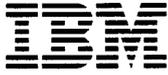




*Token-Ring Network
Adapters
Hardware Reference
Library*

Remote Program Load User's Guide

83X8882



*Token-Ring Network
Adapters
Hardware Reference
Library*

Remote Program Load User's Guide

Note: This product is intended for use within a single establishment and within a single, homogeneous user population. For sensitive applications requiring isolation from each other, management may wish to provide isolated cabling or to encrypt the sensitive data before putting it on the network.

Federal Communications Commission (FCC) Statement

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device, pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Second Edition (June 1987)

Changes are made periodically to the information herein; these changes will be incorporated in new editions of this publication.

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Preface

The Remote Program Load Module allows you to load application programs from another computer on the IBM Token-Ring Network into an IBM Personal Computer or a computer of the IBM Personal System/2™ family (those models with the Micro Channel™ architecture)¹ connected to the IBM Token-Ring Network, without using a disk or diskette drive on the receiving computer.

The Remote Program Load Module must be installed on the IBM Token-Ring Network adapter in the receiving computer. IBM Personal Computers require the IBM Token-Ring Network PC Adapter or IBM Token-Ring Network PC Adapter II; the IBM Personal System/2 models with the Micro Channel architecture require the IBM Token-Ring Network Adapter/A.

Note: In this book, the term *IBM Token-Ring Network adapter* will be taken to mean the IBM Token-Ring Network PC Adapter, the IBM Token-Ring Network PC Adapter II, or the IBM Token-Ring Network Adapter/A unless specified otherwise.

Chapter 1 of this manual introduces you to the basic principles involved in Remote Program Load. It also describes the Remote Program Load kit and what is needed to use it.

Chapter 2 describes the installation of the Remote Program Load Module in your computer.

Chapter 3 explains what programs are required to use Remote Program Load on the IBM Token-Ring Network. Included with this book are sample programs to help with writing the required programs.

¹ IBM Personal System/2 and Micro Channel are trademarks of the IBM Corporation.

Chapter 4 contains information that should help you if you are using the Remote Program Load on a Requesting Device and do not get the expected results.

Related Publications

If you are not familiar with the IBM Personal Computer or IBM Personal System/2 computer you are using, we recommend that you consult the operator's guide for that computer before proceeding:

- *IBM Guide to Operations* for the IBM Personal Computer
- *IBM Quick Reference* for the IBM Personal System/2.

Other documents related to the IBM Personal Computer, the IBM Personal System/2, and the IBM Token-Ring Network include:

- *IBM Token-Ring Network Introduction and Planning Guide*
- *IBM Token-Ring Network Installation Guide*
- *IBM Token-Ring Network PC Adapter Guide to Operations* (packaged with the adapter)
- *IBM Token-Ring Network PC Adapter Technical Reference*
An addendum to this publication, Chapter 9, covers the IBM Token-Ring Network Adapter/A.
- *IBM Token-Ring Network Problem Determination Guide, SX27-3710**
An addendum to this publication (packaged with Remote Program Load) covers problem determination procedures when adapters with Remote Program Load installed are in the network.
- *IBM Token-Ring Network Architecture Reference*
- *IBM Token-Ring Network Adapter/A Installation and Testing Instructions* (packaged with the adapter)
- *IBM Personal System/2 Hardware Maintenance Reference*
Addenda for this publication cover Remote Program Load and the IBM Token-Ring Network Adapter/A:

- *IBM Token-Ring Network Adapter/A Supplement* for the *IBM Personal System/2 Reference* manual
- *IBM Token-Ring Network Remote Program Load Supplement* for the *IBM Personal System/2 Reference* manual
- **IBM Personal System/2 Hardware Maintenance Service Addenda** for this publication cover Remote Program Load and the IBM Token-Ring Network Adapter/A:
 - *IBM Token-Ring Network Adapter/A Supplement* for the *IBM Personal System/2 Service* manual²
 - *IBM Token-Ring Network Remote Program Load Supplement* for the *IBM Personal System/2 Service* manual³

For assistance in obtaining IBM manuals, see the place where you purchased the Remote Program Load Module. For the item marked with an asterisk (*), see your IBM representative or IBM branch office.

Prerequisites

Note: You should install and test your ring as instructed in the *IBM Token-Ring Network Introduction and Planning Guide* and *IBM Token-Ring Network Installation Guide* before installing the Remote Program Load Modules on the adapters.

To use the Remote Program Load on the IBM Token-Ring Network, you need a basic understanding of the IBM Token-Ring Network (see the *IBM Token-Ring Network Introduction and Planning Guide*). To write programs for the Remote Program Load you must also understand the supporting software routines for the IBM Token-Ring Network (see the *IBM Token-Ring Network PC Adapter Technical Reference* and the *IBM Token-Ring Network Architecture Reference*).

² The IBM Token-Ring Network Adapter/A *Reference* and *Service* supplements are packaged together.

³ The Remote Program Load *Reference* and *Service* supplements are packaged together.

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Chapter 1. Introduction

The IBM Token-Ring Network allows attaching devices (IBM Personal Computers equipped with IBM Token-Ring Network PC Adapters or Adapter IIs and attached to the Token-Ring Network, for instance) to share a token-passing local area network.

Most Personal Computers or IBM Personal System/2 computers attach to the network by loading the Adapter Support code from a fixed disk or diskette drive. Remote Program Load makes it possible for these computers to attach to the network and to load an application program without using the fixed disk or diskette drive. Such attaching devices (called "Requesting Devices") do this by asking another computer (one that has a disk drive) to send it a Bootstrap Program. The computer with the disk drive is called the "Loading Device." The requirements for the Bootstrap Program are discussed in Chapter 3.

Package Contents

- The Remote Program Load Module (located in a zip-plastic page)
- A special text supplement to update the *IBM Token-Ring Network Problem Determination Guide* with information for Remote Program Load
- This *User's Guide*
- The Remote Program Load Sample Programs diskette

Remote Program Load Overview

A network with Remote Program Load must have a Loading Device and one or more Requesting Devices.

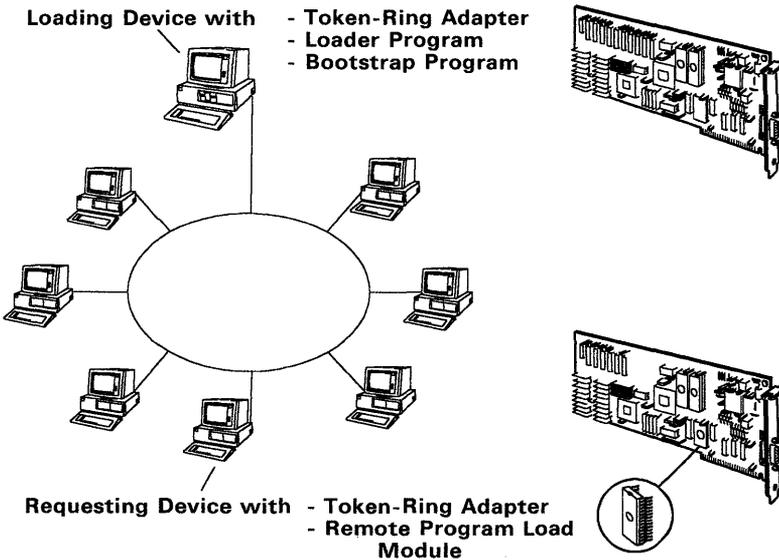
- The Loading Device

The Loading Device must have a fixed disk or diskette drive. Its purpose is to supply files to the Requesting Devices. The Loading Device must also have an IBM Token-Ring Network adapter installed (the Remote Program Load Module is not required).

Note: Because of the size of the sample programs and the speed of a diskette drive, it is recommended that you run the sample programs from a fixed disk.

- The Requesting Device

The Requesting Device does not need a fixed disk or diskette drive. It receives the files necessary to start from the Loading Device. The Requesting Device has an IBM Token-Ring Network adapter with the Remote Program Load Module installed.



Two programs are needed to use the Remote Program Load on your network. There are samples of these programs on the diskette included in this package. See the README file on the diskette for a description of these two programs.

- **The Bootstrap Program**

This program is sent by the Loading Device to the Requesting Device. The Bootstrap Program (after being installed in the Requesting Device) initializes and restarts the computer. The Bootstrap Program can be any of the following:

- A complete operating system
- A program that requests more files or programs
- A combination of the above.

- **The Loader Program**

This program sends the Bootstrap Program to the Requesting Devices in response to requests sent by Requesting Devices.

See Chapter 3 for a complete description of these programs.

Another program is required in any Requesting Device that has a fixed disk. This program is RPLBOOT.COM, an executable program that is supplied on the sample programs diskette. RPLBOOT.COM temporarily disables the DOS partition on the fixed disk of the Requesting Device so that Remote Program Load will get control when the computer is restarted. See the README file on the diskette for a more complete description of this program.

Which User Are You?

Planner or Network Administrator

If you are planning a network that will use Remote Program Load or you are the network administrator for such a network, you need to read this *User's Guide* in its entirety with the possible exception of Chapter 3.

Installer

If you are installing the Remote Program Load Module, read this chapter and Chapter 2. Chapter 2 has the instructions for installing the Remote Program Load Module onto the adapter.

Programmer

If you are writing programs for the Remote Program Load:

- Read this chapter and Chapter 3.
- You also need the *IBM Token-Ring Network PC Adapter Technical Reference* and the *IBM Token-Ring Network Architecture Reference*.

Daily User

If you are using a personal computer with Remote Program Load, you need to:

- Start Remote Program Load by turning the power on. If the computer is already powered on, press the Ctrl-Alt-Del key sequence to restart the computer.
- Look for soft-error conditions
 - Highlighted field:

If any field is highlighted, Remote Program Load will not proceed until the Remote Program Load device is restarted.
 - Unchanged Display:

If the Remote Program Load screen does not appear, or the Remote Program Load screen does appear but remains unchanged for a long time, or some other unusual condition occurs, see Chapter 4.
- Read “Requesting Device Display Screen” on page 3-9 in Chapter 3 to become more familiar with the Remote Program Load screen.

If Remote Program Load occurred successfully, the Remote Program Load screen will be replaced by an operating system prompt or an application screen, depending on what the Bootstrap Program called for.

Software and Hardware Requirements

To use Remote Program Load on your network, you need the Bootstrap Program and the Loader Program discussed above (see Chapter 3 for further details) and the following:

1. A Requesting Device

An IBM Personal Computer, IBM Personal Computer XT™, or IBM Personal Computer AT® that has an IBM Token-Ring Network PC Adapter or Adapter II **with** a Remote Program Load Module installed

or

An IBM Personal System/2 computer that has an IBM Token-Ring Network Adapter/A **with** a Remote Program Load Module installed.

The Requesting Device must also have:

- No fixed disk or diskette drive **or** a fixed disk or diskette drive that will not start the computer (for example, a fixed disk that has been marked as a non-bootable system disk, or a diskette drive with the door open.) A program is provided on the sample programs diskette that will cause the computer to treat the fixed disk as a non-bootable system disk when starting up.
- An 80-column display
- At least 256 kilobytes (Kb) of memory (if your Bootstrap Program is large, more memory may be required).

2. A Loading Device

An IBM Personal Computer, IBM Personal Computer XT, or IBM Personal Computer AT that has an IBM Token-Ring Network PC Adapter or Adapter II

or

An IBM Personal System/2 computer that has an IBM Token-Ring Network Adapter/A.

The Loading Device must also have:

- A fixed disk or diskette drive (the size of the Bootstrap Program may require a fixed disk)
- An 80-column display
- At least 256 Kb of memory.

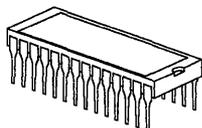
3. One Observer Terminal (Optional)

An Observer Terminal is needed only if there are problems on the network. This could be the Loading Device or another IBM Personal Computer or IBM Personal System/2 computer that has the ability to run the IBM Token-Ring Network Ring Diagnostic, the IBM Token-Ring Network Manager, or a network application program that provides ring status and fault domain information. (The Ring Diagnostic is contained on the diskette that accompanies each IBM Token-Ring Network adapter. Instructions for using this diagnostic are contained in the *IBM Token-Ring Network Problem Determination Guide*.) Make sure the observer terminal is connected to the first IBM 8228 Multistation Access Unit (MSAU) specified on the Ring Sequence Chart in its wiring closet. This position in the Multistation Access Unit is necessary to use the Remote Program Load section in the *IBM Token-Ring Network Problem Determination Guide*.

4. A cable for each device to connect to the network:

- An IBM Token-Ring Network PC Adapter Cable (P/N 6339098), if your network uses IBM Cabling System data grade media
- A Type 3 Media Filter, or equivalent, if your network uses telephone twisted-pair media. See the *IBM Token-Ring Network Telephone Twisted-Pair Media Guide*, GA27-3714.

Chapter 2. Installing the Remote Program Load Module



Installation Requirements

- The Remote Program Load Module should be installed on IBM Token-Ring Network adapters in all the Requesting Devices on the network. The Remote Program Load Module identified as part number 67X0406 should be installed on IBM Token-Ring Network PC Adapters and Adapter IIs, and the Remote Program Load Module identified as part number 83X7887 should be installed on IBM Token-Ring Network Adapter/As.
- The Remote Program Load Module may not work on other network adapters.

Tools Required

Medium-size flat-blade screwdriver (not needed for IBM Personal System/2 computers that use the Micro Channel architecture)

Optional:

- Medium screwstarter
- 3/16-inch nutdriver
- 1/4-inch nutdriver

Prerequisites

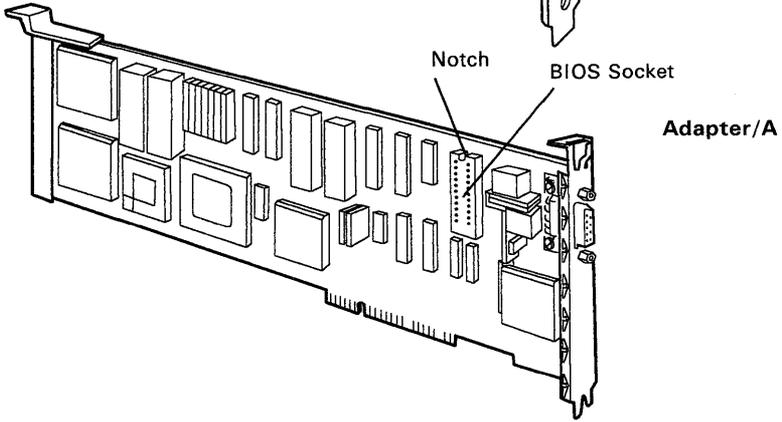
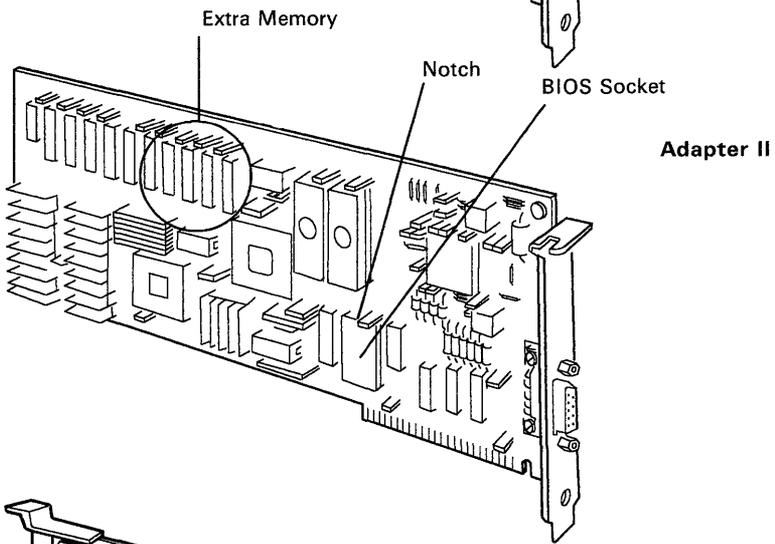
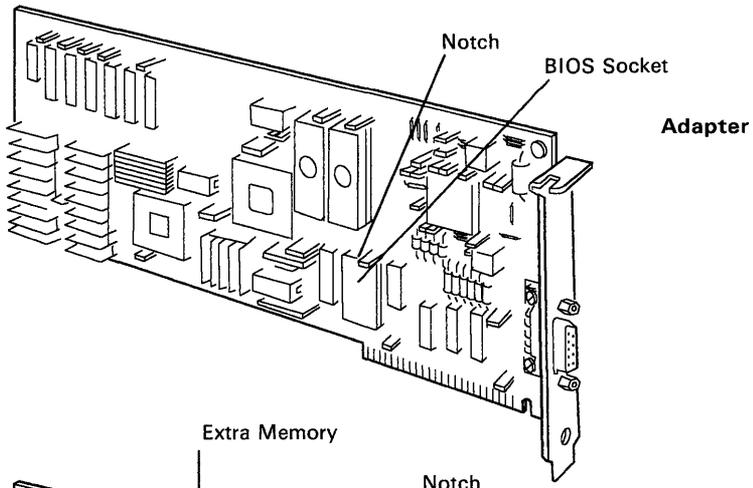
- The *IBM Token-Ring Network PC Adapter Guide to Operations*, or the *IBM Token-Ring Network Adapter/A Installation and Testing Instructions*, as appropriate
- The *Guide to Operations* for your Personal Computer or the *Quick Reference* for your Personal System/2.

Installation Instructions

- 1 If you will be installing the Remote Program Load Module on a new IBM Token-Ring Network PC Adapter or Adapter II that is not currently installed in a computer, set the switches as instructed in Chapter 2 of the *IBM Token-Ring Network PC Adapter Guide to Operations*. After setting the switches, go to step 6 in these instructions to install the module. If the adapter is currently installed, continue with step 2.

If you will be installing the Remote Program Load Module on an IBM Token-Ring Network Adapter/A that is not currently installed in a computer, go to step 6. If the adapter is currently installed, continue with step 2.

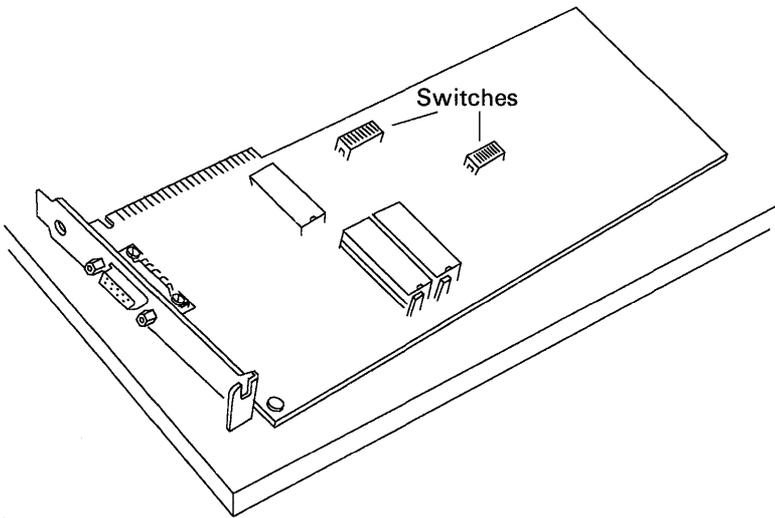
- 2 Turn the computer power off.
- 3 Remove the computer cables and cover from your computer. See the operator's guide for your IBM Token-Ring Network adapter for instructions. After removing the cables and cover, return here.
- 4 Locate the IBM Token-Ring Network adapter as illustrated on the following page.



Adapter Removal

- 5 Remove the Token-Ring Network adapter. Refer to the *Token-Ring Network PC Adapter Guide to Operations* or *Personal System/2 Quick Reference* if needed.
- 6 Place the adapter, component side up, on a flat surface (such as a table).

Warning: If the adapter is an IBM Token-Ring Network PC Adapter or Adapter II, be careful not to change the switch settings on the adapter. If they are accidentally changed, see "Setting the Switches" in Chapter 2 of the *IBM Token-Ring Network PC Adapter Guide to Operations* to reset them correctly.

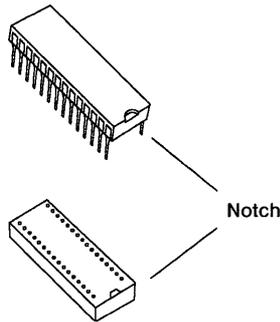


Remote Program Load Module Installation

7

Orient the Remote Program Load Module so that the notch on the module is facing in the same direction as the notch on the BIOS socket (see page 2-3 for location of BIOS socket.)

Warning: Be sure to orient the module correctly. If the adapter is installed in the computer with the module inserted incorrectly, the module will be damaged when the power is turned on.



8

Carefully start the Remote Program Load Module pins into the BIOS socket. If the pins are spread farther apart than the holes, you will need to gently push one row of pins toward the other until both rows are aligned with the holes. Be sure to push an entire row of pins at a time. Do not bend them individually.

Warning: The module pins bend easily and can break. Handle the module gently.

One way to align the pins is:

- a. Lightly rest one row of pins in their holes in the socket.
- b. Carefully push the module toward that row of pins until the other row of pins can sit down into their holes.

9

After all the pins have been started, press straight down on the top of the Remote Program Load Module until the module is fully seated in the socket.

- 10 Reinstall the adapter, replace the cover, and reconnect all cables. See the operator's guide for the adapter for complete instructions.
- 11 If you have not already done so, insert the *Problem Determination Guide* update (included in this package) into the *IBM Token-Ring Network Problem Determination Guide* (if you have that manual).
- 12 Go to Chapter 3 for programming requirements to use the Remote Program Load on the IBM Token-Ring Network.

Chapter 3. Programming Requirements

The diskette provided in this binder includes samples of the two programs that are needed to use Remote Program Load on your network. These sample programs are intended only as aids; they are not intended to be used on the network other than as examples. These two programs (the Bootstrap Program and the Loader Program), which work together to bring up the Requesting Device, need to be written or purchased elsewhere. (The third program on the diskette, RPLBOOT.COM, is not a sample program. It is executable code to be run on a Requesting Device that has a fixed disk, to disable the DOS partition on the fixed disk. See the README file on the diskette for details about this program.)

You should be able to write the Bootstrap Program and the Loader Program with the information in this chapter, the *IBM Token-Ring Network PC Adapter Technical Reference*, the *IBM Token-Ring Network Architecture Reference*, and a basic understanding of IBM personal computer system programming (for example, a knowledge of IBM Macro Assembler).

After describing a ring with Remote Program Load, this chapter covers the following topics:

- The Requesting Device display
- The Adapter Support Subset and the frames used
- RAM space usage
- The Disk Emulator
- A more complete description of the two programs
- Some sample flowcharts
- The actual frame formats.

Example Remote Program Load Sequence

Through a series of steps (described in the following pages), the Remote Program Load Module requests and receives the Bootstrap Program from the Loading Device. This is accomplished by read-only memory on the Remote Program Load Module that provides the following:

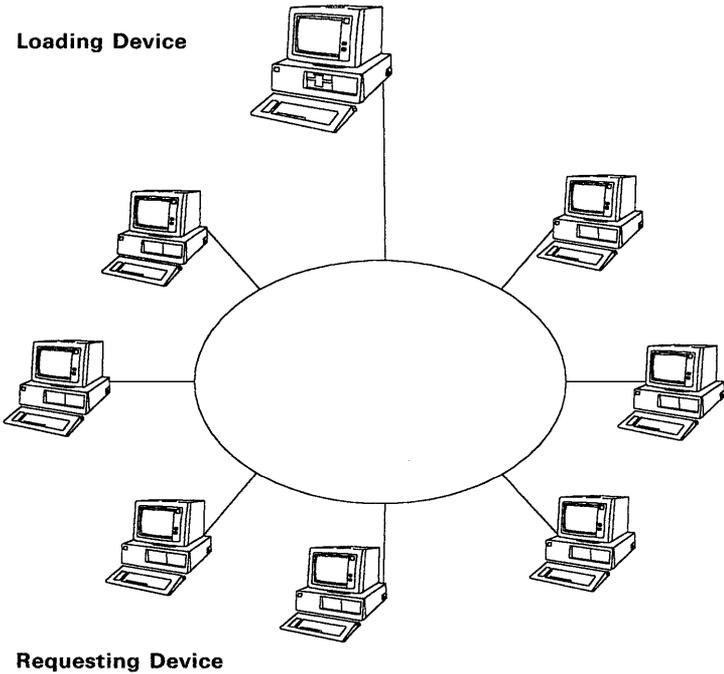
- Load Requestor - A set of commands that sends frames in search of a Loading Device that will supply the Bootstrap Program
- Adapter Support Subset - A subset of the IBM Token-Ring Network Adapter Support code used by the Load Requestor
- Disk Emulator - A function that handles the diskette image received in the Bootstrap Program (emulates INT X'13' calls).

The following section describes one example of the sequence of events that may occur during Remote Program Load. For simplicity's sake, only the major steps are described and only one Loading Device and Requesting Device are considered. On most networks there will be multiple Requesting Devices and sometimes multiple Loading Devices.

1

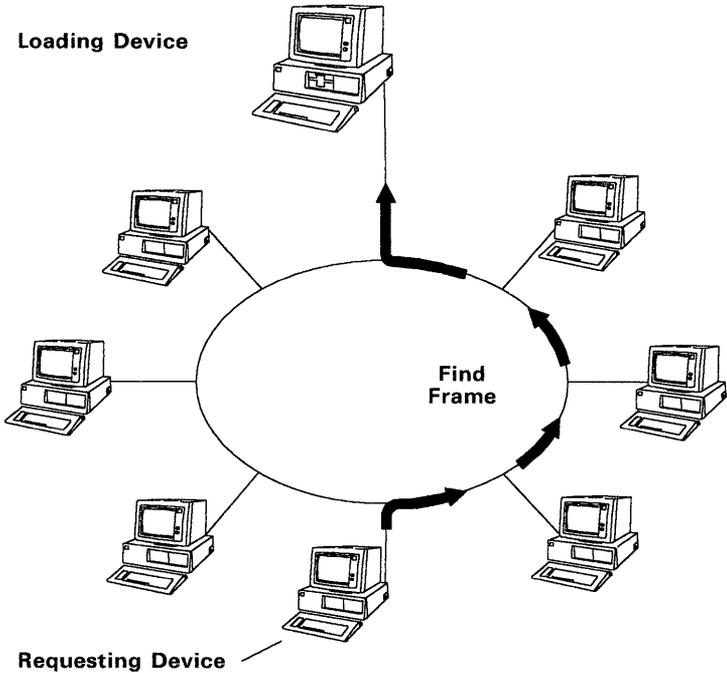
The Loading Device is powered on with the needed programs (the Bootstrap Program and the Loader Program). A Loader Program in the Loading Device attaches the Loading Device to the ring and waits for a FIND frame from a Requesting Device.

The Loader Program:
Opens Service Access Points
Issues a Receive
Sets the Functional Address



2

The Requesting Device is powered on, and the Remote Program Load Module (on an IBM Token-Ring Network adapter) obtains control. The Remote Program Load Module attaches the Requesting Device to the ring and sends a FIND frame. FIND frames are repeated periodically until a Loading Device responds.

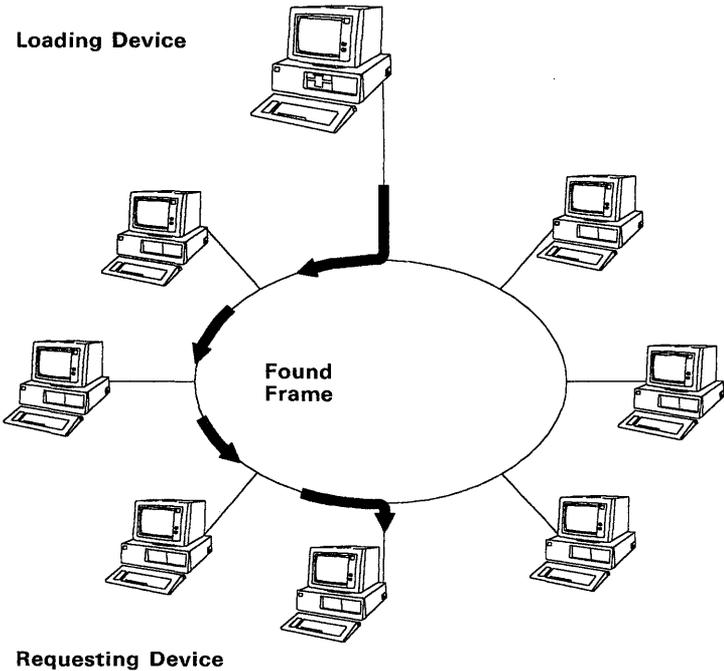


The Load Requestor:
Opens a Service Access Point
Issues a Receive
Issues a Find Frame

3

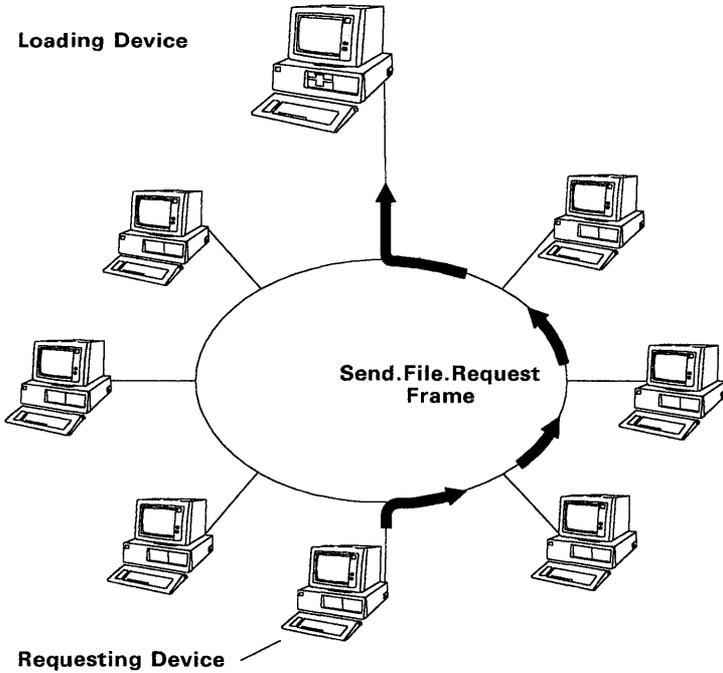
The Loading Device receives the FIND frame sent by the Requesting Device. The Loading Device responds by sending a FOUND frame to the Requesting Device. The Loading Device provides its address so the Requesting Device can identify it.

The Loader Program:
Receives the Find Frame
Issues a Found Frame



4

The Requesting Device receives the FOUND frame with the address of the Loading Device. The Requesting Device sends a SEND.FILE.REQUEST frame back to the Loading Device. This frame is a request for the Bootstrap Program.



The Load Requestor:
Receives the Found Frame
Issues a SEND.FILE.REQUEST Frame
for the Bootstrap Program

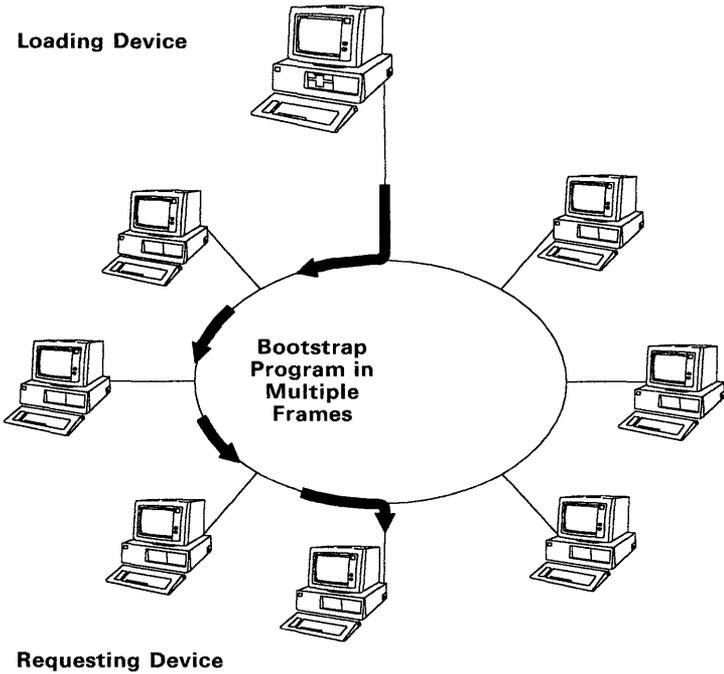
5

Upon receiving the SEND.FILE.REQUEST frame, the Loader Program in the Loading Device sends the Bootstrap Program to the Requesting Device by transmitting FILE.DATA.RESPONSE frames.

The Loader Program:

Receives the SEND.FILE.REQUEST frame

Sends the Bootstrap Program in FILE.DATA.RESPONSE frames.



6

The Requesting Device receives the Bootstrap Program and places it into memory. Status updates are displayed on the screen of the Requesting Device as the program is being sent. See “Requesting Device Display Screen” on the next page.

In most cases, more than one frame is required to completely send the Bootstrap Program. After the last frame of the program is received at the Requesting Device, control is transferred to the Bootstrap Program.

At this point the Bootstrap Program performs whatever tasks are needed for the Requesting Device and then closes the adapter.

Requesting Device Display Screen

As soon as the Remote Program Load module gains control and initializes the adapter (step 2 in our example), information is displayed on the display screen of the Requesting Device. Messages appear on the screen as the information becomes available.

An elapsed time field at the top of the screen continues to be updated to show the time accumulated since the module gained control. Some of the fields will only be displayed for error conditions and all the fields will go away when the adapter is closed by the Bootstrap Program.

If an error occurs that makes proceeding impossible, the screen is "frozen" with the field containing the error indication highlighted. If an error occurs that just stops Remote Program Load, it will not be highlighted; see Chapter 4 for possible solutions. All fields are displayed in hexadecimal values. Each field has a 2-character alphabetic prefix, explained on the following pages. The values shown in this sample screen are for example only; yours may differ.

```
ET-00:00:45
ID-166

BU-0000
AA-10005A000567
AL-00 0000 B001253
BL-00112233
MM-CC00 02
SR-D800 08
OP-0000

RQ-0001
SF-0001
SN-0023
DS-0080
RS-0040
PC-4020
AC-0040 0000 0000 0000
```

ET-00:00:45

Explanation: Elapsed Time. A continuously updated field indicating the elapsed time since the Remote Program Load Module gained control.

ID-166

Explanation: Identification. An indication of which adapter is being used for Remote Program Load.

- A value of 166 indicates the primary adapter.
- A value of 167 indicates the alternate adapter.

BU-0000

Explanation: Bring-Up. This field is displayed as X'0000' if the adapter has been successfully initialized and opened. If the adapter incurred an error a nonzero error code is displayed and the field is highlighted. See "Bring-Up Error" on page 4-5 for more information on the Bring-Up Error.

AA-10005A000567

Explanation: Adapter Address. The permanently encoded adapter address (ring address). Always 12 hexadecimal characters.

AL-00 0000 B001253

Explanation: Adapter Level. The Engineering Change (EC) level of the code on the adapter.

BL-00112233

Explanation: BIOS Level (Module Level). The Engineering Change (EC) level of the code in the Remote Program Load Module.

MM-CC00 02

Explanation: Memory (Read-Only Memory). The first four digits are the hexadecimal ROM segment address set on the adapter. The last two digits are the interrupt level set on the adapter. See the operator's guide for your IBM Token-Ring Network adapter for more information.

SR-D800 08

Explanation: Shared RAM. The first four digits are the hexadecimal shared RAM segment address that the adapter uses. The last two digits are the shared RAM segment size (in decimal). "08" indicates 8 Kb of memory and "16" indicates 16 Kb of memory.

OP-0000

Explanation: Open Error. This field is displayed as X'0000' if the adapter has been successfully opened and attached to the ring. This field contains a nonzero error code and is highlighted if the adapter incurred an Open Error in trying to attach to the ring. For more information, see "Open Error" on page 4-5.

RQ-0001

Explanation: Request Count (Find Frame Count). The number (in hexadecimal) of Find frames that have been transmitted. An excessive request count (greater than 10, for instance) indicates that the Loading Device is either not present or is congested.

SF-0001

Explanation: SEND.FILE.REQUEST Frame Count. The number of SEND.FILE.REQUEST frames that have been transmitted. An excessive SEND.FILE.REQUEST frame count (greater than 10, for instance) indicates that the Loading Device is not responding after having been found.

SN-0023

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

DS-0080

Explanation: DLC Status. The message provided by the adapter if an unexpected Data Link Control (DLC) condition occurs.

The values displayed are useful to the person writing the Loader Program or for analysis of a complex Data Link Control problem on the network. Some values may be displayed that are a combination of the values listed below.

| Value | Meaning | Load Requestor Action |
|-------|-------------------------------|--|
| 8000 | Link lost | Issue a close station CCB |
| 4000 | DM or DISC | Issue a close station CCB |
| 2000 | FRMR received | Issue a close station CCB and alert frames |
| 1000 | FRMR sent | Issue a close station CCB and alert frames |
| 0800 | SABME received | Issue a connect station CCB |
| 0400 | SABME received, link opened | Issue a connect station CCB |
| 0200 | Remote is busy | Ignore |
| 0100 | Remote not busy | Ignore |
| 0080 | Inactivity Timer (Ti) expired | Ignore |
| 0040 | DLC overflow | Ignore |
| 0020 | Priority change | Ignore |
| 0001 | Local busy | Not set by requestor |

RS-0040

Explanation: Ring Status. This field displays a code indicating the status of the ring. The field will be highlighted if the operation cannot continue; it will not be highlighted if processing can continue. For more information, see "Ring Status Error" on page 4-5.

PC-4020

Explanation: Personal Computer or Personal System/2 error. This field displays an error code indicating that the adapter has difficulty in functioning with the computer. In most cases the screen will be frozen and this field will be highlighted because the adapter cannot continue. For more information, see "PC Error" on page 4-6.

AC-0040 0000 0000 0000

Explanation: Adapter Check. The adapter has detected an internal error and cannot continue.

Restart your computer. If this problem persists, have your system unit, with the adapter, serviced. Record the adapter check code to give to the service person when the system unit is serviced.

The Load Requestor

The Load Requestor function:

- Opens the adapter and attaches to the network
- Attempts to locate a Loading Device
- Issues a SEND.FILE.REQUEST frame for the Bootstrap Program
- Places the frames of the Bootstrap Program in memory at locations specified in the frames or in sequential default locations
- Verifies the correct sequence and receipt of each frame
- Re-requests lost or missing frames
- Transfers control to a specified memory location or default location after the last frame is received and placed in memory
- Terminates itself when control is transferred to the Bootstrap Program.

The Adapter Support Subset

The Adapter Support Subset (a part of the Remote Program Load Module) consists of a modified version of the Adapter Support code¹ used by the adapter. This version of the Adapter Support code is designed to operate only with Remote Program Load. It cannot be used for any other purpose. The major differences between the Adapter Support Subset and the Adapter Support code are described in this section.

Commands Used

All commands used by the Adapter Support Subset are listed here. See the *IBM Token-Ring Network PC Adapter Technical Reference* for the meaning of each command.

¹ The Adapter Support code is provided by the Adapter Support Interface shipped with the IBM Token-Ring Network PC Adapter or Adapter II or by the IBM Local Area Network Support Program.

The Limited Command Set

The following are the only commands provided with the limited capabilities of the Adapter Support Subset. Commands identified as “modified” have been changed for Remote Program Load from the same commands in the full Adapter Support code.

| Hex Value | Command Name |
|-----------|--|
| X'00' | DIR.INTERRUPT |
| X'03' | DIR.OPEN.ADAPTER (modified) |
| X'04' | DIR.CLOSE.ADAPTER (modified) |
| X'06' | DIR.SET.GROUP.ADDRESS |
| X'07' | DIR.SET.FUNCTIONAL.ADDRESS |
| X'0A' | TRANSMIT.DIR.FRAME (modified) |
| X'0B' | TRANSMIT.I.FRAME (modified) |
| X'0D' | TRANSMIT.UI.FRAME (modified) |
| X'0E' | TRANSMIT.XID.CMD (modified) |
| X'0F' | TRANSMIT.XID.RESP.FINAL (modified) |
| X'10' | TRANSMIT.XID.RESP.NOT.FINAL (modified) |
| X'11' | TRANSMIT.TEST.FRAME (modified) |
| X'14' | DLC.RESET (modified) |
| X'15' | DLC.OPEN.SAP (modified) |
| X'16' | DLC.CLOSE.SAP (modified) |
| X'19' | DLC.OPEN.STATION |
| X'1A' | DLC.CLOSE.STATION |
| X'1B' | DLC.CONNECT.STATION |
| X'1C' | DLC.MODIFY |
| X'1D' | DLC.FLOW.CONTROL |
| X'22' | DIR.TIMER.SET |
| X'23' | DIR.TIMER.CANCEL |
| X'29' | RECEIVE.CANCEL (modified) |
| X'2A' | RECEIVE.MODIFY (modified) |
| X'2C' | DIR.CANCEL.TIMER.GROUP |

Commands Not Used

The following commands are not supported by the limited capabilities of the Adapter Support Subset. If any of these commands is issued by the Bootstrap Program before a complete version of the Adapter Support code is installed in the computer, the adapter will hang and operator intervention will be required to correct the problem.

| Hex Value | Command Name |
|-----------|--------------------------|
| X'01' | DIR.MODIFY.OPEN.PARMS |
| X'02' | DIR.RESTORE.OPEN.PARMS |
| X'05' | DIR.IMPL.ENABLE |
| X'08' | DIR.READ.LOG |
| X'09' | SET.BRIDGE.PARAMETERS |
| X'0C' | DIR.CONFIGURE.BRIDGE.RAM |
| X'12' | Reserved |
| X'13' | Reserved |
| X'17' | Reserved |
| X'18' | Reserved |
| X'1E' | DLC.STATISTICS |
| X'1F' | Reserved |
| X'20' | DIR.INITIALIZE |
| X'21' | DIR.STATUS |
| X'24' | PDT.TRACE.ON |
| X'25' | PDT.TRACE.OFF |
| X'26' | GET.BUFFER |
| X'27' | FREE.BUFFER |
| X'28' | RECEIVE |
| X'2B' | DEFINE.MIF.ENVIRONMENT |
| X'2D' | SET.USER.APPENDAGE |
| X'2E' | BEGIN.FRAME.PASSING |
| X'2F' | END.FRAME.PASSING |

Adapter Support Subset Details

- Entry Point

The entry point to the Adapter Support Subset will be provided in INT X'FD'. INT X'5C' will not be used by Remote Program Load.

- Shared RAM Address

The Remote Program Load Module will force the Shared RAM Address for the IBM Token-Ring Network PC Adapter and Adapter II to be X'D800'. The value for those adapters cannot be selected or changed by user code.

For the IBM Token-Ring Network Adapter/A, the Shared RAM Address is configurable using the IBM Personal System/2 Reference Diskette.

- Return Codes

The following Return Codes are suppressed in the Adapter Support Subset:

- X'03' Adapter open, should be closed.
- X'04' Adapter closed, should be open.
- X'07' Command canceled, unrecoverable failure.
- X'09' Adapter not initialized, should be initialized.
- X'0B' Command canceled, adapter closed.
- X'1B' CCB_PARM_TAB pointer 0-1024.
- X'1C' Invalid pointer in the CCB_PARM_TAB.
- X'1D' Invalid CCB_ADAPTER value.

- CCB_ADAPTER

This field is ignored in all CCB commands. It is used as an internal work area by the Adapter Support Subset.

- STATION_ID

The STATION_ID is not validated by the Adapter Support Subset. A value of 00xx indicates the DIRECT station, xx00 indicates the SAP station 0100, and xxxy indicates the LINK station 0101.

- Appendages

CCB_CMD_CMPL: The Command Completion appendage is taken only as a result of a hardware interrupt. It is never taken if the command executes entirely within the processor. Furthermore, if CCB_CMD_CMPL is 0000:0000, the Adapter Support Subset will not return from the INT X'FD' interrupt until the command is complete.

ADAPTER.CHECK.EXIT:

PC.ERROR.EXIT:

RING.STATUS.EXIT:

These appendages cannot be set by user code. They will always point to an internal routine within the Remote Program Load Module. When an Adapter Check, Ring Status, or a PC Error occurs, the Remote Program Load Module will display the error code on the screen.

- DIR.OPEN.ADAPTER

This command will automatically issue DIR.INITIALIZE.ADAPTER before attempting to open the adapter. The CCB_PARM_TAB field is forced to point to an internal parameter table pre-set with the following values:

| PARAMETER NAME | LENGTH (BYTES) | VALUE |
|--------------------|----------------|-----------------------------|
| OPEN_OPTIONS | 02 | X'2000' Disable Soft Errors |
| NODE_ADDRESS | 06 | X'0000 0000 0000' |
| GROUP_ADDRESS | 04 | X'0000 0000' |
| FUNCTIONAL_ADDR | 04 | X'0000 0000' |
| NUMBER_RCV_BUFFERS | 02 | X'0002' |
| RCV_BUFFER_LEN | 02 | X'0180' |
| DHB_BUFFER_LEN | 02 | X'00F0' |
| DATA_HOLD_BUF | 01 | X'01' |
| DLC_MAX_SAP | 01 | X'01' |
| DLC_MAX_STATIONS | 01 | X'01' |
| DLC_MAX_GSAP | 01 | X'00' |
| DLC_MAX_GSAP_MEMS | 01 | X'00' |
| DLC_T1_TICK_ONE | 01 | X'00' |
| DLC_T2_TICK_ONE | 01 | X'00' |

| PARAMETER NAME | LENGTH (BYTES) | VALUE |
|-----------------|----------------|------------|
| DLC_TI_TICK_ONE | 01 | X'00' |
| DLC_T1_TICK_TWO | 01 | X'00' |
| DLC_T2_TICK_TWO | 01 | X'00' |
| DLC_TI_TICK_TWO | 01 | X'00' |
| PRODUCT_ID | 18 | ALL X'00's |

- **DLC.OPEN.SAP**

The Load Requestor issues this command with the following parameters. When this command is issued to the Adapter Support code, the parameters marked as "Ignored" or "Not Used" are ignored or not used even though the Load Requestor may have specified them.

| OFF-SET | PARAMETER NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|----------------|----------------|-----------|------------------------|
| 00 | STATION_ID | 02 | DW | X'0100' = STATION_ID |
| 02 | USER_STAT | 02 | DW | Not Used. |
| 04 | TIMER_T1 | 01 | DB | X'02' = Rsp Timer |
| 05 | TIMER_T2 | 01 | DB | X'01' = Ack Timer |
| 06 | TIMER_Ti | 01 | DB | X'0A' = Inact Timer |
| 07 | MAXOUT | 01 | DB | X'08' |
| 08 | MAXIN | 01 | DB | X'08' |
| 09 | MAXOUT_INCR | 01 | DB | X'00' |
| 10 | MAX_RETRY | 01 | DB | X'00' |
| 11 | MAX_MEMBERS | 01 | DB | X'00' |
| 12 | MAX_I_FIELD | 02 | DW | X'0800' |
| 14 | SAP_VALUE | 01 | DB | X'FC' |
| 15 | OPTIONS | 01 | DB | X'04' = Individual SAP |
| 16 | STN_COUNT | 01 | DB | X'01' |
| 17 | Reserved | 02 | DB | X'0000' |
| 19 | GROUP_COUNT | 01 | DB | X'00' |
| 20 | GROUP_LIST | 04 | DD | X'0000 0000' |
| 24 | DLC_STATUS | 04 | DD | Internal routine |
| 28 | DLC_BUF_SIZ | 02 | DW | Ignored |
| 30 | POOL_LENGTH | 02 | DW | Ignored |
| 32 | POOL_ADDR | 02 | DW | Ignored |

- **DIR.CLOSE.ADAPTER**

This command will turn off the adapter, remove the Adapter Support Subset from the operational environment, and blank the display screen.

- **DLC.RESET**

The STATION_ID parameter for this command will be forced to X'0100'.

- **DLC.CLOSE.SAP**

This command will return a CCB_RETCODE of 0, if there is no SAP open.

- **RECEIVE.MODIFY**

This command will assume the following:

- The first 2 data bytes of every frame indicate the length of the Remote Program Load header in DB format. The most significant byte appears first.
- The STATION.ID is specified at offset 12 of the CCB. There is no parameter table pointer. The RECEIVE.MODIFY is accepted by the Adapter Support Subset even if the station is not open.
- The RECEIVED.DATA appendage is never taken.
- USER.LENGTH is 0000. The RECEIVE.MODIFY will ignore USER.LENGTH.

- The CCB_CMD_CMPL appendage will be called in lieu of SUBROUTINE@. When this appendage gets control, the following interface is provided:
 - AX = 0000. The CCB_RETCODE is ALWAYS an implied 00.
 - CX = 0000.
 - DX = The number of bytes left in the frame.
 - SS = ES = Adapter Support Subset Work Area Segment = 0000.
 - BP = Adapter Support Subset Work Area Offset + 128.
 - ES:BX = Receive Data SAP Buffer @.
 - DS:SI = RECEIVE.MODIFY CCB @.
 - ES:DI = Offset 58 of the Receive Data SAP Buffer. This is the beginning of the RCVD DATA field.
 - The subroutine MUST ISSUE an IRET to return to the Adapter Support code. On return, the following interface is assumed:
 - AL is 00 means ES:DI contains a valid memory address, CX indicates the number of bytes to move. Remote Program Load will convert ES:DI so that the data moved can cross segment boundaries.
 - AL not 00 means discard the rest of the data. At no time should the application issue BUFFER.FREE.

- RECEIVE.CANCEL

If there is no receive outstanding, this command will return a CCB_RETCODE of zero (0).

- Transmit Commands

The Remote Program Load Module will automatically retry all transmit commands two times if the return code given by the IBM Token-Ring Network adapter is one of the following:

X'22' - Error on frame transmission - check TRANSMIT.PCFE data.

X'23' - Error in frame transmit or strip process.

If the error persists after two times, the Remote Program Load Module will perform error recovery on a per-transmit basis.

The following assumptions are made about the CCB Parameter Table of ALL transmit commands:

XMIT.QUEUE.ONE: This field is assumed to be 0000:0000 and is ignored by the Adapter Support Subset.

XMIT.QUEUE.TWO: This field is assumed to be 0000:0000 and is ignored by the Adapter Support Subset.

BUFFER.LEN.ONE: This field contains the length of **BUFFER.ONE**, which is assumed to point to a properly formatted LAN header.

BUFFER.LEN.TWO: This field contains the length of **BUFFER.TWO**.

BUFFER.ONE: This field is assumed to point to a properly formatted LAN header. This field is ignored if **CCB_COMMAND** is **XMIT.I.FRAME**.

BUFFER.TWO: This field points to the data the user wishes to transmit. If **CCB_COMMAND** is **XMIT.I.FRAME**, this is the only data that is given to the IBM Token-Ring Network adapter.

RAM Space

The Remote Program Load Module alters RAM (Random Access Memory) from X'0000:0000' to X'0000:0C00' (segment X'0000' offset X'0000' to segment X'0000' offset X'0C00'). This area is initialized by the Remote Program Load Module when it gets control. It is also used as the Remote Program Load stack space. At offset X'0600' is a block of control information that may be used by the Bootstrap Program when it takes control (segment X'0000'). Each parameter is explained on the following pages.

| OFF-SET | PARAMETER NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|----------------|----------------|-----------|---|
| 0600 | WORK_AREA | 98 | DB | The Remote Program Load Module variable work area |
| 0662 | ADP_FLG0 | 1 | DB | Adapter flag zero |
| 0663 | ADP_FLG1 | 1 | DB | Adapter flag one |
| 0664 | ALERT_CODE | 1 | DB | Temporary save area for PROGRAM.ALERT frame code |
| 0665 | TIMER | 1 | DB | Countdown timer |
| 0666 | USER_TMR | 1 | DB | Available user timer |
| 0667 | BRING_UP | 1 | DB | Bring-up error code |
| 0668 | FRAME_HDR | 32 | DB | LAN header for transmit |
| 0688 | NEXT_ADDR | 4 | DD | Next contiguous address for FILE.DATA.RESPONSE |
| 068C | XFER_ADDR | 4 | DD | Transfer control address |
| 0690 | XMIT_PARMS | 24 | DB | Transmit CCB parameter table |
| 06A8 | FRAME_SKEL | 174 | DB | FIND/SEND.FILE.REQUEST skel-eton |
| 0756 | RCV_BUFFER | 232 | DB | RECEIVE.MODIFY data buffer |
| 083E | USER_WORK | 130 | DB | Available user work area |
| 08C0 | CCB_WORK | 64 | DB | Remote Program Load CCB work area |
| 0900 | STACK | 512 | DB | Remote Program Load stack area |
| 0B00 | USER_STCK | 256 | DB | Optional user stack area |

WORK_AREA

Explanation: A work area reserved for the Remote Program Load variables. This field must not be modified by any program using the Remote Program Load.

ADP_FLG0

Explanation: A bit-significant flag used to control the Adapter Support Subset execution environment. The bits are:

| Bit | Meaning |
|--------------|--|
| 7 (X'80') | This bit is set by the Remote Program Load when it receives a FOUND frame in response to a FIND frame. It should not be altered by the Bootstrap Program. |
| 6 (X'40') | This bit is set by the Remote Program Load when it receives a valid FILE.DATA.RESPONSE frame. It will be zero (0) when the Bootstrap Program gets control. |
| 5 (X'20') | This bit will force a Remote Program Load restart on the next adapter interrupt. The restart will occur regardless of the state of any other bits in ADP_FLG0 or ADP_FLG1. It will be zero (0) when the Bootstrap Program gets control. |
| 4 (X'10') | This bit will force the Remote Program Load to go into the PROGRAM.ALERT sequence after the next adapter interrupt. This bit will be zero (0) when the Bootstrap Program gets control. FRAME_SKEL is assumed to contain the PROGRAM.ALERT frame. The Remote Program Load will issue PROGRAM.ALERT frames at 10-second intervals until bit 5 of this flag is on. If bit 5 does not come on within three minutes, the Remote Program Load will generate a restart condition. Note that this bit has priority over bit 3. |
| 3 (X'08') | This bit will force the Remote Program Load to send a SEND.FILE.REQUEST frame after the next adapter interrupt. FRAME_SKEL is assumed to contain the SEND.FILE.REQUEST frame. SEND.FILE.REQUEST frames will be sent at 10-second intervals until bit 6 of this field is on. If bit 6 does not come on within three minutes, the Remote Program Load will generate a restart condition. This bit will be zero when the Bootstrap Program gets control. |
| 2 (X'04') | This bit is used internally by the Remote Program Load and must not be altered by any program using the Remote Program Load. |
| 1 (X'02') | This bit is set by the Remote Program Load to indicate that it is in the PROGRAM.ALERT sequence. This field must not be modified by the Bootstrap Program. |
| 0 (X'01') | This bit is set by the Remote Program Load to indicate that it is in the SEND.FILE.REQUEST sequence. This field must not be modified by the Bootstrap Program. |

ADP_FLG1

Explanation: A bit-significant flag used to control the Remote Program Load Adapter Support Subset operating environment. The bits are:

| Bit | Meaning |
|--------------|--|
| 7 (X'80') | This bit is set by the Remote Program Load when it receives an end of file on a FILE.DATA.RESPONSE frame. It will be zero (0) when the Bootstrap Program gets control. The Remote Program Load RECEIVE.MODIFY routine will discard all FILE.DATA.RESPONSE frames until this bit is zero. |
| 6 (X'40') | This bit is used internally by the Remote Program Load and must not be altered by any program using the Remote Program Load. |
| 5 (X'20') | This bit will suspend the Remote Program Load RECEIVE.MODIFY command from processing any frames. Any frames received while this bit is on are discarded. This bit will be on (1) when the Bootstrap Program gets control. It must be set to zero (0) to activate the Remote Program Load RECEIVE.MODIFY routine. |
| 4 (X'10') | This bit is used by the Adapter Support Subset to control the display I/O. The Adapter Support Subset will not issue INT X'10' while this bit is on unless an unrecoverable problem is detected. If such a problem is detected, the Adapter Support Subset displays the highlighted error and goes into a hard loop. It may be set by the Bootstrap Program to turn off the Adapter Support Subset display. It will be zero (0) when the Bootstrap Program gets control. |
| 3 (X'08') | This bit causes the Adapter Support Subset to transfer control to the address in the XFER_ADDR field at the end of the next adapter interrupt. It will be zero (0) when the Bootstrap Program gets control. Note that the transfer control is not taken until bits 5, 4, 3, 1, and 0 of the ADP_FLG0 are all zero. If XFER_ADDR is 0000:0000 this bit is ignored by the Adapter Support Subset. |
| 2 (X'04') | This bit is used internally by the Remote Program Load and must not be altered by any program using the Remote Program Load. |
| 1 (X'02') | This bit is used internally by the Remote Program Load and must not be altered by any program using the Remote Program Load. |
| 0 (X'01') | This bit is used internally by the Remote Program Load and must not be altered by any program using the Remote Program Load. |

ALERT_CODE

Explanation: A temporary ALERT_CODE save area. The Remote Program Load will move this value to the PROGRAM.ALERT frame when it detects bit 4 on in the ADP_FLG0 field. The PROGRAM.ALERT frame will be built from the FRAME_SKEL at offset X'06A8'.

LOADR_TMR

Explanation: An internal timer used by the Remote Program Load to update the elapsed time on the screen. This field should not be altered by any program using the Remote Program Load.

USER_TMR

Explanation: A 1-byte field available to the Bootstrap Program to time events. This variable will be incremented by 1 every 100 milliseconds. The Remote Program Load uses this field to time the FIND, SEND.FILE.REQUEST, and PROGRAM.ALERT frames.

BRING_UP

Explanation: The adapter bring-up code. This field is set by the Remote Program Load after the adapter has been initialized. This value will be 00 when the Bootstrap Program gets control. It is not used by the Remote Program Load after the loaded program gets control.

FRAME_HDR

Explanation: A LAN header built by the Remote Program Load. It contains 2 bytes of control fields, 6 bytes of destination address, 6 bytes of source address, and up to 18 bytes of routing information. Remote Program Load points to this header when it is transmitting Unnumbered Information (UI) frames to the Loader Device.

NEXT_ADDR

Explanation: The next contiguous memory address for placing FILE.DATA.RESPONSE data. The Remote Program Load updates this field on every valid FILE.DATA.RESPONSE frame received. When the Bootstrap Program gets control, this field will be set to 0000:0000. It must be set to an address greater than 0000:0C00 prior to activating the Remote Program Load RECEIVE.MODIFY Subroutine.

XFER_ADDR

Explanation: When the Bootstrap Program gets control, this field points to an internal Remote Program Load routine which emulates an INT X'19' call.

XMIT_PARMS

Explanation: The transmit CCB parameter table. See the *IBM Token-Ring Network PC Adapter Technical Reference*.

FRAME_SKEL

Explanation: The FIND, SEND.FILE.REQUEST, and PROGRAM.ALERT frame skeleton. When the Bootstrap Program gets control, this skeleton will be filled with an appropriate SEND.FILE.REQUEST frame.

RCV_BUFFER

Explanation: This buffer is used to copy all frame headers sent to SAP X'FC'. Its format is described in the *IBM Token-Ring Network PC Adapter Technical Reference*. This field should not be altered by any program using the Remote Program Load.

USER_WORK

Explanation: When the Bootstrap Program gets control, this field will be X'00'. It may be used by the program as a work area. It is not used by the Remote Program Load or the Adapter Support Subset.

CCB_WORK

Explanation: The Remote Program Load work area. This field must not be altered by any program using the Remote Program Load.

STACK

Explanation: The Remote Program Load and Adapter Support Subset stack.

USER_STCK

Explanation: Optional stack area. The Bootstrap Program may use this for stack space if desired.

The Disk Emulator

After the Remote Program Load Module gets control, it will redirect all INT X'13' calls to a disk emulator program provided by the Remote Program Load Module. This allows the computer to simulate a diskette drive in memory, or override the use of an existing drive. This function remains active after the Remote Program Load functions have completed.

Disk Emulator Installation

The Remote Program Load Module performs the following steps to install the disk emulator program:

1. Save the original contents of INT X'13' in INT X'18' (0000:0060).
2. Redirect INT X'13' to point to a disk emulator in the Remote Program Load Module.
3. Initialize 0000:0120 to zero. All INT X'13' commands to drive zero will be rejected until 0000:0120 is set to a value greater than X'1000:0000' (64K).

Operational Requirements

1. The code is enabled during the Remote Program Load mode, which receives control when INT X'18' is invoked.
2. I/O requests to drives other than BIOS (Basic Input/Output System) drive zero are passed to the original INT X'13' call.
3. INT X'18' vector (0000:0060) will be used to save the contents of the original INT X'13' vector. It must not be altered.

4. 0000:0120 is reserved for the address of the start of the diskette image header in RAM. The diskette image must not be located above the 640 Kb boundary. This vector must be set up by the Bootstrap Program application code before the first INT X'13' is issued. It is assumed to point to a diskette image header followed by a diskette image having the following structure:

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|-------------|----------------|-----------|--------------------------------------|
| 0 | Heads | 1 | DB | Number of Heads = h |
| 1 | Tracks | 1 | DB | Number of Tracks per Head = t |
| 2 | Sectors | 1 | DB | Number of Sectors per Head = s |
| 3 | Sector.Size | 2 | DW | Number of Bytes per Sector = ss |
| 5 | Status | 1 | DB | Diskette Status Byte |
| 6 | Image.Data | ss | DB | Head (0). Track (0). Sector (1). |
| | | ss | DB | Head (0). Track (0). Sector (s). |
| | | ss | DB | Head (0). Track (1). Sector (1). |
| | | ss | DB | Head (0). Track (1). Sector (s). |
| | | ss | DB | Head (0). Track (t-1). Sector (1). |
| | | ss | DB | Head (1). Track (0). Sector (1). |
| | | ss | DB | Head (1). Track (1). Sector (1). |
| | | ss | DB | Head (1). Track (t-1). Sector (1). |
| | | ss | DB | Head (0). Track (t-1). Sector (s). |
| | | ss | DB | Head (h-1). Track (t-1). Sector (s). |

Disk Emulator Usability

The Disk Emulator Program is designed so that code written to use the IBM BIOS INT X'13' interface does not need to be altered. I/O Requests for drives other than drive zero are passed on to the original INT X'13' vector. Requests to drive zero are made exactly as they would be to the BIOS diskette I/O code with the following exceptions:

- Reset Requests (AH = 00) are ignored. The return code is set to indicate successful command completion.
- Status Requests (AH = 01) are implemented to give the current status of the disk emulator.
- Read Requests (AH = 02) are implemented to return to the user the contents of the sector(s) requested.

- Write Requests (AH = 03) are implemented to update the RAM disk with the contents of the user supplied data. Note that the updates are not preserved if the user restarts or powers off the machine.
- Verify Requests (AH = 04) are ignored. The return code is set to indicate successful command completion.
- Format Requests (AH = 05) are not honored. The return code is set to indicate an invalid command.
- Unknown Functions (AH > 05) are not honored. The return code is set to indicate an invalid command.

The Bootstrap Program

The Bootstrap Program may use the Adapter Support Subset to download an operating system, other application programs, or a combination of both. The following considerations are given for this interface:

- System Environment

The computer's Basic Input/Output System (BIOS) will be initialized. The display will be active; the Remote Program Load Module will continue to update the display as defined in "Requesting Device Display Screen."

- Adapter Environment

When the Bootstrap Program acquires control, the IBM Token-Ring Network adapter will be in the following state:

- The adapter will be open. DIR.OPEN.ADAPTER parameters are given in the table below.

| PARAMETER NAME | LENGTH (BYTES) | VALUE |
|--------------------|----------------|-----------------------------|
| OPEN_OPTIONS | 02 | X'2000' Disable Soft Errors |
| NODE_ADDRESS | 06 | X'0000 0000 0000' |
| GROUP_ADDRESS | 04 | X'0000 0000' |
| FUNCTIONAL_ADDR | 04 | X'0000 0000' |
| NUMBER_RCV_BUFFERS | 02 | X'0002' |
| RCV_BUFFER_LEN | 02 | X'0180' |
| DHB_BUFFER_LEN | 02 | X'00F0' |
| DATA_HOLD_BUF | 01 | X'01' |
| DLC_MAX_SAP | 01 | X'01' |
| DLC_MAX_STATIONS | 01 | X'01' |
| DLC_MAX_GSAP | 01 | X'00' |
| DLC_MAX_GSAP_MEMS | 01 | X'00' |
| DLC_T1_TICK_ONE | 01 | X'00' |
| DLC_T2_TICK_ONE | 01 | X'00' |
| DLC_TI_TICK_ONE | 01 | X'00' |
| DLC_T1_TICK_TWO | 01 | X'00' |
| DLC_T2_TICK_TWO | 01 | X'00' |
| DLC_TI_TICK_TWO | 01 | X'00' |
| PRODUCT_ID | 18 | ALL X'00's |

- The DLC.OPEN.SAP will be active. The parameters used for the DLC.OPEN.SAP are given in the table below.

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|-------------|----------------|-----------|------------------------|
| 00 | STATION_ID | 02 | DW | X'0100' = STATION_ID |
| 02 | USER_STAT | 02 | DW | Not Used. |
| 04 | TIMER_T1 | 01 | DB | X'02' = Rsp Timer |
| 05 | TIMER_T2 | 01 | DB | X'01' = Ack Timer |
| 06 | TIMER_Ti | 01 | DB | X'0A' = Inact Timer |
| 07 | MAXOUT | 01 | DB | X'08' |
| 08 | MAXIN | 01 | DB | X'08' |
| 09 | MAXOUT_INCR | 01 | DB | X'00' |
| 10 | MAX_RETRY | 01 | DB | X'00' |
| 11 | MAX_MEMBERS | 01 | DB | X'00' |
| 12 | MAX_I_FIELD | 02 | DW | X'0800' |
| 14 | SAP_VALUE | 01 | DB | X'FC' |
| 15 | OPTIONS | 01 | DB | X'04' = Individual SAP |
| 16 | STN_COUNT | 01 | DB | X'01' |
| 17 | Reserved | 02 | DB | X'0000' |
| 19 | GROUP_COUNT | 01 | DB | X'00' |
| 20 | GROUP_LIST | 04 | DD | X'0000 0000' |
| 24 | DLC_STATUS | 04 | DD | Internal routine |
| 28 | DLC_BUF_SIZ | 02 | DW | Ignored |
| 30 | POOL_LENGTH | 02 | DW | Ignored |
| 32 | POOL_ADDR | 02 | DW | Ignored |

- The DLC.OPEN.STATION will not be active. The Bootstrap Program will have one link station to use if it wishes to use IEEE 802.2 Type 2 services. It must activate this service by issuing a DLC.OPEN.STATION and a DLC.CONNECT.STATION.
- The DIR.SET.GROUP.ADDRESS and DIR.SET.FUNCTIONAL.ADDRESS will not be active. The Remote Program Load Module will set the Group Address to 0000:0000 prior to giving control to the Bootstrap Program.
- The Remote Program Load Module RECEIVE.MODIFY will be in a suspended state when the Bootstrap Program gets control. To activate the SAP, the Bootstrap Program must reset bit 5 of the ADP_FLG1 to zero. This command will use LOCATE_ADDR and XFER_ADDR of the FILE.DATA.RESPONSE frame to locate each frame it receives. If the programmer wishes to override this

RECEIVE.MODIFY, the Bootstrap Program may issue its own RECEIVE.MODIFY. RECEIVE.CANCEL is not required.

The parameter NEXT_ADDR in the Remote Program Load Module work area may be re-initialized by the Bootstrap Program to set the default for the next contiguous address to use. The Remote Program Load Module sets this value to 0000:0000 before giving control to the Bootstrap Program. If the Bootstrap Program uses the Remote Program Load Module RECEIVE.MODIFY without setting the NEXT_ADDR to a valid value, the Adapter Support Subset will detect a MEMORY OVERRUN condition and issue program alert frames.

The parameter XFER_ADDR in the Remote Program Load Module work area may be re-initialized by the Bootstrap Program to set the default for transferring control to the operating system. The Remote Program Load Module sets this value to point to an internal routine that performs an INT X'13' to read the diskette image Bootstrap Program from a previously downloaded diskette image into 0000:7C00 and transfers control to it. The Bootstrap Program may change this value if it wishes to use some other routine to bring up the operating system.

- Locating the Loading Device

On entry to the Bootstrap Program, registers SS:BP will be set up to point to the work area plus 128 bytes. The work area will have all the necessary information required to locate the Loading Device that was used to download the Bootstrap Program. If the Bootstrap Program wishes to use another Loading Device, it must first locate it by sending a FIND.

- Receiving the Operating System

The Remote Program Load Module makes no assumptions about the operating system that is being downloaded. If a derivative of PC DOS is being used, a diskette image of that operating system should be downloaded. If the diskette image is in the format described previously, the Remote Program Load Disk Emulator may be used to start the operating system by issuing the appropriate INT X'13' calls.

- **Transferring Control to the Operating System**

Prior to transferring control to the operating system, the Bootstrap Program must issue a DIR.CLOSE.ADAPTER to the Adapter Support Subset. This command will remove the Adapter Support Subset from the operational environment and clear the screen on the display. Unpredictable results will occur if this is not done.

Note: If you want to use an application program on the IBM Token-Ring Network, the Adapter Support code provided with the IBM Token-Ring Network adapter or from the LAN Support Program should be downloaded as part of the operating system.

Writing the Bootstrap Program

A Bootstrap Program can be written in many different ways. The simplest way to write a Bootstrap Program is to write it as a single-stage program.

The Single-Stage Bootstrap Program

A single-stage Bootstrap Program is contained in a file that also contains the programs and data to be loaded into the Requesting Device. The programs and data may be in the form of a diskette image. This file resides on the Loading Device's fixed disk or diskette (depending upon the size of the file) and is downloaded to the Requesting Device starting at location X'0000:7C00' in response to the initial request sent by the Requesting Device. After this file has been downloaded and control has been transferred to the Bootstrap Program in it, the Bootstrap Program allocates the necessary memory, loads the programs and data from the file into the Requesting Device memory, closes the adapter, and transfers control to the program to be executed in the Requesting Device.

A single-stage Bootstrap Program can be written in a variety of ways, but must be compatible with the Loader Program being used. The following paragraphs describe the sample Bootstrap Program from the Sample Programs diskette, which will work with the sample Loader Program from the Sample Programs diskette.

The README file on the Sample Programs diskette describes how to generate a single-stage Bootstrap Program file. The file in this case consists of the Bootstrap Program from the Sample Programs

diskette followed by a diskette image header and a system diskette image. After this file has been downloaded and control has been transferred to the Bootstrap Program, the sample Bootstrap Program creates a RAM diskette image in the Requesting Device memory and transfers control by performing the following steps:

- Compute the size of the diskette image using the data contained in the diskette image header
- Check memory size
- Reduce memory size by the amount of space required for the diskette image header and diskette image
- Move the diskette image header and diskette image to high memory
- Initialize the pointer to the diskette image header for the Remote Program Load Module disk drive emulator
- Issue a DIR.CLOSE.ADAPTER command
- Transfer control to the program pointed to by XFER_ADDR, which will generate an interrupt X'13' to force a restart from the relocated system diskette image.

The Remote Program Load disk emulator treats the RAM diskette image as drive zero, and the interrupt X'13' will cause the program on the system diskette image to be loaded and executed. If the diskette image that was downloaded is the image of a DOS system diskette, then DOS will be loaded from the diskette image and control will be transferred to it. If the diskette image contains an AUTOEXEC.BAT file, it will automatically be executed and start any programs contained in the diskette image that are specified, including any IBM Token-Ring Network programs, in the same manner as if an actual diskette drive and diskette were used.

The primary disadvantage of the single-stage Bootstrap Program is that the Requesting Device must contain enough memory to contain the RAM diskette image in addition to the memory required to execute the programs contained in the image. If the image of a 360Kb diskette were used, the computer would probably require 640 Kb of memory. On the other hand, if the image of the smaller single-sided, 8-sector, 160Kb diskette were used, the computer might require only 256 Kb of memory.

The Multistage Bootstrap Program

If the single-stage Bootstrap Program described above cannot be used because of memory size restrictions or other special requirements, then a multistage Bootstrap Program must be used. Although a multistage Bootstrap Program is more complex than a single-stage Bootstrap Program, it is also more flexible and can request only the specific files required and does not need to have a complete diskette image downloaded. When a multistage Bootstrap Program is used, the Bootstrap Program is downloaded alone and control is passed to it. It then issues additional SEND.FILE.REQUEST frames to the Loading Device to cause the additional program files to be downloaded to the Requesting Device.

The general flow of the downloading portion of a multistage Bootstrap Program might be similar to the sample below.

```
Let XFER.FLAG = OFF
Let FRAME.SEQ = Zero
Issue a RECEIVE.MODIFY command
Build a SEND.FILE.REQUEST frame
Transmit the SEND.FILE.REQUEST frame
DO UNTIL XFER.FLAG = ON
ENDDO
Issue a DIR.CLOSE.ADAPTER command
Transfer control to the address specified by XFER@
```

The general flow of the receive subroutine used by the Requesting Device might be similar to the following:

```
If FILE.DATA.RESPONSE
  If FRAME.SEQ = SEQ.NUMBER
    Then DO
      FRAME.SEQ = FRAME.SEQ + 1
      If ACK.REQUEST = ON
        Then DO
          Update the SEND.FILE.REQUEST frame
            using FRAME.SEQ
          Transmit the SEND.FILE.REQUEST frame
        ENDDO
      ENDIF
      AL = Zero
      CX = DATA.SIZE
      If LOCATE.ENABLE = ON
        Then ES:DI = LOCATE_ADDR
        Else ES:DI = Next Contiguous Address
      ENDIF
      If END.OF.FILE = ON
        Then DO
          If XFER.ENABLE = ON
            Then XFER@ = XFER_ADDR
            Else XFER@ = Default Value
          ENDIF
          XFER.FLAG = ON
        ENDDO
      ENDIF
    ENDDO
  Else DO
    Update the SEND.FILE.REQUEST frame
      using FRAME.SEQ
    Transmit the SEND.FILE.REQUEST frame
    AL = 255
  ENDDO
ENDIF
RETURN
```

Loader Program

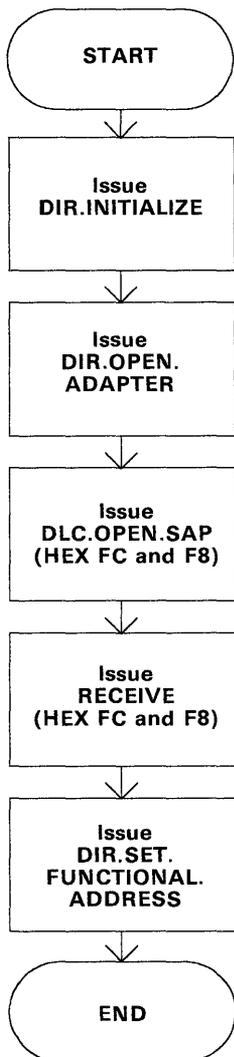
It is assumed the Loader Program will reside in a computer with a fixed disk or diskette drive that is capable of downloading a file or a disk image by responding to the frames from the Requesting Device. The frames are designed to give the programmer maximum flexibility.

The Loading Device must be accessible to the Requesting Device through the IBM Token-Ring Network. Besides this, no other assumption is made as to where the Loading Device is located. It may be located on the same ring or it may be located on another ring connected by a bridge.

The frames are designed to handle more than one Loading Device on the same ring. It is recommended that the Loading Device allocate its resources on a per-request basis and only after receiving the SEND.FILE.REQUEST frame. The Requesting Device will respond to the first FOUND frame it receives and ignore the others. (See "Multiple Loading Devices" on page 3-50.)

Sample Loader Flow Charts

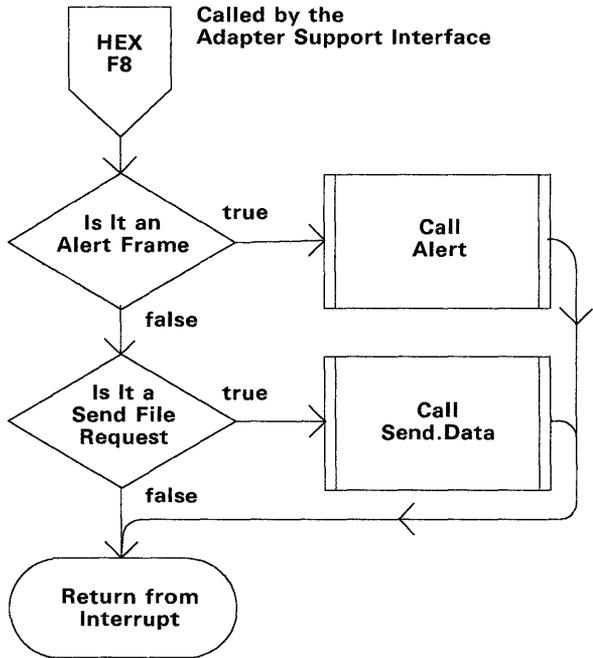
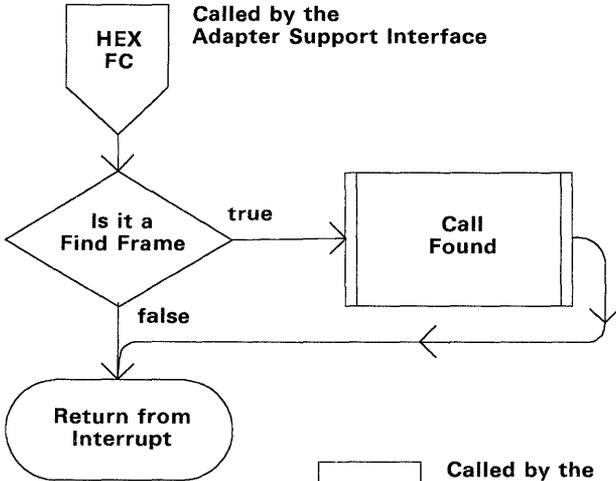
Initialization Code



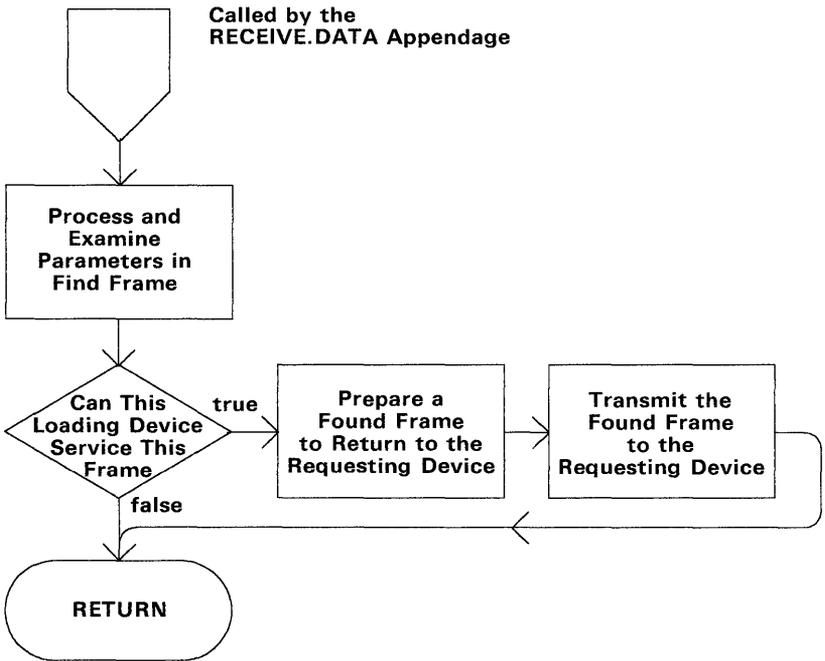
All Remote Program Load frames issued by Requesting Devices will be processed by the RECEIVE.DATA appendage which is set by the Receive command. RECEIVE.DATA is given control by the Adapter Support code.

RECEIVE.DATA Appendage

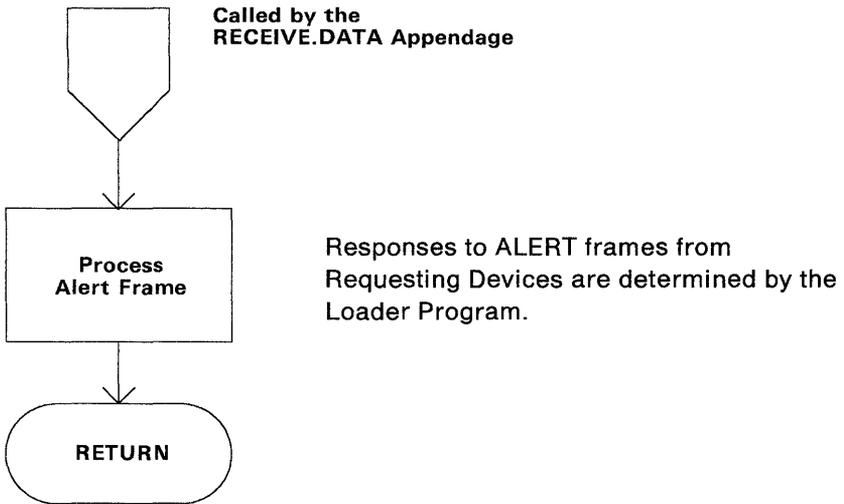
The Adapter Support code invokes this code when it has data for either of the Service Access Points opened by DLC.OPEN.SAP in the initialization code.



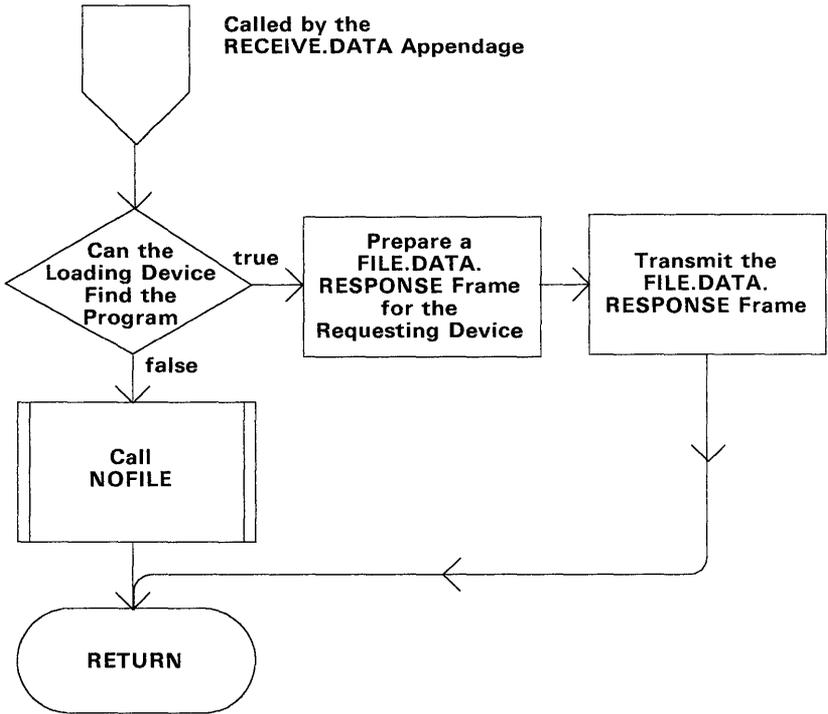
FOUND



ALERT

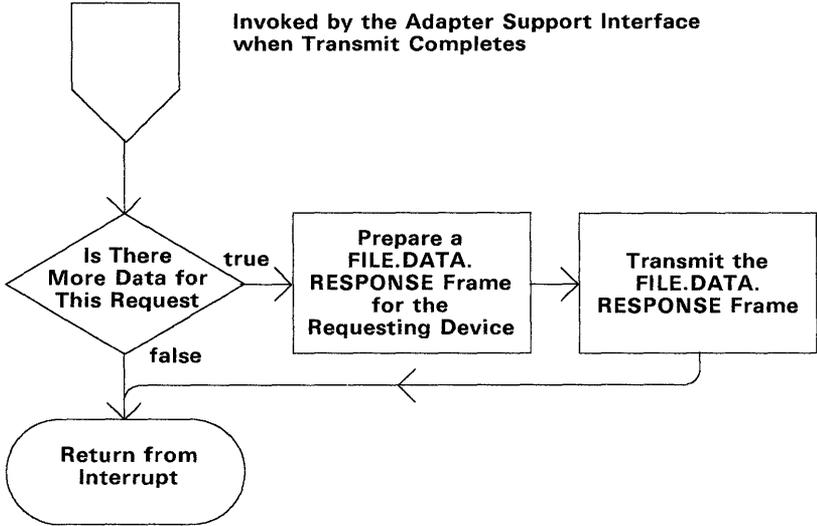


SENDFILE.DATA

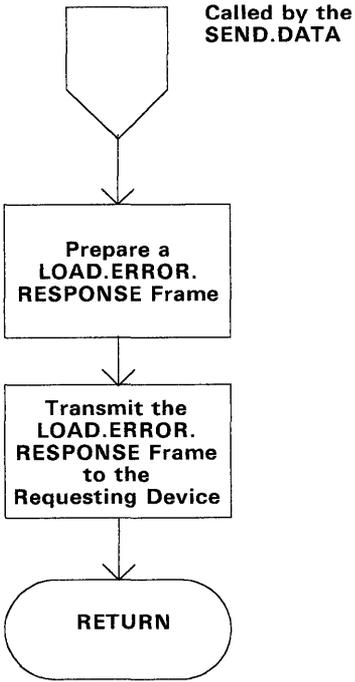


Subsequent FILE.DATA.RESPONSE frames for this request will be handled by the appendage TRN_APPEN defined in the TRANSMIT command.

TRN_APPEN



NOFILE



Options Available with Remote Program Load

The following sections list some of the options available to the programmer and the user.

Multiple Loading Devices

For increased performance on the ring, multiple Loading Devices may be used. The FIND frame transmitted by the Remote Program Load Module uses the functional address X'40000000'. If multiple Loading Devices are programmed to respond to this address, they all will respond to the FIND. The first response that is returned to the Requesting Device is the one that will be used. If the Loader Program allocates any resources as a result of a FIND frame, it is the Loader Program's responsibility to free them up after a suitable timeout period.

Make sure all Loading Devices have the same resources, or make sure the Loader Program knows which Requesting Device to respond to.

Multiple Adapters

Multiple adapters with the Remote Program Load Module may be installed in one computer, but only the one with the highest ROM setting will be used.

Multiple Rings

Multiple rings may be used with Remote Program Load. When the Loading Device and the Requesting Device are on different rings, the rings must be connected with bridges.

Type of Service

Two types of service can be used. IEEE 802.2 Type 1 Service is recommended. It allows FILE.DATA.RESPONSE frames to be sent by an Unnumbered Information frame to a specific address. IEEE 802.2 Type 2 Service is also available. Below are two sample flow diagrams showing the possible differences in the two types of service.

Type 1 Service Example

This sequence allows the Requesting Device to determine the node address of the Loading Device. It is used if the Requesting Device wishes to have FILE.DATA.RESPONSE frames sent by an Unnumbered Information frame to a specific address. Type 1 Service can also be used to send a Broadcast frame to a Group or Functional Address.

This flow diagram shows the Loading Device responding by sending Unnumbered Information frames to a specific address. If a Group Address is substituted for the specific address, the flow diagram can also be used to describe Broadcast. It also gives an example of what the Requesting Device should do if it gets a sequence number out of sequence.

| <u>Loading Device</u> | <u>Requesting Device</u> |
|---------------------------------------|-------------------------------|
| DIR.INITIALIZE | DIR.INITIALIZE |
| DIR.OPEN.ADAPTER | DIR.OPEN.ADAPTER |
| DLC.OPEN.SAP (X'FC' and X'F8') | DLC.OPEN.SAP |
| RECEIVE (X'FC' and X'F8') | RECEIVE.MODIFY |
| DIR.SET.FUNCTIONAL.ADDRESS | XMIT.UI.FRAME(FA) |
| <----- | FIND |
| . | Timeout |
| | XMIT.UI.FRAME(FA) |
| <----- | FIND |
| XMIT.UI.FRAME(SA) | |
| FOUND -----> | |
| | DIR.SET.GROUP.ADDI |
| | XMIT.UI.FRAME(SA) |
| <----- | SEND.FILE.REQUEST(Seq = 0000) |
| . | Timeout |
| | XMIT.UI.FRAME(SA) |
| <----- | SEND.FILE.REQUEST(Seq = 0000) |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0000) -----> | |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0001) -----> | |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0002) ---/ | |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0003) -----> | |
| | XMIT.UI.FRAME(SA) |
| <----- | SEND.FILE.REQUEST(Seq = 0002) |
| . | Timeout |
| | XMIT.UI.FRAME(SA) |
| <----- | SEND.FILE.REQUEST(Seq = 0002) |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0002) -----> | |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0003) -----> | |
| . | |
| . | |
| . | |
| XMIT.UI.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = last) -----> | |
| | Transfer control |
| | to 0000:7C00. |

Type 2 Service Example

| Loading Device | Requesting Device |
|---------------------------------------|-------------------------------|
| DIR.INITIALIZE | DIR.INITIALIZE |
| DIR.OPEN.ADAPTER | DIR.OPEN.ADAPTER |
| DLC.OPEN.SAP (X'FC' and X'F8') | DLC.OPEN.SAP |
| RECEIVE (X'FC' and X'F8') | RECEIVE.MODIFY |
| DIR.SET.FUNCTIONAL.ADDRESS | XMIT.UI.FRAME(FA) |
| <----- | FIND |
| . | Timeout |
| | XMIT.UI.FRAME(FA) |
| <----- | FIND |
| XMIT.UI.FRAME(SA) | |
| FOUND -----> | |
| | XMIT.UI.FRAME(SA) |
| <----- | SEND.FILE.REQUEST(Seq = 0000) |
| DLC.OPEN.STATION | |
| DLC.CONNECT | |
| SABME -----> | |
| | DLC.OPEN.STATION |
| | DLC.CONNECT |
| <----- | UA |
| XMIT.I.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0000) -----> | |
| XMIT.I.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = 0001) -----> | |
| . | |
| . | |
| . | |
| XMIT.I.FRAME(SA) | |
| SEND.FILE.RESPONSE(Seq = last) -----> | |
| DLC.CLOSE.STATION | |
| DISC -----> | |
| | DLC.CLOSE.STATION |
| <----- | UA |
| | Transfer control |
| | to 0000:7C00. |

Frame Formats

All Remote Program Load frames issued by either the Requesting Device or the Loading Device have a similar format. Explanations of the individual fields follow each frame. Here is an example of the header format (Find frame):

1. A LAN header (offset 0 through 15)
2. A DLC header (offset 16 through 18)
3. The Remote Program Load header (offset 19 through hh)
4. Any additional data.

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|----------------------------|----------------|-----------|---|
| 0 | AC | 1 | DB | Access Control byte |
| 1 | FC | 1 | DB | Frame Control byte |
| 2 | Destination address | 6 | DB | X'C000 4000 0000' The Remote Program Load Functional address |
| 8 | Source address | 6 | DB | Address of this adapter. The high-order bit must be '1' to specify routing information is included. |
| 14 | Routing information | 2 | DB | X'C200' to specify limited broadcast |
| 16 | Remote SAP | 1 | DB | |
| 17 | Source SAP | 1 | DB | |
| 18 | Control | 1 | DB | X'03' = Control flags for UI frame |
| 19 | Remote Program Load_HEADER | hh | DB | The specific Remote Program Load header content |
| 19 + hh | FILE_DATA | nn | DB | The data provided with a FILE.DATA.RESPONSE frame. |

Below are the Remote Program Load Header formats for each frame:

The Find Frame

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|------------------------|----------------|-----------|---|
| 0 | PROGRAM_LENGTH | 2 | DB | X'0053' + value in first 2 bytes of FILE_HDR |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0001' = FIND |
| 4 | CORR_HDR | 4 | DB | X'0008 4003' = Correlator vector |
| 8 | CORRELATOR | 4 | DB | Correlator |
| 12 | INFO_HDR | 4 | DB | X'0010 0008' = Connect info vector |
| 16 | FRAME_HDR | 4 | DB | X'0006 4009' = Frame size sub-vector |
| 20 | MAX_FRAME | 2 | DB | Maximum frame size |
| 22 | CLASS_HDR | 4 | DB | X'0006 400A' = Connect class sub-vector |
| 26 | CONN_CLASS | 2 | DB | Defines the type of service |
| 28 | SOURCE_HDR | 4 | DB | X'000A 4006' = Address vector |
| 32 | SOURCE_ADDR | 6 | DB | Ring address of this adapter |
| 38 | LSAP_HDR | 4 | DB | X'0005 4007' = Logical SAP vector |
| 42 | RSAP | 1 | DB | X'FC' Remote SAP value |
| 43 | SEARCH_HDR | 4 | DB | X'0028 (+FILE_HDR) 0004' = Search vector |
| 47 | LOADER_HDR | 4 | DB | X'0024 C005' = Loader info sub-vector |
| 51 | MACH_CONF | 8 | DB | Configuration obtained from system unit via INT X'15' |
| 59 | EQUIP_FLAGS | 2 | DB | Register AX after INT X'11' |
| 61 | MEMORY_SIZE | 2 | DB | Register AX after INT X'12' |
| 63 | REMOTE PROGRAM LOAD_EC | 8 | DB | Remote Program Load Module level |
| 71 | ADAPTER_ID | 2 | DB | Adapter identifier |
| 73 | ADAPTER_EC | 10 | DB | Adapter level |
| 83 | FILE_HDR | 4 | DB | X'00nn (+04) 4013' = File name sub-vector |
| 87 | FILE_NAME | nn | DB | File name in ASCII |

CORRELATOR

Explanation: This field is not used by the Remote Program Load Module. It is set to X'0000 0000'.

MAX_FRAME

Explanation: The maximum frame size a Requesting Device can handle, including the LAN header, the DLC header, the Remote Program Load header, and all file data. The Remote Program Load Module will set this field to a value of 2040, which is the RCV_BUFFER_LEN set by the DIR.OPEN.ADAPTER minus the 8 bytes of overhead.

CONN_CLASS

Explanation: In a FIND frame this is a 2-byte bit-significant field used to specify the type of service that the Requesting Device supports. The bits are:

| Bit | Function | Meaning |
|------|---------------------------------|---|
| 15-4 | Reserved | Must be 0. |
| 3 | Broadcast to functional address | The Requesting Device can accept Unnumbered Information frames sent to a functional address specified in the FOUND frame. The Remote Program Load Module sets this to 1. |
| 2 | Broadcast to group | The Requesting Device can accept Unnumbered Information frames sent to a group address specified in the FOUND frame. The Remote Program Load Module sets this to 1. |
| 1 | Class II | The Requesting Device can accept information frames using connection-oriented services. The Remote Program Load Module sets this to 1. |
| 0 | Class I | The Requesting Device can accept Unnumbered Information frames sent to this adapter's ring address specified by the SOURCE_ADDR. The Remote Program Load Module sets this to 1. |

SOURCE_ADDR

Explanation: The 6-byte permanently encoded address of the requesting adapter.

RSAP

Explanation: The Service Access Point value which the Loading Device should use to send a FOUND frame. Remote Program Load will set this field to X'FC'.

MACH_CONF

Explanation: The machine configuration of the computer in which the Remote Program Load Module is installed. The system configuration parameters are obtained by issuing an INT X'15' with the AH register containing X'C0'. If the INT resulted in an invalid return code (carry flag = 1) this field will contain the value taken from the computer system BIOS location X'FFFF:000E' followed by 7 bytes of zeros.

EQUIP_FLAGS

Explanation: The equipment flag variable of the computer with the Remote Program Load Module. This variable was obtained by issuing an INT X'11'. See the BIOS section of the *Technical Reference* for your computer.

MEMORY_SIZE

Explanation: The number of contiguous 1K blocks of memory in the computer with the Remote Program Load Module. This variable was obtained by issuing an INT X'12'.

REMOTE PROGRAM LOAD_EC

Explanation: The level of the Remote Program Load Module installed on the adapter. This value will also be displayed on the screen.

ADAPTER_ID

Explanation: This parameter indicates which of the two possible adapter positions this adapter is configured for.

- X'166' indicates the primary position.
- X'167' indicates the alternate position.

ADAPTER_EC

Explanation: The level of the adapter. This value will also be displayed on the screen.

FILE_NAME

Explanation: This field is a left-justified ASCII string specifying a file name. This is an optional field. If it is not present, the SOURCE_ADDR and/or other configuration information is to be used to locate the Bootstrap Program. If it is present, the length (nn) is variable up to a maximum of 80 (decimal) bytes. Normally this field contains an ASCII file name. However, the user may set the first byte of this field to a non-ASCII character (X'80' through 'FF') to specify a user-defined field.

The Found Frame

The FOUND Frame is sent as a UI frame to the SOURCE_ADDR of the FIND Frame with the GENERAL BROADCAST bits in the routing field of the DLC header on.

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|-----------------|----------------|-----------|--|
| 0 | PROGRAM_LENGTH | 2 | DB | X'003A' |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0002' = FOUND |
| 4 | CORR_HEADER | 4 | DB | X'0008 4003' = Correlator vector |
| 8 | CORRELATOR | 4 | DB | Correlator |
| 12 | RESP_HDR | 4 | DB | X'0005 400B' = Response vector |
| 16 | RESP_CODE | 1 | DB | Response code |
| 17 | DEST_HDR | 6 | DB | X'000A 400C' = Set address vector |
| 21 | DEST_ADDR | 6 | DB | Group or ring address of the Requesting Device |
| 27 | SOURCE_HDR | 4 | DB | X'000A 4006' = Loader address vector |
| 31 | SOURCE_ADDR | 6 | DB | Loading Device ring address |
| 37 | INFO_HDR | 4 | DB | X'0010 0008' = Connect info vector |
| 41 | FRAME_HDR | 4 | DB | X'0006 4009' = Frame size sub-vector |
| 45 | MAX_FRAME | 2 | DB | Maximum frame size |
| 47 | CLASS_HDR | 4 | DB | X'0006 400A' = Connect class sub-vector |
| 51 | CONN_CLASS | 2 | DB | Defines the type of service |
| 53 | LSAP_HDR | 4 | DB | X'0005 4007' = Loader SAP vector |
| 57 | RSAP | 1 | DB | X'F8' SAP Value of the Loading Device |

CORRELATOR

Explanation: This field is not used by Remote Program Load. It is set to X'0000 0000'.

RESP_CODE

Explanation: For the FOUND frame this is a reason code for transmitting the frame. This parameter is not used by the Remote Program Load Module.

DEST_ADDR

Explanation: The low-order 4 bytes of this parameter is used as a broadcast address:

- If the CONN_CLASS field bit 2 of the FOUND frame is on (1), it is a Group address.
- If the CONN_CLASS field bit 3 of the FOUND frame is on (1), it is a Functional address.

SOURCE_ADDR

Explanation: The ring address of the Loading Device. The Requesting Device should use this address as the destination address in the SEND.FILE.REQUEST frame.

MAX_FRAME

Explanation: The maximum frame size that will be used for FILE.DATA.RESPONSE frames. This value includes the LAN header, the DLC header, the Remote Program Load header, and the file data.

CONN_CLASS

Explanation: This is a 2-byte bit-significant field used to specify the type of service that the Loading Device will use when sending FILE.DATA.RESPONSE frames. This value from the FOUND frame should be duplicated in the SEND.FILE.REQUEST frame.

RSAP

Explanation: For a FOUND frame, the SAP value (X'F8') to which the Requesting Device should direct a SEND.FILE.REQUEST frame to the Loading Device. This permits the Loading Device to direct the SEND.FILE.REQUEST frames to a different service access point.

The SEND.FILE.REQUEST Frame

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|------------------------|----------------|-----------|---|
| 0 | PROGRAM_LENGTH | 2 | DB | X'0053' + value in first 2 bytes of FILE_HDR |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0010' = SEND.FILE.REQUEST |
| 4 | SEQ_HDR | 4 | DB | X'0008 4011' = Sequence number vector |
| 8 | SEQ_NUM | 4 | DB | Starting sequence number |
| 12 | INFO_HDR | 4 | DB | X'0010 0008' = Connect info vector |
| 16 | FRAME_HDR | 4 | DB | X'0006 4009' = Frame size sub-vector |
| 20 | MAX_FRAME | 2 | DB | Maximum frame size |
| 22 | CLASS_HDR | 4 | DB | X'0006 400A' = Connect class sub-vector |
| 26 | CONN_CLASS | 2 | DB | Defines the type of service |
| 28 | SOURCE_HDR | 4 | DB | X'000A 4006' = Address vector |
| 32 | SOURCE_ADDR | 6 | DB | Ring address of this adapter |
| 38 | LSAP_HDR | 4 | DB | X'0005 4007' = Logical SAP vector |
| 42 | RSAP | 1 | DB | X'FC' Remote SAP value |
| 43 | SEARCH_HDR | 4 | DB | X'0028(+FILE_HDR) 0004' = Search vector |
| 47 | LOADER_HDR | 4 | DB | X'0024 C005' = Loader info sub-vector |
| 51 | MACH_CONF | 8 | DB | Configuration obtained from system unit via INT X'15' |
| 59 | EQUIP_FLAGS | 2 | DB | Register AX after INT X'11' |
| 61 | MEMORY_SIZE | 2 | DB | Register AX after INT X'12' |
| 63 | REMOTE PROGRAM LOAD_EC | 8 | DB | Remote Program Load Module level |
| 71 | ADAPTER_ID | 2 | DB | Adapter identifier |
| 73 | ADAPTER_EC | 10 | DB | Adapter level |
| 83 | FILE_HDR | 4 | DB | X'00nn(+04) 4013' = File name sub-vector |
| 87 | FILE_NAME | nn | DB | File name in ASCII |

SEQ_NUMBER

Explanation: For a SEND.FILE.REQUEST frame, this is the sequence number of the FILE.DATA.RESPONSE frame to be sent. If this value is X'0000', the Loading Device should start at the beginning of the Bootstrap Program file. If the Remote Program Load Module receives a frame out of sequence, it will set this field to the value it expected and issue the SEND.FILE.REQUEST frame to the Loading Device.

MAX_FRAME

Explanation: The maximum frame size that will be used for FILE.DATA.RESPONSE frames. This value includes the LAN header, the DLC header, the Remote Program Load header, and the file data.

CONN_CLASS

Explanation: The CONN_CLASS given in the Found frame must be the same as the CONN_CLASS in the SEND.FILE.REQUEST frame.

SOURCE_ADDR

Explanation: The ring address of the Requesting Device.

FILE_NAME

Explanation: This field is a left-justified ASCII string specifying a file name. This is an optional field. If it is not present, the SOURCE_ADDR and/or other configuration information is to be used to locate the Bootstrap Program. If it is present, the length (nn) is variable up to a maximum of 80 (decimal) bytes. Normally this field contains an ASCII file name. However, the user may set the first byte of this field to a non-ASCII character (X'80' through 'FF') to specify a user-defined field.

The File Data Response Frame

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|-----------------|----------------|-----------|--|
| 0 | PROGRAM_LENGTH | 2 | DB | X'0019' + value in first 2 bytes of DATA_HDR |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0020' = FILE.DATA.RESPONSE |
| 4 | SEQ_HDR | 4 | DB | X'0008 4011' = Sequence number vector |
| 8 | SEQ_NUM | 4 | DB | Sequence number for this frame |
| 12 | LOADER_HDR | 4 | DB | X'000D C014' = Loader instruction vector |
| 16 | LOCATE_ADDR | 4 | DB | Loader Program - generated address of where to put this data |
| 20 | XFER_ADDR | 4 | DB | Loader-generated address of where to transfer control if this is the last frame of the file. |
| 24 | FLAGS | 1 | DB | Bit-significant options |
| 25 | DATA_HDR | 4 | DB | X'00nn(+04) 4018 = File data vector |
| 29 | FILE_DATA | nn | DB | Binary data file |

SEQ_NUMBER

Explanation: This is the sequence number of the frame being sent. Sequence numbers start at X'0000' and increment by 1.

LOCATE_ADDR

Explanation: The absolute address in the computer's RAM to place the data portion of this frame. This field is valid only if bit 5 of the FLAGS field is on (1). Remote Program Load will convert this address into a segment:offset form. The segment is obtained by dividing the value by 16. The offset is the remainder of the division. If this field is greater than 640K (X'A000:0000') or an attempt to overlay X'0000:0000' to X'0000:0C00' is made, a program alert sequence will be initiated at the Requesting Device.

XFER_ADDR

Explanation: The absolute address in the computer's RAM to transfer control if this is the last frame of the file. This field is valid only if bits 6 and 7 of the FLAGS field are both on (1). Remote Program Load will convert this address into a segment:offset form. The segment is obtained by dividing the value by 16. The offset is the remainder of the division. The Adapter Support Subset will transfer control to XFER_ADDR if bit 3 (X'08') of ADR_FLG1 is on. Control is never transferred to address 0000:0000. Other than checking for 0000:0000, XFER_ADDR is not validated by Remote Program Load. The default XFER_ADDR is 0000:7C00.

FLAGS

Explanation: This field contains bit-significant options.

| Bit | Function | Meaning |
|-----|---------------|---|
| 7 | END_OF_FILE | 1 = last frame of the file |
| 6 | XFER_ENABLE | Only valid if bit 7 equals 1. 1: XFER_ADDR is a 4-byte absolute address of where to transfer control. 0: Transfer control to X'0000:7C00'. |
| 5 | LOCATE_ENABLE | 1: LOCATE_ADDR is a 4-byte absolute address of where to place the data portion of this frame. 0: Use the next contiguous address to locate the data portion of this frame. |
| 4 | ACK_REQUEST | 1: Issue a SEND.FILE.REQUEST to acknowledge receipt of this frame. The SEQ_NUMBER of the SEND.FILE.REQUEST frame must be the SEQ_NUMBER from this frame + 1. 0: Issue a SEND.FILE.REQUEST only if this frame is out of sequence. |
| 3-0 | Reserved | |

FILE_DATA

Explanation: The data to be placed in the computer's RAM at the location specified by the value in the LOCATE_ADDR field. The length of this field + 4 is specified by the value in the 2 high-order bytes of the DATA_HDR field.

The Load Error Response Frame

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|-----------------|----------------|-----------|--|
| 0 | PROGRAM_LENGTH | 2 | DB | X'000A' + value in first 2 bytes of FILE_HDR |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0040' = LOAD.ERROR.RESPONSE |
| 4 | ERROR_HDR | 4 | DB | X'0006 401A' = Reason code vector |
| 8 | ERROR_CODE | 2 | DB | Error code |
| 10 | FILE_HDR | 4 | DB | X'00nn(+04) 4013' = File name sub-vector |
| 14 | FILE_NAME | nn | DB | File name in ASCII |

ERROR_CODE

Explanation: The reason the LOAD.ERROR.RESPONSE frame is being sent.

| | |
|------|---|
| 0000 | Restart. The Loading Device is informing the Requesting Device that it needs to start the Remote Program Load process over. Remote Program Load Module at the Requesting Device will restart and issue a FIND frame. The Requesting Device will restart even if it is issuing PROGRAM_ALERT frames. |
| 0002 | File not found. The file specified in the FILE_NAME field of the SEND.FILE.REQUEST frame was not found. |

FILE_NAME

Explanation: This field is a left-justified ASCII string specifying a file name that was requested by the SEND.FILE.REQUEST frame. If it is provided, the length can vary up to a maximum of 80 (decimal) bytes as specified by the FILE_HDR value. Normally this field contains an ASCII file name. However, the user may set the first byte of this field to a non-ASCII character (X'80' through 'FF') to specify a user-defined field.

The Program Alert Frame

| OFF-SET | FIELD NAME | LENGTH (BYTES) | 8086 TYPE | DESCRIPTION |
|---------|------------------------|----------------|-----------|---|
| 0 | PROGRAM_LENGTH | 2 | DB | X'0059' +value in first 2 bytes of FILE_HDR. |
| 2 | PROGRAM_COMMAND | 2 | DB | X'0030' = PROGRAM.ALERT |
| 4 | SEQ_HDR | 4 | DB | X'0008 4011' = Sequence number vector |
| 8 | SEQ_NUM | 4 | DB | Current sequence number |
| 12 | INFO_HDR | 4 | DB | X'0010 0008' = Connect info vector |
| 16 | FRAME_HDR | 4 | DB | X'0006 4009' = Frame size sub-vector |
| 20 | MAX_FRAME | 2 | DB | Maximum frame size |
| 22 | CLASS_HDR | 4 | DB | X'0006 400A' = Connect class sub-vector |
| 26 | CONN_CLASS | 2 | DB | Defines the type of service |
| 28 | SOURCE_HDR | 4 | DB | X'000A 4006' = Address vector |
| 32 | SOURCE_ADDR | 6 | DB | Ring address of this adapter |
| 38 | LSAP_HDR | 4 | DB | X'0005 4007' = Logical SAP vector |
| 42 | RSAP | 1 | DB | X'FC' Remote SAP value |
| 43 | SEARCH_HDR | 4 | DB | X'0028(+FILE_HDR) 0004' = Search vector |
| 47 | LOADER_HDR | 4 | DB | X'0024 C005' = Loader info sub-vector |
| 51 | MACH_CONF | 8 | DB | Configuration obtained from system unit via INT X'15' |
| 59 | EQUIP_FLAGS | 2 | DB | Register AX after INT X'11' |
| 61 | MEMORY_SIZE | 2 | DB | Register AX after INT X'12' |
| 63 | REMOTE PROGRAM LOAD_EC | 8 | DB | Remote Program Load Module level |
| 71 | ADAPTER_ID | 2 | DB | Adapter identifier |
| 73 | ADAPTER_EC | 10 | DB | Adapter level |
| 83 | FILE_HDR | 4 | DB | X'00nn(+04) 4013' = File name sub-vector |
| 87 | FILE_NAME | nn | DB | File name in ASCII |
| xx | ALERT_HDR | 4 | DB | X'0006 4019' |
| yy | ALERT_CODE | 2 | DB | Reason for sending frame |

ALERT_CODE

Explanation: A 2-byte reason code for sending the alert frame. The valid values are:

| | |
|------|--|
| 0000 | Unknown ERROR.CODE. The Remote Program Load Module has received a LOAD.RESPONSE frame with an unknown ERROR.CODE parameter. |
| 0002 | File not found. The Loader Program sent an unexpected LOAD.ERROR.RESPONSE frame to the Requesting Device. |
| 0004 | Out of memory. The Remote Program Load Module has detected an attempt to store a FILE.DATA.RESPONSE frame data at an address that does not exist in this device. |
| 0006 | Memory overrun. Remote Program Load Module has detected an attempt to store a FILE.DATA.RESPONSE frame data at an address between X'0000:0000' and X'0000:0C00'. |
| 0008 | Unexpected DLC Status. Remote Program Load Module has detected an unexpected DLC status code. |

FILE_NAME

Explanation: This field is a left-justified ASCII string specifying a file name. This is an optional field. If it is not present, the SOURCE_ADDR and/or other configuration information is to be used to locate the Bootstrap Program. If it is present, the length (nn) is variable up to a maximum of 80 (decimal) bytes. Normally this field contains an ASCII file name. However, the user may set the first byte of this field to a non-ASCII character (X'80' through 'FF') to specify a user-defined field.

Chapter 4. Troubleshooting Remote Program Load Problems

This chapter contains information that should help if you are using the Remote Program Load on a Requesting Device and you do not get the expected results. If other computers on the network need problem determination, you might need one or more of the following:

- The operator's guide for the IBM Personal Computer or IBM Personal System/2 computer being used
- The operator's guide that came with the adapter
- The *IBM Token-Ring Network Problem Determination Guide* that includes problem determination for ring-related problems.

The following chart lists possible failure indications and suggested actions to take for problem determination.

| Failure Indication | Problem Determination Action |
|---|---|
| The computer displays an error indicating there is no diskette drive. | See "Error for Some Computers without Diskette Drives Installed" on page 4-2. |
| The computer displays a ROM error. (XXXXX ROM Press F1 to resume) | See "ROM Error" on page 4-3. |
| The computer beeps more than once. | See "Multiple beeps" on page 4-4. |
| The computer's BASIC panel is displayed. | See "BASIC Panel Displayed" on page 4-4. |
| A system screen or an application screen is displayed. | See "System Screen Displayed" on page 4-4. |

Figure 4-1 (Part 1 of 2). Remote Program Load Failure Indications

| Failure Indication | Problem Determination Action |
|---|---|
| A Bring-Up Error. The Remote Program Load screen is displayed with the BU field highlighted. | See "Bring-Up Error" on page 4-5. |
| An Open Error. The Remote Program Load screen is displayed with the OP field highlighted. | See "Open Error" on page 4-5. |
| A Ring Status Error. The Remote Program Load screen is displayed and the RS field is displayed with a value other than zero (0) or it is highlighted. | See "Ring Status Error" on page 4-5. |
| A PC Error. The Remote Program Load screen is displayed and the PC field is highlighted or the field is displayed with counters not being updated. | See "PC Error" on page 4-6. |
| An RQ Count Greater than 10. | See "RQ Count Greater than 10" on page 4-7. |
| Any other response that has not been identified. | Have the system unit serviced. |

Figure 4-1 (Part 2 of 2). Remote Program Load Failure Indications

If you have a failure indication that is listed below, some possible causes and actions are provided.

Error for Some Computers without Diskette Drives Installed

Some Personal Computers or Personal System/2 computers will display an error on a computer that does not have a diskette drive installed. On these computers perform the step that is required to continue. Follow the instructions in the user's guide for the computer.

ROM Error

The computer detected a ROM error during the Power-On Self Test (POST).

- For an IBM Token-Ring Network PC Adapter or Adapter II:

If the ROM address displayed is not the address configured for the adapter using the switches on the adapter (the default settings are CC000 or DC000), refer to the operator's guide for the computer. Correct the problem and restart the computer.

If the address displayed *is* the address configured for the adapter, the Remote Program Load Module on the IBM Token-Ring Network PC Adapter or Adapter II may be defective. (If two IBM Token-Ring Network adapters are installed in this device, the suspected module is the one on the adapter with its address switches set to the address in the error message.)

1. Replace the suspected Remote Program Load module.
2. If the ROM error goes away, the suspected module is defective; permanently replace the suspected module. If, however, you still get the ROM error, have the adapter serviced.

- For an IBM Token-Ring Network Adapter/A:

If the ROM address displayed is not the starting address of the address range configured for the adapter using the IBM Personal System/2 Reference Diskette, refer to the operator's guide for the computer. Correct the problem and restart the computer.

If the address displayed *is* the starting address of the range configured for the adapter, the Remote Program Load Module on the IBM Token-Ring Network Adapter/A may be defective.

1. Replace the suspected Remote Program Load module.
2. If the ROM error goes away, the suspected module is defective; permanently replace the suspected module. If, however, you still get the ROM error, have the adapter serviced.

Multiple beeps

The computer did not perform the Power-On Self Test (POST) successfully. Refer to the operator's guide for the computer. Correct the problem and restart the computer. If the problem continues, have the system unit serviced.

BASIC Panel Displayed

If a ROM error preceded the BASIC panel and F1 was pressed to resume, restart the computer and follow the instructions for "ROM Error" on page 4-3 when the ROM error is displayed again.

The computer's BASIC panel is displayed after the POST has completed. The computer did not locate the Remote Program Load Module provided on the adapter. Using Chapter 2 in this manual, verify that:

- An IBM Token-Ring Network adapter is installed in the computer.
- The Remote Program Load Module is plugged into the adapter correctly.

Verify the following using the operator's guide for your adapter:

- The adapter switch settings are correct (IBM Token-Ring Network PC Adapter and Adapter II only).
- There are no conflicting ROM addresses.
- There are no conflicting interrupt levels.
- There are not two adapters with the same switch settings (IBM Token-Ring Network PC Adapter and Adapter II only).

If the problem persists, have the system unit serviced.

System Screen Displayed

The memory test displays have completed, but the system is loaded from the fixed disk or diskette.

- If the computer contains one or more diskette drives but no fixed-disk drive, ensure that there is no diskette in the first diskette drive (drive A).

- If the computer has a fixed disk, the DOS partition on the disk must be disabled using RPLBOOT.COM. See the README file on the sample programs diskette to learn about RPLBOOT.COM.

Bring-Up Error

The Remote Program Load screen is displayed, the elapsed time field has stopped with only a few seconds of time accumulated, and the *BU* field is highlighted. The Load Requestor function tried three times and was unable to initialize the adapter for use. The *BU* error codes and the action to take are listed below:

| Value | Cause | Action |
|------------|-----------------------------------|---|
| 0024 | The shared RAM diagnostic failed. | See the information on "Shared RAM" in the operator's guide for the adapter and make sure the shared RAM does not conflict with other shared RAM. |
| All others | Adapter Failure. | The adapter is defective. Have the system unit serviced. |

Open Error

The *OP* field contains an error code and is highlighted. After three tries the Load Requestor function was unable to open the adapter for use. Retry the operation by restarting the computer at least once. If the problem persists, record the low-order (right-most) character of the highlighted *OP* field. This low-order character is the Reason Code. The high-order (left-most) byte is always 00.

Using the Open Error and Reason Code as the symptom, go to the *IBM Token-Ring Network Problem Determination Guide*.

Ring Status Error

A ring error was detected when the Load Requestor function or Bootstrap Program was executing. Locate the Ring Status Error Code in the table below to determine the proper action. Some values may be displayed that are a combination of the values listed below. X's used in the value column can be any number.

| Value | Cause | Action |
|--------------|---|--|
| 4XXX or more | The ring is in a beaconing condition. | See the <i>IBM Token-Ring Network Problem Determination Guide</i> . |
| 2000 | This adapter has detected a soft-error condition. | No action required. |
| 08XX | Wire Fault. The adapter has detected a problem in itself or in its lobe. | See the <i>IBM Token-Ring Network Problem Determination Guide</i> . |
| 04XX | This adapter detected an internal hardware error. | Have the system unit serviced. |
| X1XX | Remove received. This adapter removed from the ring. | Contact the network administrator. |
| 0080 | Counter overflow. One of the error log counters has incremented past 256. | Restart the computer. |
| 0040 or 0060 | Single Station. The adapter has opened and is the only station on the ring. This bit will reset when another station inserts. | No action is required unless other stations are known to be operating on this ring. If other stations are on the ring, go to the <i>IBM Token-Ring Network Problem Determination Guide</i> . |
| 0020 | Ring recovery. The adapter is transmitting or receiving claim token frames. | No action is required. |
| All others | Reserved. | Contact the network administrator. |

PC Error

Personal Computer or Personal System/2 error. The Load Requestor function has detected a problem with either the software or the hardware. Retry the operation by restarting the computer at least once. If the problem persists, see the following chart for a description of the PC field and the action to take. Xs used in the value column can be any number.

| Value | Cause | Action |
|-------------------------|--|--|
| 06XX (not high-lighted) | <p>Program alert frames being transmitted. The XX portion of the value represents the alert code:</p> <p>00 = Unexpected error response frame received.</p> <p>02 = File not found.</p> <p>04 = Out of memory space.</p> <p>06 = Memory overrun.</p> <p>08 = Unexpected DLC status received.</p> | Restart the computer. If this alert code persists, contact your network administrator. |
| 0700 | The adapter failed a wrap test. | The adapter is defective. Have the system unit serviced. |
| All others | A computer hardware or software error has occurred. | Perform the computer diagnostic test procedure or contact the network administrator. |

RQ Count Greater than 10

The Loading Device has not been located on the network. Verify that the Loading Device is connected to the network and has an active Loader Program operating.

If the Loading Device is active, you must determine that both the Loading Device and the Requesting Device are gaining access to the same network. Determine if the Loading Device is servicing other devices, and has been busy and unable to respond.

If the Loading Device and the Requesting Device are connected on the network, and the Loading Device is available, contact your network administrator.

List of Abbreviations

| | | | |
|-------------|---------------------------|-------------|------------------------|
| BIOS | Basic Input/Output System | POST | power-on self test |
| DLC | Data Link Control | ROM | read-only memory |
| DOS | Disk Operating System | SS | stack segment |
| EC | Engineering Change | UI | Unnumbered Information |
| PC | Personal Computer | | |

Glossary

A

adapter. The circuit card within a communicating device (such as an IBM Personal Computer) and its associated software, that enable the device to be attached to a network.

application program. A program written for or by a user that applies to the user's work.

B

Bootstrap Program. A program used to establish another program.

F

formatted diskette. A diskette that can be used by the computer to store data.

L

Loader Program. In Remote Program Load, the program running in the Loading Device that sends other programs to the Requesting Device.

Loading Device. In Remote Program Load, a computer on the IBM Token-Ring Network that supplies files or programs to requesting devices.

P

POST. Power-On Self Test. A series of diagnostic tests that are run each time the computer's power is turned on.

R

read-only memory (ROM). A computer's storage area whose contents cannot be modified.

Requesting Device. A computer on the IBM Token-Ring Network that uses the Remote Program Load Module instead of a disk or diskette drive to request a Bootstrap Program. The Bootstrap Program enables the Requesting Device to use network application programs.

ring (network). A network configuration where a series of attaching devices, such as IBM Personal Computers, are connected by unidirectional transmission links to form a closed path.

T

token. A sequence of bits passed from one device to another along the network.

W

working diskette. A computer diskette to which files are copied from an original diskette for use in everyday operation.

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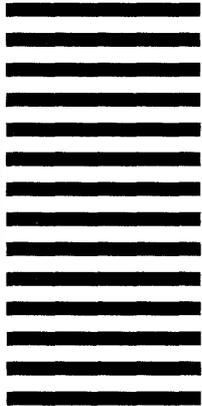
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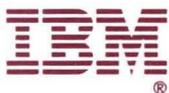


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