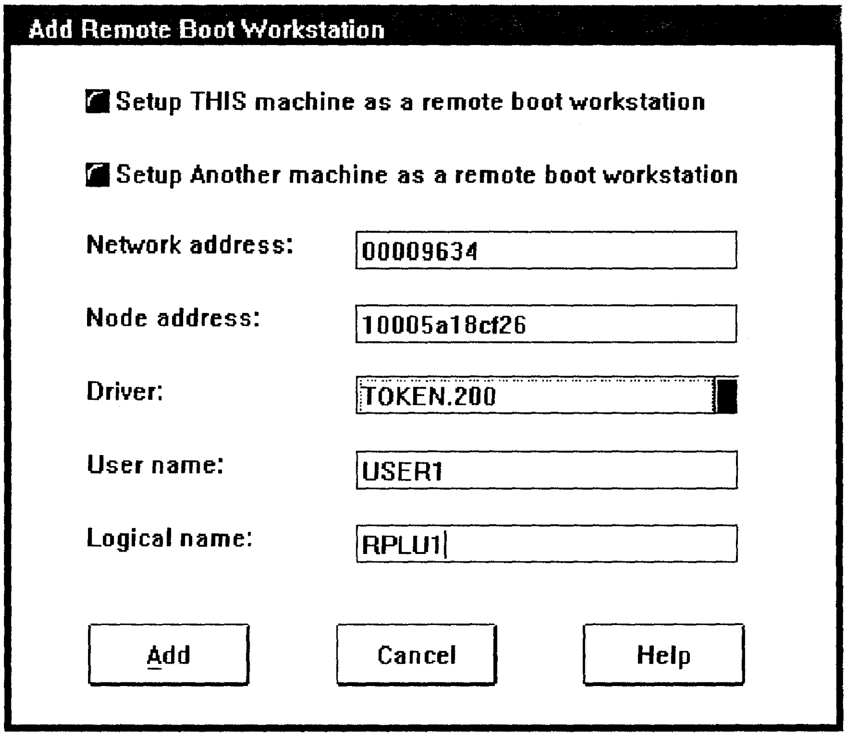
If you do not know the exact name of the file server, the pulldown button may be used to provide a list of all the file servers on your network. From this you may select the required server by double clicking on its name, or by highlighting its name and pressing Enter. The program automatically fills in the user's name in -- Fig 'BNC5D16' unknown -- as "Supervisor". It is best to leave it as this, because of the rights required to perform the install, and also to mark the owner of the files on the file server as the supervisor.

In -- Fig 'BNC5D26' unknown --, if more than one file server has to have the remote boot facility installed on it, then the space bar or mouse right button may be used to toggle which servers are selected.

Select the required file server(s) and click on the "OK" button to continue.

The install utility displays the screen shown in Figure 38 on page 108 requesting the information required to make the file server(s) aware of the workstation.

Note: These details are only valid for OS/2 V2.0.



■ Setup THIS machine as a remote boot workstation

■ Setup Another machine as a remote boot workstation

Network address: 00009634

Node address: 10005a18cf26

Driver: TOKEN.200

User name: USER1

Logical name: RPLU1

Figure 38. Add Remote Boot Workstation

For each workstation which is to boot remotely:

1. If the present workstation is to be the RPL workstation, click on "This Workstation".
2. If the present workstation is not the one being set up to boot remotely, click on "Other Workstation".
3. Check the network address to make sure it is correct. If it is not correct, enter the network address of the RPL workstation.
4. Type in the node address of the RPL workstation.
5. Click the arrow to the right of the driver field, and select the RIPL driver which matches the NIC installed in the RPL workstation. The available RIPL drivers are shown in Figure 39.

```
NE2.200
NE1000.200
NE2000.200
PCN2L.200
TOKEN.200
```

Figure 39. NetWare OS/2 V2.0 RPL Drivers

6. Type the user name of the person using the RPL workstation. (After exiting the installation utility, make sure the users specified here have accounts on the file server targeted for remote boot installation. Also, grant read and filescan rights in the SYS:RPL2 directory to these users and to the RPL user name.)
7. Optionally, type an alphanumeric logical name.

A logical name is necessary if you have more than one workstation logged in under the same user name.

8. Click on "Add".

To add another workstation, repeat steps 1-8.

7.4.2 The OS/2 V2.0 RPL2 Image on the File Server

Each time a RPL workstation is added to the file server, the installation program performs the following tasks:

1. It creates the SYS:RPL2\COMPUTER directory, unless it already exists
2. It creates a SYS:RPL2\COMPUTER\node_id directory on the file server

   The node ID of the directory created under the SYS:RPL2\COMPUTER\ directory directly corresponds to the node address specified on the screen shown in Figure 38 on page 108. If the node address is 10005A123456, the directory created would be 0005A123.456.

3. It creates an ASCII text file, CONFIG.WSS in the SYS:\RPL2\COMPUTER\node_id directory. This file is used as a redirection file and contains the specific directories and files which OS/2 requires non-sharable access to.

   Figure 40 shows an example of CONFIG.WSS file. Paths are enclosed in quotation marks to allow long file name paths.

```
USERNAME rpluser
DIRECTORIES
"C:\DESKTOP" "C:\USER\rpluser\DESKTOP"
"C:\SPOOL" "C:\USER\rpluser\SPOOL"
FILES
"C:\CONFIG.SYS" "C:\USER\rpluser\CONFIG.SYS"
"C:\OS2\OS2.INI" "C:\USER\rpluser\OS2.INI"
"C:\OS2\OS2SYS.INI" "C:\USER\rpluser\OS2SYS.INI"
```

Figure 40. Example of CONFIG.WSS

If at some later stage, some other application requires nonsharable rights to some files or directories, these may also be added to CONFIG.WSS. The CONFIG.WSS acts as a general-purpose redirection specification.

As can be seen the file has three sections. The restrictions which must be observed when altering this file are:

- Keywords are always in capitals
- Protected mode drivers cannot be redirected from the NetWare
- New paths must include quotation marks directory.

7.5 NetWare Rights

1. Use SYSCON to create a user account named RPL. Grant RF rights to the RPL user name for the SYS:RPL directory:

   ```
   SYS:RPL2 (R F)
   ```

2. Use SYSCON to create a user ID for each user name in the CONFIG.WSS files. There is a CONFIG.WSS file for each station. For each user, grant the following rights:

   ```
   SYS:RPL2\USER\user_name (ALL RIGHTS)
   SYS:RPL2 (R F)
   SYS:RPL2\COMPUTER\0005A123.456 (ALL RIGHTS)  etc.
   ```

   Replace user_name with the workstation's user name specified in the CONFIG.WSS file.

7.6 Finishing Off

If the workstation on which you installed the requester has a hard drive, run RIPLON.EXE, which can be found on the OS/2 requester diskette in the RPL subdirectory. This clears the active partition on the hard drive and keeps the workstation's hard drive from booting. The hard drive may be reactivated using the FDISK program to set the active partition back.

To help check that everything is in the correct place, refer to Figure 41 which gives an overview of the directory structure on the file server, and the new files that have been copied or created.

```
SYS: ──┬───LOGIN\
       │   ┌ BOOTCONF.SYS
       │   ├ TOKEN.200
       │   └ TOKEN.RPL
       │
       ├───SYSTEM\
       │   ┌ TOKEN.LAN
       │   └ RPL.NLM
       │
       ├───RPL2\───────┬MINI.IFS
                       ├COMPUTER\┬─0005A123.456\
                       │         │     CONFIG.WSS
                       │         └─0005A123.457\
                       │               CONFIG.WSS
                       │
                       ├NETWARE\
                       │
                       ├USER\──────RPLUSER\────────┬OS!2_2.0_D\
                       │              ┌EPW.INI     └SPOOL\
                       │              │OS2.INI
                       │              │OS2SYS.INI
                       │              │VPD.INI
                       │              └CONFIG.SYS
                       │
                       └OS2\   (Image of C:\OS2 Directory tree
                           .       with files from workstation.)
                           .
                           .
```

Figure 41. The RIPL Directory Structure on a NetWare Server

7.7 File Server Connections

The OS/2 RIPL image uses two connections to the file server. The first connection always uses the universal adapter address. This is the connection the RIPL process starts from. Once the RIPL process has completed, and the workstation is operating, a user can log in using the second connection.

According to Novell, locally administered addresses are supported on this second connection. This depends on the versions of LAN drivers, RPL bootstrap code, and TOKEN.200 modules in use. It has been shown to work.

The LAA is set by specifying a node address parameter in the link driver section within the aliased SYS:RPL2\NET.CFG file.

```
Link Driver TOKEN
    NODE ADDRESS 400010010001
```

7.8 Bridging Considerations

It is not yet known if OS/2 V2.0 can successfully RIPL across a source routing bridge.

Appendix A. Software Revision List

This Appendix lists all of the software used while testing the RIPL functions described in this manual. For the NetWare products, the general revision has been given, as well as all file date/size information of updated files. These files were obtained either directly or indirectly from Novell, and have been placed on various tools disks (depending on whether the files are general reiease, or still in field test).

A.1 IBM LAN Servers

Operating System: IBM OS/2 V2.0
IBM LAN Server V2.0

A.2 NetWare 3.11 File Server

Operating System: NetWare V3.11

LAN Drivers and NLMs

```
RPL      NLM  4953 03-06-92 10:51a | Novell V3.x  FT
IBMETHR  LAN 15890 06-28-91  4:40p | W/D    V2.06 (910628)
                                   |  from IBM Ethernet Adapter/A Options V1.01
TOKEN    LAN 10324 09-09-91 11:30a | Novell V3.16 (910909)
TOKENDMA LAN  9170 09-16-91 10:12a |        V3.11 (910916)
```

A.3 NetWare 2.2 File Servers

Operating System: NetWare V3.11

LAN Drivers

```
IBM Token-Ring w/AT 2 V2.63 (910731)
IBM Personal System/2 Adapter for Ethernet V1.12 (910426)
```

Value Added Processes (VAPs)

```
ROUTE    VP0      3896  05-01-91  1:53p   |   Novell V1.02 (910503)
RPL      VP1      1856  05-03-91  2:31p   |   Novell V1.01 (910503)
```

RPL.Vp1 Configuration Utility

```
RPCONFIG COM      2726   6-08-90  5:15p   |   Novell V1.00 (900608)
```

Note: The External Routers also used the same LAN drivers and VAPs as the NetWare 2.2 File Server.

A.4 NetWare Lite File Server

Operating System: IBM PC-DOS V5.0 with UR36603 applied

LAN Drivers for NetWare Lite Server

```
IBMODISH COM     17023  06-28-91  4:53p   |   W/D    V.103 (910628)
IPXODI   COM     20903  11-20-91  4:57p   |   Novell V3.10 (911120)
LSL      COM      7648  11-20-91  4:57p   |   Novell V3.10 (911120)
NETX     COM     51201  07-31-91 10:47a   |   Novell V3.10 (910731)
ROUTE    COM      4450  05-01-91  8:28a   |   Novell V3.10 (910501)
TOKEN    COM     15663  06-14-91  4:10p   |   Novell V3.10 (910614)
```

RIPL Drivers for NetWare Lite RPL-Server

```
RPL      COM      5744  11-27-91  2:29p   |   Novell V1.00 (911127)
BOOTNCPL COM      5136  10-08-91  3:48p   |   Novell V1.00 (911008)
```

A.5 DOS RIPL Workstation Clients

Operating System: IBM PC-DOS V5.0 with UR36603 applied

```
IBMBIO   COM    33446 11-29-91  12:00p | DOS 5.0 with UR36603
IBMDOS   COM    37378 11-29-91  12:00p | DOS 5.0 with UR36603
COMMAND  COM    48006 11-29-91  12:00p | DOS 5.0 with UR36603
```

LAN Drivers for DOS LAN Requester

```
DXMA0MOD SYS      4736  01-23-92  8:44a | LAN Support Program V1.25
DXMC0MOD SYS     28800  01-23-92  8:43a | LAN Support Program V1.25
DXME0MOD SYS     36736  01-23-92  8:45a | LAN Support Program V1.25
DXMT0MOD SYS     29696  01-23-92  8:43a | LAN Support Program V1.25
MACETH   DOS     16624  07-17-91 12:00p | NDIS Ethernet Driver V1.16 (910625)
                                        |   from IBM Ethernet
                                        |   Adapter/A Options V1.01
NETBIND  EXE     15639  01-23-92  8:46a | LAN Support Program V1.25
PROTMAN  DOS     10657  01-23-92  8:46a | LAN Support Program V1.25
PRO      MSG      1392   1-23-92  8:46a | LAN Support Program V1.25
PROTOCOL INI      5120  03-01-91 10:00a | ASCII text file - USER Modifiable
                                        |
NET      COM     13568  03-14-92 11:04a | DLR: IBM LAN OS/2 Server V2.0
```

LAN Drivers for NetWare Requester

```
IBMODISH COM     17023  06-28-91  4:53p | W/D    V1.03 (910628)
IPX_ETH  COM     27843  03-27-92 12:40p | IPX: V3.10 (911121),  ETH: V1.12 (910426)
IPX_LSP  COM     24520  03-02-92  9:10a | IPX: V3.10 (911121),  LSP: V2.62 (910415)
IPX_TKN  COM     25342  12-13-91  3:41p | IPX: V3.10 (911121),  TKN: V2.63 (910823)
IPXODI   COM     20903  11-20-91  4:57p | Novell V3.10 (911120)
LANSUP   COM     14094  04-30-91 10:32a | Novell V3.10 (910430)
LSL      COM      7648  11-20-91  4:57p | Novell V3.10 (911120)
NETX     COM     51201  07-31-91 10:47a | Novell V3.10 (910731)
ROUTE    COM      4450  05-01-91  8:28a | Novell V3.10 (910501)
TOKEN    COM     15663  06-14-91  4:10p | Novell V3.10 (910614)
```

NetWare RPL BootStrap Code Files:

```
ETHER    RPL     15772  12-05-91  9:25a | Novell V3.10 (911205)
PCN2L    RPL     10107  12-05-91  9:25a | Novell V3.10 (911205)
TOKEN    RPL     12143  03-27-92 12:35p | Novell V4.10 (920327)
```

A.6 OS/2 V1.3 RIPL Workstation Clients

IBM OS/2 V.1.30.2 (equivalent to IBM OS/2 V1.3 with CSD 5050 applied)

NetWare Requester for OS/2 V1.3 with NSD004 applied

RPL Bootstrap Image

```
TOKENRPL SYS     16661  04-01-92  2:33p | Novell Field Test Module
```

A.7 OS/2 V2.0 RIPL Workstation Clients

IBM OS/2 V2.0 (920401)

Pre-Release NetWare Requester for OS/2 V2.0 (Level 006)

Appendix B. BIOS Patch Files Used by OS/2

This chapter provides the relationship between the various PS/2 models and the *.BIO files that are supplied with OS/2 1.2 and OS/2 1.3.

It is possible to determine which *.BIO files should be installed on a particular machine by use of the reference diskette. The filename is composed of three two-digit hexadecimal numbers corresponding to model, submodel, and ROM revision of the machine it should be applied to. For example, if a machine has a model byte of F8h, submodel of 04h, and ROM revision 02h, A:\F80402.BIO should be installed.

ABIOS.SYS is a text file that has the names of all *.BIO patch files installed.

The model, submodel and ROM revision level of a system can be found by running the latest level of the hardware reference diskette on that system and selecting the option "Display Revision Levels".

Machine Type	Model Byte	Submodel Byte	Revision Level	OS/2 1.2 BIO File	OS/2 1.3 BIO File
PS/2 Model 30-286	FC	09			
PS/2 Model 35	F8	19			
PS/2 Model 40	F8	19			
PS/2 Model L40	F8	23			
PS/2 Model 50 (021/R21)	FC	04	00	FC0400.BIO	FC0400.BIO
PS/2 Model 50Z(031/061)	FC	04	03	FC0403.BIO	FC0403.BIO
PS/2 Model 55	F8	0C	00	F80C00.BIO	F80C00.BIO
PS/2 Model 55	F8	0C	01		
PS/2 Model 55LS	F8	1E	00		
PS/2 Model 57	F8	26	00		
PS/2 Model 60	FC	05	00	FC0500.BIO	FC0500.BIO
PS/2 Model 65	F8	1C	00		
PS/2 Model 70 (061/121)	F8	04	02	F80402.BIO	F80402.BIO
PS/2 Model 70 (061/121)	F8	04	03	F80403.BIO	F80403.BIO
PS/2 Model 70 (061/121)	F8	04	04	F80404.BIO	F80404.BIO
PS/2 Model 70 (E61/F61)	F8	09	02	F80902.BIO	F80902.BIO
PS/2 Model 70 (E61/F61)	F8	09	03	F80903.BIO	F80903.BIO
PS/2 Model 70 (E61/F61)	F8	09	04	F80904.BIO	F80904.BIO
PS/2 Model 70 (A21/A61)	F8	0D	00	F80D00.BIO	F80D00.BIO
PS/2 Model 70 (A21/A61)	F8	0D	01		F80D01.BIO*
PS/2 Model 70 (B21/B61)	F8	1B	00		F81B00.BIO*
PS/2 Model 70 (R21/R61)	F8	1B	00		F81B00.BIO*
PS/2 Model P70	F8	0B	00	F80B00.BIO	F80B00.BIO
PS/2 Model P70	F8	0B	02	F80B02.BIO	F80B02.BIO
PS/2 Model P70	F8	50	01	F85001.BIO	F85001.BIO
PS/2 Model P75(401)	F8	52			
PS/2 Model 80 (041/071)	F8	00	00	F80000.BIO	F80000.BIO
PS/2 Model 80 (111/311)	F8	01	00	F80100.BIO	F80100.BIO
PS/2 Model 80 (121/321)	F8	01	00	F80100.BIO	F80100.BIO
PS/2 Model 80 (A21/A31)	F8	80	00	F88000.BIO	F88000.BIO
PS/2 Model 90 (xJ5/xJ9)	F8	11	00		
PS/2 Model 90 (xJ5/xJ9)	F8	11	01		
PS/2 Model 90 (xKD/AK9)	F8	13	00		
PS/2 Model 90 (xKD/AK9)	F8	13	01		
PS/2 Model 95 (xJ9/xJD)	F8	14	00		
PS/2 Model 95 (xJ9/xJD)	F8	14	01		
PS/2 Model 95 (xKD/AK9)	F8	16	00		
PS/2 Model 95 (xKD/AK9)	F8	16	01		

Figure 42. Model, Submodel, and BIOS Revision Levels of PS/2 Systems

Figure 42 shows which PS/2 models require .BIO files and which file should be used with a particular model of system. If a Japanese PS/55 system is being used then the hardware to *.BIO file relationship is as shown in Figure 43 on page 119.

Machine Type	Model Byte	Submodel Byte	Revision Level	OS/2 1.2 BIO File	OS/2 1.3 BIO File
PS/55 Model 71 (S)	F8	02	00	F80200.BIO	F80200.BIO
PS/55 Model 71 (T)	F8	06	00	F80600.BIO	F80600.BIO
PS/55 Model 02 (T0A/B)	F8	07	00	F80700.BIO	F80700.BIO
PS/55 Model 51 (T0A/B)	F8	07	00	F80700.BIO	F80700.BIO
PS/55 Model 02 (T09)	F8	07	01	F80701.BIO	F80701.BIO
PS/55 Model 51 (T09)	F8	07	01	F80701.BIO	F80701.BIO
PS/55 Model 51 (T0A/B)	F8	07	02	F80702.BIO	F80702.BIO
PS/55 Model 51 (T09)	F8	07	03	F80703.BIO	F80703.BIO
PS/55 Model 02 (Txx)	F8	07	04	F80704.BIO	F80704.BIO
PS/55 Model 02 (S01)	F8	0A	00	F80A00.BIO	F80A00.BIO
PS/55 Model 51 (S09)	F8	0A	00	F80A00.BIO	F80A00.BIO
PS/55 Model 51 (S09)	F8	0A	01	F80A01.BIO	F80A01.BIO
PS/55 Model 02 (Sxx)	F8	0A	02	F80A02.BIO	F80A02.BIO
PS/55 Model	F8	10	00	F81000.BIO	F81000.BIO

Figure 43. Model, Submodel, and BIOS Revision Levels of PS/55 Systems

The file 000000.BIO is an unconditional BIOS patch file. In other words, the OS/2 installation process will install this file regardless of the model bytes returned when the system is queried.

The files marked with an asterisk (*), that is F80D01.BIO and F81B00.BIO, and file 000000.BIO have been introduced to OS/2 V1.3 since the refresh level was released. The original ship version of OS/2 V1.3 did not include these modules.

With the release of CSD5050, there are some new .BIO files. These are:

Table 16. BIOS Patch Files Introduced by CSD5050

W060100.BIO	Serial Port Patch File Installed on all machines, but only loads itself on machines with DMA serial ports such as Models 56SX, 57SX, 90 and 95.
W050000.BIO	Parallel Patch Files - Only required for Model 95
W050100.BIO	
W050101.BIO	Parallel Patch File - Not yet known to which models this applies
W020100.BIO	Unknown at present
W020101.BIO	
W0F0000.BIO	

If a user were to install the OS/2 EE 1.3 refresh level code onto a PS/2 Model 60, the root directory of drive C would contain the files 000000.BIO, FC0500.BIO and W060100.BIO. The ABIOS.SYS file for that system would contain the references to these files:

```
000000.BIO
W060100.BIO
FC0500.BIO
```

Figure 44. ABIOS.SYS File of a PS/2 Model 60 Running OS/2 V1.3

Appendix C. Abbreviations

ABBREVIATION	MEANING
APA	all points addressable
BIOS	Basic Input/Output Services
DOSGEN	DOS Remote Image File GENeration
FAT	File Allocation Table
FIT	File Index Table
IPL	Initial Program Load
ITSC	International Technical Support Center
LAA	Locally Administered Address
LAN	Local Area Network
MLID	Multiple Link Interface Device Driver
NLM	NetWare Loadable Module
NIC	Network Interface Card
POST	Power-On-Self-Test
RAM	Random Access Memory
RIPL	Remote Initial Program Load
ROM	Read Only Memory
RPL	Remote Program Load
TSR	Terminate and Stay Resident
UAA	Universal Adapter Address
VAP	Value Added Process

Glossary

A

Abend. Abnormal termination of an operation due to a detected fault.

Access Control List (ACL). In computer security, a list associated with an object that identifies all the subjects, that can access the object and their access rights.

Acces Control Profile. A list of the access privileges assigned to users and groups for a particular network resource in a domain.

ACL. See access control list

Active session. The session in which the user is currently interacting with the workstation.

adapter address. The address of the media access control point.

Additional Server. A server other than the domain controller ina domain. There can be multiple additional servers on a domain. Each additional server receives a copy of the user and group definition file from the domain controller.

administrator. The person responsible for the designing, planning, instlling, configuring, controlling, managing and maintaining of a network, system or resource.

action bar. The area on top of a panel that contains the choices currently available in the applicaion program.

Access control. The means by which network administrators restrict access to network resources and user programs and data.

access mode. A method of operation used to obtain a specific logical record from, or to place a specific logical record into, a file assigned to a mass storage device.

Access priority. In the IBM Token-Ring Network, the maximum priority a token can have for the adapter to use for transmission.

Access procedure. In a local area network (LAN), the procedure or protocol used to gain access to the transmission medium.

active monitor. A function in a single adapter that initiates the transmission of tokens and provides token error recovery facilities. Any active adapter on the ring has the ability to provide the active monitor function if the current active monitor fails. Synonymous with *token monitor*.

Adapter. The circuit card with a communicating device and its associated software that enable the device to be attached to a network.

adapter address. The address of the Media Access Control Service Access Point (MSAP).

adapter number. A specific number that identifies an adapter when more than one adapter is used in a workstation.

additional server. A server in a domain other than the domain controller. See *server*. See also *domain* and *controller*.

address. A value that identifies the location of a register, a particular part of storage, or a network node.

alert. (1) In communications, an error message sent to the system services control point (SSCP) at the host system. (2) In OS/2 LAN Server, an error or warning specified in the IBMLAN.INI file that is sent to the user. See also *system services control point*. See *problem management focal point*.

alias. (1) An alternative name used to identify an object or a database. (2) A nickname set up by the network administrator for a file, printer, or serial device. (3) A name used to identify a network resource to a domain. Aliases are similar to network names but can be used only through the full-screen interface. See also *network name*.

allocate. (1) To assign a resource to perform a specific task. (2) In Advanced Program-to-Program Communications (APPC), a verb used to assign a session to a conversation for its use.

application program. (1) A collection of software components, such as Communications Manager and Database Manager that a user installs to perform particular types of work, or *applications*, on a computer. (2) A program written for or by a user to perform the user's work on a computer.

application program interface (API) trace. A method used to trace points of the interface where user programs interact with an API.

application programming interface (API). A formally-defined programming language interface which is between an IBM system control program or a licensed program and the user of a program.

Asynchronous Communications Device Interface (ACDI). An application programming interface (API) for asynchronous communications provided by Communications Manager.

ASCII. American Standard Code for Information Interchnage

B

baud. The unit of modulation rate of an analog signal transmitted between data circuit-terminating equipment (DCE). In data communications each baud can encode one or more binary bits of computer data. Typically one, two, or four bits are encoded.

beacon. In the IBM Token-Ring Network, a frame sent by an adapter indicating a serious network problem, such as a broken cable.

binary synchronous communication (BSC). A form of telecommunication line control that uses a standard set of transmission control characters and control characters sequences, for binary synchronous transmission of binary-coded data between stations. Contrast with *Synchronous Data Link Control (SDLC).*

bridge. In LAN, a device that connects IBM Token-Ring and PC Network together. See *gateway.*

bridge number. In LAN, a number that distinguishes parallel bridges (that is, bridges spanning the same two rings).

broadcast. A message sent to all computers on a network, rather than to specific users or groups.

Broadcast frame. A frame that is to be fowarded by all bridges, unless otherwise restricted.

C

CCITT (Comite Consultatif International Telegraphique et Telephonique). See the *International Telegraph and Telephone Consultative Committee.*

clear to send (CTS). A signal that is raised by the data circuit-terminating equipment (DCE) when it is ready to accept data, usually in response to request to send (RTS) being raised. ACDI will not transmit data without this circuit being raised. If this circuit is lowered and remains lowered for more than 30 seconds, ACDI will assume the connection is lost and will bring the connection down.

clipboard. In Presentation Interface, an area of memory that holds data being passed from one program to another.

COM. A representation of one of the asynchronous serial communications ports, (COM1, COM2, and COM3), supported by the OS/2 program.

Communications Manager. A component of the OS/2 program that lets a workstation connect to a host computer and use the host resources as well as the resources of other personal computers to which the workstation is attached, either directly or through a host. Communications Manager provides application programming interfaces (APIs) so that users can develop their own applications.

CONFIG.SYS. A file that contains configuration options for an OS/2 program installed on a workstation. See also *configuration file.*

configuration file. The collective set of item definitions, that describe a configuration.

configure. (1) To prepare a workstation component or program for operational use. (2) To describe to a system the devices, optional features, and programs installed on the system.

Corrective Service diskette. A diskette provided by IBM to registered service coordinators for resolving user-identified problems. This diskette includes program updates designed to resolve problems. See also *program updates.*

CSMA/CD. Carrier Sense Multiple Access with Collision Detection. A network media protocol for managing collision of data packets.

custom install diskette. A diskette created using the custom build feature of the OS/2 installation program. A custom install diskette contains the specific features and device drivers needed for installing Database Manager, Communications Manager, and LAN Requester on one or more computers.

D

data carrier detect (DCD). This signal is raised by the data circuit-terminating equipment (DCE) when it and the remote DCE have recognized each other's carrier signal and have synchronized themselves. If this circuit is lowered and remains lowered for more than 30 seconds, ACDI will assume the connection is lost and will bring the connection down.

data circuit-terminating equipment (DCE). (1) The equipment installed at the user's premises that provides all the functions required to establish, maintain, and end a telephone connection for data transmission, and which does the signal conversion and coding between the data terminal equipment (DTE) and the line. See also *modem.* (2) For an X.25 packet switching network, the equipment in a data station that provides the signal conversion and coding between the data terminal equipment (DTE) and the line.

data link layer. In Open Systems Interconnection architecture, the layer that provides the functions and procedures used to provide error-free, sequential transmission of data units over a data link.

data set ready (DSR). This signal is raised by the data circuit-terminating (DCE) to indicate it is on-line and ready to begin communicating. Some DCEs use this signal as a power-on. indicator. ACDI expects this signal to be lowered after every connection take down for a minimum of 100ms. Failure to do so may cause a warning message to be displayed instructing the user to insure the DCE has, in fact, gone on-hook.

data terminal equipment (DTE). The equipment that sends or receives data, or both.

data terminal ready (DTR). The on condition of the circuit connected to the RS232C modem indicating that the terminal is ready to send or receive data.

database. (1) A systematized collection of data that can be accessed and operated upon by an information processing system. (2) In Database Manager, a collection of information such as tables, views, and indexes. With Query Manager, a database can also include such other information as report forms, queries, panels, menus, and procedures. network layer of the adapter protocol. When a message is sent as a

Datagram. When data is sent as a datagram, the receiver of the message sends no acknowledgement for its receipt.

dedicated server. A personal computer on a network that functions only as a server, not as a requester and a server.

device driver. The executable code needed to attach and use a device such as a display, printer, plotter, or communications adapter.

disk operating system (DOS). An operating system for computer systems that use disks and diskettes for auxiliary storage of programs and data.

Diskette image. A representation of a diskette containing files and programs. The image resides in computer storage and is used by the computer as though if were a physical diskette.

domain. A set of servers that allocates shared network resources within a single logical system.

domain control database (DCDB). A database that resides on the domain controller and contains files that describe the current domain.

domain controller. A server within the domain that provides details of the OS/2 LAN Server to all other servers and requesters on the domain. The domain controller is responsible for coordinating and maintaining activities on the domain.

domain definition. A list of network resources and users that can be printed out by the network administrator.

DOS. See *disk operating system*.

drive. (1) The device used to read and write data on disks or diskettes. (2) In the OS/2 program, a diskette (created using the CREATEDD command) that contains the contents of storage at a specified point in time.

duplex. Pertaining to communication in which data can be sent and received at the same time. Synonymous with *full-duplex*. Contrast with *half-duplex*.

dynamic link library. A module containing a dynamic link routine (DLR) that is linked at load or run time.

E

Emulator High-Level Language Application Programming Interface (EHLLAPI). A Communications Manager Application Programming Interface that provides a way for users and programmers to access the IBM 3270, IBM AS/400, or System/36 host presentation space.

end user. The ultimate source or destination of data flowing through an SNA network. An end user can be an application program or a workstation operator.

error log. A file that stores error information for later access. See *log*.

Ethernet. A Data Link Layer protocol jointly developed by INTEL, XEROX, and DEC and subsequently adopted by the IEEE as a standard.

extended binary-coded decimal interchange code (EBCDIC). A coded character set consisting of 8-bit coded characters used by host computers.

external resource. A file, printer, or serial device resource supplied by a server outside the current domain.

external server. A server outside the domain that defines and controls domain resources.

F

frame. (1) In high level data link control (HDLC), the sequence of contiguous bits bracketed by and including the opening and closing flag (01111110). Frames are used to transfer data and control information across a data link. (2) A data structure that consists of fields predetermined by a protocol for the transmission of user data and control data. Synonymous with *data frame*.

G

gateway. In communications, a functional unit that connects two computer networks of different network architectures. Contrast with *bridge*.

H

half-duplex. In two-way communication, where only one user transmits at a time. Contrast with *full-duplex*.

Hard error. An error occuring that makes it inoperative. See beaconing.

Hop count. The number of bridges through which a frame has passed on the way to its destination.

host computer. (1) In a computer network, a computer providing services such as computation, database access, and network control functions.
(2) The primary or controlling computer in a multiple computer installation.

I

IBM Operating System/2 LAN Server. A program that allows resources to be shared with other computers on the network. See also *server*.

IBM Token-Ring Network. IBM Token-Ring Network is a high speed, star-wired local area network to which a variety of IBM products can be connected.

IEEE 802.2 interface. An interface adhering to the 802.2 logical link control (LLC) Standard of the Institute of Electrical and Electronics Engineers (IEEE). This standard is one of several standards for local area networks approved by the IEEE.

image. In OS/2 LAN Server, a binary file that is structured to look like the files used during a normal machine initial program load (IPL). Images are used to load software on machines that are not loaded from their own fixed disk or diskette drives. Synonymous with *IPL image*.

initial program load (IPL). (1) The initialization procedure that starts an operating system. (2) The process of loading programs and preparing a system to run jobs.

International Organization for Standardization (ISO). An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

International Telegraph and Telephone Consultative Committee (CCITT). An international organization that recommends and publishes standards for the interconnection of communications equipment.

interprocess communication. The exchange of information between processes.

interrupt. A suspension of a process such as the execution of a computer program caused by an event external to that process, performed in such a way that the process can be resumed.

K

kernel. (1) The part of an operating system that performs basic functions such as allocating hardware resources.

kilobyte (KB). A term meaning 1024 bytes.

L

LAN. See Local Area NetWork

Local Area Network. A network, in which communications are limited such as an office building etc.. A LAN depends upon a communications medium capable of moderate high rate and normally operates with a consistently low error rate.

LAN adapter. A card which is installed in a Personal Computer and is used to attach this device to a local area network.

LAN segment. Any portion of a local area network that can operate independently, but is connectetd to the establishment network via routers, bridges or gateways.

LAN Requester. A component of the OS/2 program that allows users to access shared network resources made available by OS/2 LAN Servers. See *requester*.

link. (1) The physical medium of transmission, the protocol, and associated devices and programming used to communicate between computers. (2) To interconnect items of data or portions of one or more computer programs, for example, the linking of object programs by a linkage editor, or the linking of data items by pointers.

link station. (1) In Systems Network Architecture (SNA), the combination of hardware and software that allows a node to attach to and provide control for a link. (2) On a local area network (LAN), part of a service access point (SAP) that enables an adapter to communicate with another adapter.

Lobe. The section of cable in a Token-Ring network, that connects a device to an access unit.

local area network (LAN). (1) Two or more computing units connected for local resource sharing. (2) A network in which communications are limited to a moderate-sized geographic area such as a single office building, warehouse, or campus, and that do not extend across public rights-of-way.

Local bridge. A function in a single personal computer oder Personal System, that connects two LAN segments without using a telecomminucations link.

logical device. (1) An input/output (I/O) device identified in a program by a label or number that corresponds to the actual label or number assigned to the device. Contrast with *physical device*. (2) In the OS/2 program, a redirected disk, file, printer, or other specific device.

logical link control (LLC). The DLC.LAN sub-layer that provides two types of Data Link Control (DLC) operation. The first type is connectionless service, which allows information to be sent and received without establishing a link. The LLC sub-layer does not perform error recovery or flow control for connectionless service. The second type is connection-oriented service, which requires the establishment of a link prior to the exchange of information. Connection-oriented service provides sequenced information transfer, flow control, and error recovery.

logical unit (LU). In Systems Network Architecture (SNA), a port through which an end user accesses the SNA network in order to communicate with another end user and through which end users access the functions provided by system services control points (SSCPs).

logical unit 6.2 (LU 6.2). A particular type of Systems Network Architecture (SNA) logical unit (LU) that provides a connection between resources and transactions programs running on different network nodes. See *Advanced Program-to-Program Communications (APPC)*.

M

Media Access Control Service Access Point (MSAP). In the IBM Token-Ring Network, the logical point at which an entity in the medium access control (MAC) sublayer provides services to the logical link control sublayer.

medialess requester. A requester without a disk drive.

medium access control (MAC). In local area network (LAN), the sub-component of IEEE 802.2 application programming interface (API) that supports medium-dependent functions and uses the services of the physical layer to provide services to logical link control. Medium access control (MAC) includes the medium access port.

medium access control (MAC) frame. The frame that controls the operation of the IBM Token-Ring Network and any ring station operations that affect the ring.

medium access control (MAC) protocol. In a local area network (LAN), the part of the protocol that governs access to the transmission medium independently of the physical characteristics of the medium, but taking into account the topological aspects of the network in order to enable the exchange of data between data stations.

megabyte (MB). 1,048,576 bytes

Micro Channel. The architecture used by IBM Personal System/2. Synonymous with *advanced I/O channel*.

multistation access unit (MAU). In the IBM Token-Ring Network, a wiring concentrator that can connect up to eight lobes to a ring network.

multitasking. A mode of operation that provides for concurrent performance or interleaved execution of two or more tasks.

MVDM. A Virtual DOS Machine is a DOS session under OS/2 version 2.0, which simulates a complete 8088 system to the operating system. (Multiple Virtual DOS Machine)

Multiple Virtual DOS Machines. See also MVDM

N

NDIS. The Network Driver Interface Specification (NDIS) is a standard for OS/2 and DOS network platforms. This standard is developed by 3COM and Microsoft. NDIS provides access to network services at the Data Link Layer and is especially useful if more than one network protocol has to have access to the same network board.

NetBIOS. An application programming interface (API) between a local area network adapter and programs.

network. A configuration of data processing devices and software connected for information interchange.

Network manager. A program or a group of programs that is used to monitor, manage and diagnose the problems of a network.

network address. An address, consisting of subarea and element fields, that identifies a link, a link station, or a network addressable unit. Subarea nodes use network addresses; peripheral nodes use local addresses. The boundary function in the subarea node to which a peripheral node is attached, pairs local addresses with network addresses and vice versa.

network management. In the IBM Token-Ring Network, the conceptual control element of a data station that interfaces with all of the layers of that data station and is responsible for the resetting and setting of control parameters, obtaining reports of error conditions, and determining if the station should be connected to or disconnected from the medium.

NMS. See also NetWare Services for OS/2

NetWare Services for OS/2. NetWare Services for OS/2 is the IBM product, which is identical to NMS from Novell. NetWare Services for OS/2 is a network management tool to watch and administer the IPX network. Only IPX workstations can be administered by this utility.

node. An endpoint of a communications link or a junction common to two or more links in a network. Nodes can be processors, controllers, or workstations. See *peripheral node*.

node address. The address of a node in a network.

non-switched line. A connection between computers or devices using telephone switching equipment that does not have to be established by dialing. See *leased line*. Contrast with *switched line*.

O

octet. A byte composed of eight binary elements.

ODI. The Open Data-Link Interface (ODI) is a standard for OS/2 and DOS network platforms. This standard is developed by Novell. ODI provides access to network services at the Data Link Layer and is especially useful if more than one network protocol has to have access to the same network board or one network protocol has to have access to more than one network board. screen used to display messages and status information.

P

pacing. In data communications, a technique by which receiving equipment controls the transmission of data by sending equipment to prevent overrun. See also *flow control* See *receive pacing* and *send pacing*.

packet. In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole.

R

RAM. Random Access Memory. A computer's storage area into which data may be entered and retrieved in a consequential manner.

Random Access Memory. See RAM.

Remote bridge. A function that connects two LAN segments using a telecomminucations link between two Personal Systems.

remote initial program load (RIPL). The initial program load of a remote requester by a server on which the appropriate image is located.

remote IPL. See *remote initial program load*.

remote IPL server. A server that provides remote IPL (initial program load) support for one or more remote IPL requesters.

request header (RH). A three-byte header preceding a request unit (RU). See *request/response header*. Contrast with *response header*.

request to send (RTS). This signal is raised by ACDI prior to establishing a connection, and it is lowered when the connection is brought down. This signal works in concert with data terminal ready (DTR) in that it is always raised after DTR and lowered before DTR.

requester. (1) In Server-Requester Programming Interface (SRPI), the application program that relays a request to host computer. Contrast with *server*. (2) A computer that accesses shared network resources made available by other computers running as servers on the network. See *LAN Requester*.

router. The hardware and software necessary to link to subnetworks of the same network together. More specifically, the hardware and software necessary to link two subnetwork at the Network Layer of the OSI Reference Model.

S

SAA. See *Systems Application Architecture*.

SAP. See *service access point*.

server. (1) On a local area network (LAN), a data station that provides facilities to other data stations.

session. (1) A logical connection between two stations or network addressable units (NAUs) that allows them to communicate.

Synchronous Data Link Control (SDLC). A communications protocol for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges can be duplex or half-duplex, over switched or non-switched links.

Systems Application Architecture (SAA). A set of software interfaces, conventions, and protocols that provide a framework for designing and developing applications across multiple computing environments.

Systems Network Architecture (SNA). The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through and controlling the configuration and operation of networks.

T

token. (1) In a local area network (LAN), the symbol of authority passed among data stations to indicate the station temporarily in control of the transmission medium. It consists of a starting delimiter, a frame control field, and an ending delimiter. The frame control field contains a token indicator bit that indicates to a receiving station that the token is ready to accept information. If the station has data to send along the network, it appends the data to the token. The token then becomes a frame.

Token-Ring Network. See *IBM Token-Ring Network.*

topology. The schematic arrangement of the links and nodes of a network.

U

user ID. A unique name that identifies a user to the network.

W

wide area network (WAN). A network that provides data communication capability in geographic areas larger than those serviced by local area networks.

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for
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