Multiprotocol Networking with the 3172 Model 3

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┌─ Take Note! ─────────────────────────────────────────────────────────────┐
│                                                                            │
│  Before using this information and the product it supports, be sure to read the general information under │
│  "Special Notices" on page xix.                                            │
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First Edition (May 1994)

This edition applies to the IBM 3172 Model 3, with either ICP 3.2 or OS/2 2.1.

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Abstract

This document describes the IBM 3172 LAN Interconnect Controller. It provides configuration and planning assistance for the use of the 3172 as a System/390 channel-attached host gateway for Local Area Network workstations that use the System Network Architecture (SNA) and Transport Control Protocol/Internet Protocol (TCP/IP) communication protocols. It is intended to illustrate some of the common implementation scenarios and related issues.

This document was written for customers, systems engineers, network professionals and technical support personnel responsible for the planning, installation, and customization of Host-to-LAN connections.

To obtain maximum benefit from the use of this document the reader should have experience with and a solid understanding of SNA and/or TCP/IP, network topologies and common data communications terminology. It is helpful to have fundamental knowledge of OS/2, MVS and VM.

(494 pages)

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Special Notices

This publication is intended to help both IBM Customers and IBM Systems Engineers, as well as network professionals and technical support personnel understand the ways in which the IBM 3172 may be used. It contains information found in other IBM documentation as well as the results of our experiences with the products in a controlled environment.

The information in this publication is not intended as the specification of any programming interfaces that are provided by the IBM 3172 and its associated software platforms. See the PUBLICATIONS section of the IBM Programming Announcement for the IBM 3172 and its related software and hardware options for more information about what publications are considered to be product documentation.

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Preface

This document provides planning and configuration information for the IBM 3172 LAN Interconnect Controller. It is organized based on three different implementation scenarios. Due to the increasing interest of connecting local area networks to IBM S/390 hosts for mission critical applications where availability is a prime concern, several alternatives for systems recovery from disruptive events are presented. As a key element of the network, the ability to manage the 3172 from NetView and SNMP is explored. Systems management issues, primarily backup and recovery, are also covered.

How This Document is Organized

The document is organized as follows:

- Chapter 1, "3172 Perspectives"

  This chapter presents the IBM 3172 to the reader. It contains a product synopsis covering positioning, performance, features and architecture. All readers should review this chapter before any others.

- Chapter 2, "3172 ICP Environment"

  The first of three distinct ways in which we configured the 3172 is presented here. Background information on the ICP hardware and software requirements is included as well as useful tips on the customization of the 3172 itself and the related components for this setting. Personnel interested in the 3172 ICP environment may read Chapters 1 and 2 to cover this area.

- Chapter 3, "3172 for Offload of TCP/IP"

  Contained within this chapter is the second scenario examined for this book. It outlines the results of our experiences with the Offload platform for the 3172. Valuable configuration information for the 3172 and related supporting hardware and software products is offered. Personnel interested in the 3172 Offload environment may read Chapters 1 and 3 to cover this area.

- Chapter 4, "3172 Multiprotocol Extensions"

  This chapter describes the results of our experiences with the MPE platform for the 3172. Supported configurations are explored along with hints and customization recommendations for the use of the product in a Frame-Relay network. Personnel interested in the 3172 MPE environment may read Chapters 1 and 4 to cover this area.

- Chapter 5, "3172 Network Management"

  In this chapter the subject of managing the 3172 using NetView and/or SNMP is reviewed. The types of alerts and commands typically used to manage a 3172 are covered across all three platforms discussed in this book.

- Chapter 6, "3172 Backup and Restore"

  The systems management disciplines of backup and recovery for a 3172 in any of the three potential subject implementations are reviewed. A technique to provide a stronger, more robust backup and recovery vehicle for the Offload and MPE platforms is outlined.

- Chapter 7, "3172 Model 3 High-Availability"

Using the 3172 in a high-availability arena with recovery implications for SNA and TCP/IP is presented in this chapter. Several differing approaches to the issue are offered with the results of our experiences. Those readers who are interested in minimizing host to gateway outages may find this chapter useful.

Related Publications

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

- *IBM 3172 Interconnect Controller Program Version 3.3 User's Guide*, SC30-3572

  This manual describes how to install and use Version 3.3 of ICP on a 3172. It is provided with the software, which is purchased separately from the 3172.

- *IBM 3172 Interconnect Controller Program Version 3 Planning Guide*, GA27-4002

  This guide introduces customers to the Interconnect Controller Program Version 3. It helps them plan their system requirements for the host, the LAN, the workstation, and the IBM 3172. It provides examples of configurations and includes a planning checklist to guide the user through the planning tasks.

- *IBM 3172 Interconnect Controller Model 3 Hardware Planning Guide*, GA27-4003

  This guide identifies tasks involved in preparing for installation of a 3172 Model 3. Use this book to determine what hardware is needed for your installation. It also provides information about environmental specifications, feature codes, and how to order hardware components. Worksheets are provided to help you plan for ordering your hardware.

- *IBM 3172 Interconnect Controller Model 3 Operator's Guide*, GA27-3970

  This document is a reference summary card. It provides information about the Operator Panel, its use, and general problem isolation procedures.

- *IBM 3172 Interconnect Controller Model 3 Maintenance Information*, SY27-0334

  This manual explains how to install, test, and repair the IBM 3172 Interconnect Controller Model 3.

- *Using the IBM 3172 Operator Facility/2 Version 3*, SC30-3573

  This manual describes how to use the Operator Facility/2 Version 3, which is a function provided with ICP Version 3.3 that allows remote and stand-alone reconfiguration and monitoring of the IBM 3172.

- *Input/Output Configuration Program User's Guide and ESCON Channel-to-Channel Reference*, GC38-0401

  This guide describes the Input/Output Configuration Program (IZP IOCP) that supports the IBM Enterprise Systems Connection (ESCON) Architecture. It is intended for systems programmers and service representatives who are responsible for defining, installing, and configuring the channels or channel paths, control units, and I/O devices on IBM processor complexes that require IZP IOCP.

International Technical Support Organization Publications

A complete list of International Technical Support Organization publications, with a brief description of each, may be found in:

Bibliography of International Technical Support Organization Technical Bulletins, GG24-3070.

The following individual ITSO publications may be of valuable assistance in the planning, installation and configuration of a 3172 in your network. As well, they offer a wealth of information on IBM products, industry technologies and standards combined with real world, practical illustrations of applications in everyday use.

- *FDDI Concepts and Products*, GG24-3865

  This document provides an introduction to the IBM Fiber Distributed Data Interface (FDDI) Local Area Network (LAN). It describes the concepts behind FDDI LANs and explains the functions and the various ways to design, install and manage FDDI LANs using IBM FDDI products. The document is intended mainly for customers, IBM system engineers and marketing support representatives who are responsible for supporting FDDI networks.

- *TCP/IP Tutorial and Technical Overview*, GG24-3376

  This document is for customers, FSC communications specialists and field system engineers working on projects involving connectivity of IBM systems to equipment manufactured by other equipment manufacturers (OEM). It should be used to gain a basic understanding of the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite and to gain an overview of the possible functionality of the IBM TCP/IP products in heterogeneous networks.

- *High-Speed Networking Technology, An Introductory Survey*, GG24-3816

  This publication presents a broad overview on the emerging technology of very high speed communications. It is written at the "technical conceptual" level with some areas of greater detail. It was written for computer professionals who have some understanding of communications (but who do not necessarily consider themselves experts). The primary topics of the book are:

  - The Principles of High-Speed Networking

  - Fiber Optical Technology and Optical Networks

  - Local Area Networks (Token-Ring, FDDI, MetaRing, CRMA, Radio LANs)

  - Metropolitan Area Networks (DQDB/SMDS)

  - High-Speed Packet Switches (Frame Relay, Paris, plaNET)

  - High-Speed Cell Switching (ATM)

- *Integration of Common OS/2 Communications Products* GG24-4005

  Communications software is easy to install, isn't it? Well, perhaps that is true if you only want one, two or three products on one workstation. But what if you need six or more different communications products on one workstation? Their documentation tends to concentrate on a single installation on a simple, empty machine. This book focuses on the combined installation of 12 products: NTS/2, RouteXpander/2, CM/2, LAN Server, DB2/2, DDCS/2, PC Support/400, LSM, DCAF, TCP/IP, LMU and NetView DM/2. For

example, are there problems caused by the order of the statements in
CONFIG.SYS, or by the required number of Link Stations or SAPs? We
describe how these are installed in a typical scenario consisting of a User
Workstation, a Gateway/Server and an Administrator Workstation. This book
is intended for communications specialists. A good knowledge of OS/2,
LANs, WANs, AS/400, and mainframes is assumed.

Acknowledgments

Chapter 1. 3172 Perspectives

1.1 Introduction

This book is intended to provide assistance to IBM* customers, IBM systems engineers, network managers, professionals and other parties that may be interested in using the IBM 3172 Model 3 in their business setting. The book is logically if not physically divided into several parts. In the first half we provide background reference information. The latter half covers our actual experiences with the 3172 in three distinct scenarios. Where possible, we have tried to collect relevant and pertinent information into a single chapter. It was hoped that this would minimize the need to scan multiple sections to find requisite material.

This first chapter is written to acquaint the user with the many features and potential implementations of the product. A discussion of what constitutes a gateway is followed by a brief historical background and chronology of the product. We then explore the 3172 within the context of other IBM products. Lastly, an overview is presented of what a 3172 appearance in a network resembles, along with configuration-related information as background for the rest of the book.

The next part of the book, and what we hope will be of most use to you, covers three ways in which we utilized the 3172 and the issues surrounding each setting. Systems management topics, an important element for the integration of S/390 hosts and local area networks are covered in each scenario.

As you may be aware, the 3172 has undergone significant enhancements in recent months and continues to be positioned as a key product in the IBM family of communication processors. While there are many more ways that the IBM 3172 can be used than the ones detailed here, we, the authors as well as the advisors, felt that these three scenarios in various forms would be of interest to you, our audience. There are several scenarios we contemplated that are not covered. These primarily involved the LANRES and LFS/ESA options for the 3172 and the most recently announced SNA Communications program. Everyone associated with this project felt that the capabilities of the product, with its flexibility and range of options, readily lent themselves to more scenarios than the three we detail here. No significance should be attached to areas untreated other than if it is your desire to see them presented to use the reader comment form to make your wishes known.

1.2 What Is a Gateway?

The term gateway has been used in so many contexts and across so many environments that it has become very difficult to attach proper meaning to it. Depending on a combination of factors, it may mean something quite specific or it can be rather broad. Since the purpose of this section is markedly different from the subject treatment offered by the classic approach of William Stallings in *Local Networks* or Marshall Rose in *The Open Book*, we shall offer a generalized conception of the term. We define a gateway to be an entity that provides a client the ability to interact across disparate systems using technologies native

to each system while maintaining an appearance in each respective environment of a well-behaved participant.

1.2.1 Addressing in a LAN Environment

Connectivity between programs and/or devices is dependent upon the use of commonly understood addresses. Different types of addresses exist in networking just as they do in non-DP environments. For example, a telephone number is a type of address for establishing a voice line connection, while a postal address specifies a location for the physical delivery of mail.

In networking, addresses exist at various levels of connectivity. This is most often illustrated with the OSI Reference Model of communications.

Application Layer - application association, for example a transaction

Presentation Layer - presentation services association, for example 3270 DS

Session Layer - session ID and characteristics

Transport Layer - addresses/names to distinguish transport services such as security, reliability, etc.

Network Layer - routing addresses such as SNA Network Addressable Unit or IP addresses

Link Layer - address for access method services such as SNA, TCP/IP, NetBIOS, etc.

Physical Layer - adapter address/port, etc.

In SNA, we usually think of addresses in two different ways. The average programmer or system administrator thinks of the addresses in terms of Physical Unit (PU) names and Logical Unit (LU) names, while the communications subsystems view these network resources as Network Addressable Units (NAUs) associated with particular links and ports. Again, depending upon the *level* of connectivity in SNA, there are different addressing concepts. Thus, in the customization of SNA communication products, such parameters as adapter address, port position, XID names, mode table entries (and names) and application control blocks must be defined before connections can be enabled. When different SNA networks are interconnected, a NETID must also be defined. The NETID is also used in APPN networks to provide fully-qualified resource names.

In a TCP/IP network, a hierarchical addressing scheme is used in which a numeric address is broken down (somewhat like a telephone number) into parts associated with a network, company, location, or port. Because such numeric addresses can be difficult to remember and easily transposed, TCP/IP also provides various naming services to associate more easily recognized names with specific IP addresses. For example it is far easier to remember LUKE @ STAR.WARS.COM than 9.67.38.101.

1.2.2 Networks and Subnetworks

The terms "network" and "subnetwork" or "subnet" are interpreted in various ways for different environments. For this document, unless otherwise specified, we will use the OSI Reference Model and associated terminology as a basis for defining networks and subnets. The basis of these definitions is a concept of service access points and points of attachment between the layers of the reference model.

Subnet   The OSI Reference Model defines a subnet as a set of facilities and services which provide data link (layer 2) services to network entities. Each instance of a subnetwork point of attachment (that is, the specific identification of each network entity to the data link layer) has a unique identifier called a subnetwork protocol point of attachment (SNPA) address. The SNPA address is the link service access point (LSAP) used by the network entity to access these data link services. The SNPA address is a fundamental parameter in the protocols used to establish a data link through a subnet. In general a subnetwork address consists of:

1. An identifier of the system in which the network entity is located (for example, a LAN adapter MAC address)
2. A local LSAP identifier or network identifier (for example, an SNA subsystem or NetBIOS environment service access point value).

Each Logical Link Control (LLC) frame transported on an IEEE 802 LAN contains both a destination and source SNPA address, that is the destination MAC address and DSAP, and the source MAC address and SSAP. The set of addresses that can be assigned to the network entities attached to a given subnet is referred to as the address space of the subnet. All addresses in this set are consistent in syntax and format, and thus need no conversion to establish connections.

Connectivity between network entities attached to the same subnet use the data link services provided by the subnet. The addressing used at this layer is independent of such networking protocols as SNA, TCP/IP, or OSI. However, network entities attached to two different subnets cannot establish a data link connection because the address space is not shared. This may be because of:

- Lack of physical connectivity (that is, sharing of the same medium)
- Incompatible SNPA addresses
- Duplicate SNPA addresses resulting in ambiguity
- Incompatible data link establishment procedures

In such cases, the use of higher level network connection facilities is required; that is, the services of a network layer and possibly the services of an intermediate system are required.

Network   A network represents the set of services (layer one through three) implemented for specific transport layer entities. Just as the data link layer provides a SAP to identify particular communications environments within a subnet, transport entities in layer 4 are uniquely identified to the network layer by a Network Service Access Point (NSAP). This boundary enables transport entities to request network services with the appropriate level of error detection and recovery. NSAP addresses must be unique throughout a network, for example an IP address or an SNA Network Addressable Unit address.

Networks are generally characterized as providing either connection-oriented (CONS) services or connectionless (CLNS) services. Connection-oriented networks are those which would provide greater flow control and recovery with the network, while connectionless networks would treat each message as an independent entity with no sequencing of messages or guarantee of delivery. This difference is somewhat analogous to the concept of registering a letter to guarantee its delivery (by logging its transfer

and receipt) versus posting a letter on the assumption that it will get to its destination and that other means of follow-up or recovery will be used.

Unlike the subnets defined above, a network address does reflect protocol characteristics and thus connection must be based upon matching protocols or upon protocol conversion.

1.3 What Are the Differences between Bridges, Routers, and Gateways?

A **bridge** is a device that interconnects two subnets using the MAC address of stations. Bridges operate at layer 2 of the OSI protocol stack. Because MAC addresses are protocol independent, a bridge is very useful for physical network extension, speed matching, and wiring optimization. However, since a bridge is essentially transparent to the attaching stations, dependencies upon such protocol variables as timers, flow control and error recovery are not supported. Thus, problems may arise if too many workstations are bridged. These include issues such as broadcast storms, time-outs and congestion-caused delays in response times.

A **router** is a device that interconnects two or more network segments on the basis of OSI layer 3 addresses. Because such addresses have protocol dependencies, a router must either participate in the protocols for purposes of routing, flow control, and error recovery, or must encapsulate protocol dependent information in frames supported by the routers. Even with encapsulation however, a router must understand the network topology and where to send data frames. Routers maintain topology information as a result of an exchange of topology information with other routers in the network. Communication of topology information between the routers may use open standards for exchange such as OSPF or EGP or vendor-specific protocols. They do not assume responsibility for the integrity of the address information used within the network.

A **gateway** is a device that handles interconnection and transfer of information between entities in layers 4 through 7 of the OSI Reference Model. Thus a gateway is required when an entity using one protocol needs to communicate with an entity using another protocol (protocol conversion), when the addressing structure of two entities is inconsistent, or when connection is required between independent networks.

1.4 What Is a LAN-to-Host Gateway?

In the previous section, we gave a definition of a gateway that is generic to data networking. However, over time our usage of the term also acquired another meaning, more specifically:

A combination of hardware and software that provides access to S/390-based applications from LAN-attached devices.

IBM has not chosen to name the 3172 as a bridge, router or gateway. Rather, the official product description is ″LAN Interconnect Controller.″ The 3172 performs as a physical interface between the host and LAN. The 3172 connects to one or more mainframes using either Parallel Channel Architecture or the newer, fiber-based ESCON architecture. In either case, it communicates to the host using a proprietary channel protocol.

It has LAN adapters that support open, industry standard IEEE 802.5 and 802.3 protocols, as well as FDDI, DIX V2, X.25 and frame relay. These adapters are responsible for moving traffic into the 3172 for processing. The 3172 then decides whether or not the traffic should be passed on to the host(s). At this level the 3172 is a MAC layer protocol converter (within the context of the OSI Reference Model) that transforms LAN-based packets into channel blocks.

Above the physical and MAC layers in the OSI model we find the immediately adjacent network and transport layers. Here we may think of the 3172 as a classic gateway providing a path for LAN-based traffic (primarily TCP/IP or SNA) to an S/390 mainframe host. At this level the 3172 becomes a logical gateway.

Defining the network appearance of a 3172 presents a problem. While it maintains a connection on behalf of SNA clients it is largely invisible in an SNA net; one cannot think of it as a PU because it does not conform to full SNA PU functionality. Similarly, in the TCP/IP world it may at first glance appear to be an IP host. In actual fact, it is not a true IP host at all. Rather, the 3172 is acting as servant to the master, which is the TCP/IP subsystem residing in the mainframe. It can accomplish both of these feats in each environment concurrently and on the same or different LAN adapters across multiple host channel interfaces. As one can see, the 3172 readily fits within the broad definition of a gateway previously offered.

1.5 The IBM 3172 Models and History of the 3172

In October of 1989, IBM announced the 3172 Interconnect Controller Model 1. This was a new product designed to supersede the earlier 8232 LAN Channel Station. Now withdrawn, the Model 1 was the first of this family of LAN/Host gateways. It featured an 80386 processor and an IBM Micro Channel* Architecture supporting up to four LAN adapters and two host channels. In addition, this model had the capability for remote channel-to-channel services.

Oriented to TCP/IP connectivity, the Model 1 was initially designed to be used with the Interconnect Controller Program (ICP) Version 1. Goals for the 3172 included the systems availability, environmental and packaging design points demanded by customers. It is rack mountable in an industry standard 19″ rack, such as the IBM 9309. All controls are on the front panel.

The Model 2 was announced in September of 1990. With this announcement the product gained SNA capabilities as well as an FDDI interface. Performance was slightly enhanced as well with the release of ICP Version 2. A major change was the introduction of the Operator Facility/2 (OF/2) utility. This filled the requirement for a more robust interface for the configuration and installation of ICP. Based on the Presentation Manager of OS/2, it utilizes NetBIOS for communication with the 3172 over a token-ring or Ethernet connection. OF/2 is a convenient, flexible tool for managing up to sixteen 3172s from a single workstation.

The Model 3 was announced in June of 1992. As of publication of this manual it is the current model shipping from IBM. Similar in nature to its predecessors, the Model 3 surpasses them in performance and in available options. A new design with enhanced RAS (Reliability, Availability and Serviceability) characteristics, it features an Intel** 25 MHz 80486SX processor on a pluggable processor card as standard equipment with 50 MHz 80486DX and 66 MHz Pentium** upgrade options. The Model 3 has a 1.0GB SCSI disk drive option,

extendable memory up to 64MB and for the first time gains direct wide area connections through the IBM Micro Channel Wide-Area Connector card to a public or private frame relay network or leased line SDLC network through the ARTIC Portmaster* card options. The Model 3 offers a greater span of options and at lower cost than the Model 1. Both the original Model 1 and the Model 2 have now been withdrawn and superseded by the Model 3.

The current release of ICP is V3.3. Three options based on the Operating System/2 V2.1 platform, are available. The first is called ″Offload of TCP/IP.″ It incorporates IBM TCP/IP V2.0 for OS/2 V2.0 and a specially written set of routines co-resident in the 3172 and on the host. Designed to conserve mainframe resources and outboard from the host, Offload performs some IP functions on its behalf.

The second option is called ″MPE″ or Multiprotocol Extensions. By exploiting the power and capability of both the hardware base and the OS/2 operating system, this offering includes all of the products in the Offload option plus the incorporation of IBM′s RouteXpander/2 (RXR/2) product. RXR/2 is a high-function, entry-level software based routing product. Taking advantage of a frame relay connection utilizing RXR/2 and the Wide-Area Connector adapter card, the 3172 can provide new services to remote clients. Source route bridging for LAN protocols, including IPX and NetBIOS, from remote LANs to 3172-attached token-rings as well as remote TCP/IP connectivity for attached mainframe hosts are primary examples of this increased functionality.

The third option based on OS/2 V2.1 is the SNA Communications Program Version 1.1. This offering is designed to provide customers the ability to transport SDLC/SNA traffic from wide-area connections (either point-to-point or multi-point) or from LAN connections including token-ring, Ethernet and FDDI to one or more VTAM hosts that are channel attached to a 3172. In essence, the combination of hardware and software provided in this option allows the 3172 to perform the role of a line concentrator. If it is desirable to use the X.25 protocol for transport of SDLC/SNA traffic, this is possible through the use of RXR/2 V2.0 with the RouteXpander X.25 Xpander/2 program.

Lastly, there are client-server options available for the 3172. These take the form of intermediate gateways with the flexibility of running either in a Novell** environment or in the IBM OS/2 LAN Server* realm. The former utilizes LANRES* for VM and MVS as its host counterpart, with NetWare** Version 3.11 or higher installed on the 3172. The latter utilizes LAN File Services* on the host with LAN Server 3.0 installed in the 3172. Both of these platforms incorporate the mainframe into the LAN arena as an extension to the client world.

1.6 Product Positioning

In this section we will attempt to assist you in understanding where the 3172 fits in the product family of IBM controllers and host gateways. There are three main offerings from IBM that provide channel-attached connections to AIX, MVS and VM-based S/390 mainframes. In some areas they compete with one another while in others they are complementary. These products are the 3172, 3174 and 3745 network controllers.

Traditional IBM mainframe-based data processing sites will be very familiar with the 3174 and 3745 family. The 3172, having come to market only within the last 5 years is a newcomer. Customer requirements and marketplace dynamics have

combined in this timeframe to motivate IBM to evolve and enhance each product, while doing so in the difficult situation of preserving the capital investment made by customers. This is a very fine balancing act and one made all the more so by the severe pressure of advancements in technology and competitive mandates.

To put each product in perspective of market segment and user functionality cannot be done in a traditional matrix. Each product encroaches on the other in terms of capability and price. Indeed, it can be argued that, given the pace with which each product continues to evolve, the day such a matrix is built it would be obsolete. It is plain however, that when faced with the dilemma of which is the right product to choose, a framework must be built to offer a basis for rational decision making.

One cannot approach the decision strictly from a cost perspective. To do so would ignore performance. Price/performance ratios historically have proved useful; their drawback lies in being cast in sand. It is possible to use available options and/or capabilities, although this too suffers as product refresh cycles are shortening. Perhaps the best gauge to use is one based on the unique environmental criteria for the institution.

By this is meant not only the physical factors, but the more subtle ones as well. Is one product (or more) already installed with a trained skill set available to support it? How will the technology chosen today fit with the installed base? Where is it desirable to place the processing load? What is the estimated capacity requirement? Will it grow and if so, does the product have the ability to grow with it? How? Gateways are critical resources that must be managed. Is the network management platform of choice supported by the product? What is the impact of an outage and what are the implications for recovery? Are the connectivity options available a match for today and conceivably tomorrow?

The litany of issues raised above are by no means comprehensive and are surely very familiar to those professionals who have faced similar choices before. It may be useful to have them articulated and incorporated into your decision model. Within the caveats given, please use the following matrices judiciously. As a reference they may serve as a base, keeping in mind that by the time they are published they may be in need of revision.

A reminder to the reader:

The following tables are valid for a relatively short timeframe from the publication date of this manual due to the continuous evolution of these products by IBM. IBM personnel may reference the document **GWPOS** on MKTTOOLS for the most recent material. Customers may ask their IBM representative for a document review.

NOTES: It is possible that these tables may be misunderstood or misused. Therefore, we wish to make sure that the reader is made aware of what is meant by them and how to use them. A brief examination of category explanations is essential and included below each table for proper interpretation.

1.6.1 Relative Performance

The 3172 Model 3 has been tested in a laboratory for performance. The results of this comprehensive testing program are available to IBMers on the MKTTOOLS disk with the file name *3172M332*. In this document SNA and TCP/IP throughput measurements are detailed along with the methodologies utilized. The results are applicable exclusively to the 3172 and are not compared with any other IBM product, for example the 3174 or 3745. Customers may ask their IBM representative for a review of 3172M332. Formal testing for the 3174 and/or 3745 has historically been modelled and documented extensively elsewhere in IBM literature and is not the subject of this document.

Because we felt a general comparison of the 3172, 3174 and 3745 might benefit our readers we offer the following broad models. The table below shows the 3172 Model 3 capabilities positioned against the IBM 3174 and 3745 gateways.

Table 1. Relative Performance Positioning of the IBM 3172, 3174 and 3745			
Category	**3172**	**3174**	**3745**
Throughput Capacity	Very High	High	Very High
Workstation Service Capacity	High	Medium High	High-Very High
SNA Routing performed by:	VTAM	VTAM	NCP
TCP/IP Routing performed by:	Host TCP/IP -or- 3172 w/offload	None	NCP

NOTES

- Throughput Capacity

   This is only a general indicator of the potential throughput for the individual products. Each implementation will, of necessity have varying levels of actual throughput. Any analysis must always take into consideration the distribution of function throughout the network.

- Workstation Service Capacity

   This is not an indicator of the maximum number of devices a product is physically capable of attaching. Rather, it relates to the number of devices in session with a VTAM host that can be serviced by the gateway with acceptable response times. As shown by the chart, the 3745 can service the most devices (several thousand) followed by the 3172 and then the 3174.

- SNA Routing

   Neither the 3172 nor the 3174 products can route SNA workstation traffic to other hosts in the network today. The 3172 uses VTAM in its host to perform SNA routing on its behalf. In addition, ACF/VTAM can route host-to-host traffic (above and beyond the workstation-to-host traffic) through the same 3172 and token-ring adapter. ACF/VTAM cannot route host-to-host traffic through a 3174, so other 3172/3745 links and/or token-rings within the SNA network must be used.

The 3745 uses ACF/NCP to route traffic to other hosts in the network. It is the only product that has internal SNA routing capability today. Use of the 3745 routing functions conserves host CPU cycles, while providing fewer hops for a device requiring VTAM access. In contrast to the 3172 or 3174, once a device is in session with a VTAM application through NCP and the 3745, VTAM is no longer involved.

A 3172 or 3174 should be used when minimal SNA network routing is needed. The 3745 and ACF/NCP should be considered when significant SNA routing requirements are anticipated.

- TCP/IP Routing

   The 3172 in conjunction with the Offload feature implements an IP stack capable of performing IP routing. This conserves host cycles by not requiring the routing function and table maintenance to be performed by the host.

   Using the Ethernet TCP/IP feature gives the 3745 the ability to route TCP/IP traffic within an SNA backbone network.

   A 3172 should be used when the primary gateway protocol will be TCP/IP or when SNA over 802.3 is a requirement.

1.6.2 Management

This table shows the 3172 Model 3 capabilities positioned against the IBM 3174 and 3745 gateways.

Table 2. Relative Management Positioning of the IBM 3172, 3174 and 3745			
Category	3172	3174	3745
Pass LNM Alerts to NetView	Yes	Yes	Yes
Pass NetView Commands to LNM	Yes	Yes	Yes
Configuration Management	OF/2	3174	MOSS
Problem Management	NetView, SNMP, OF/2	NetView	NetView
Impact of Changes	Low	High	Low
Integrated Availability	Some	No	Yes

NOTES

- Pass LAN Network Manager (LNM) Alerts to NetView

   All of these gateways may send LNM alerts from devices attached to a token-ring to NetView on the host. The 3172 may send an alert from devices attached to 802.3 Ethernet. Because the 3174 implements the Ring Error Monitor (REM) function it may send these alerts to NetView as well.

- Pass NetView command to LNM

   All of these gateways may pass NetView commands to LNM on an attached token-ring. The 3172 may send a command to devices that are attached to Ethernet.

- Configuration Management

   Configuration management to the 3172 is performed at a workstation that is running the Operator Facility/2 program. If the workstation is not network attached to the 3172, then configuration is performed via diskettes. OF/2 is described separately later in Chapter 2, "3172 ICP Environment" on page 37.

   Configuration management of the 3174 is performed at a 3174. Large customers with many 3174s in their network may be using Central Site Change Management (CSCM) together with the functions of NetView Distribution Manager.

   The 3745 is managed by the MOSS console to make hardware changes. MOSS runs as a separate subsystem and is available for changes while the 3745 and ACF/NCP are operational.

- Impact of Changes

Both the 3172 and 3745 define token-ring attached devices as Switched major nodes within VTAM. This provides a great deal of flexibility with regard to the addition or deletion of token-ring attached devices.

The 3174 defines token-ring attached devices as channel attached PUs. The 3174 must define each PU and in concert, each PU must define the 3174.

The 3172 and 3745 are more flexible than the 3174 for SNA connectivity. The 3174 has a slight advantage where APPN and PU 2.1 elements are present.

- Integrated Availability

    The 3174 does not provide integrated availability features other than the standard, hardware-based RAS ones. To minimize the impact of potential outages multiple controllers should be installed.

    The 3172 provides a backup path with multiple LAN adapter connections to the same network. As in the 3174, to minimize the impact of potential outages multiple controllers should be installed.

    The 3745 provides redundancy features through non-disruptive maintenance with concurrent diagnostics, hot plug of cards and dual processors. Specific to the VTAM token-ring environment, the 3745 provides token-ring interface connector (TIC) swapping, duplicate TIC addressing, non-disruptive intermediate network node (INN) route switching and multi-medium, multi-link transmission groups.

1.6.3 Host Subsystems

This table shows the 3172 Model 3 capabilities positioned against the IBM 3174 and 3745 gateways.

Table 3. Supported Host Subsystems			
Subsystems	**3172**	**3174**	**3745**
ACF/VTAM	Yes	Yes	Yes
ACF/NCP	No	No	Yes
TCP/IP	Yes	No	Yes●
AIX/ESA	Yes	No	No
OSI/CS	Yes	No	Yes●
Interlink	Yes	No	No
BTAM - TCAM - RYO●	No	No	Yes
Note: ●With VTAM/SNA Link ●With NPSI ●Roll Your Own using BTAM-like interface in EP			

NOTES

- Supported Host Subsystems

  The chart above references traffic flows between LAN attached devices (token-ring or Ethernet) as well as TP line-attached devices to a local or remotely attached host.

  Both the 3172 and 3174 with their associated downstream devices are owned by VTAM. The 3745 NCP is owned by VTAM and the downstream links are owned by NCP. In addition, the 3172 can connect to TCP/IP, AIX/370/ESA, OSI/CS and Interlink** host subsystems.

  The 3172 connects to VM and MVS hosts (ACF/VTAM) and VSE/ESA. For customers needing other VSE support, either a 3174 or 3745 should be used.

1.6.4 Connectivity

This table shows the 3172 Model 3 capabilities positioned against the IBM 3174 and 3745 gateways.

Table 4. Connectivity				
Connection variables		**3172**	**3174**	**3745**
Maximum Host Channels	PCA	2	1	4-16●
	ESCON	16	8●	16●
Maximum Token-Ring Adapters/Controller		4	1	4/8
Maximum SNA Workstations Attached/Controller		1020	250	9999
Maximum TCP/IP Workstations Attached/Controller		Unlimited●	N/A	Unlimited●
Frame Sizes		256 - 16,384 Bytes	256 - 4096/8192 Bytes●	256 - 16,384 Bytes

Note:

●Depending on the model the 3745 may have up to 16 PCAs.
●3174-12L/22L ESCON models provide attachments for up to 8 hosts.
●Per ESCA - the 3745 may have up to 4 ESCAs depending on the model.
●The number of TCP/IP workstations that may attach is dependent on the network class in use (A, B or C). The host environment is more restrictive than the individual gateway products. MVS TCP/IP has a sockets limitation of 5000 hosts for example.
●3174-12L/22L ESCON models provide 8KB frame sizes

NOTES

- Maximum Host Channels (Parallel Channels)

    The 3172 controller can attach to one or two host channels. The 3174 can attach to only one host channel. In addition, the 3174 can link up to two other hosts.

    The 3745 may attach up to 4 channel adapters on the Models 130/170. It may link to up to 16 channels on the X10 models.

- ESCON Capable (Fiber Channels)

    The 3172 supports ESCON in the LAN gateway configuration for TCP/IP and SNA traffic. The 3174 has announced support for the new ESCON serial optical channel to run at a device speed of 4.5 MBps. The 3174 Models 12L/22L provide ESCON attachment for up to 8 hosts. Any individual workstation on the attached LAN may access only one of the channel-attached hosts. Devices may have up to 5 LUs defined.

- Maximum Token-Ring Adapters/Controller

    The 3172 may be configured with up to 4 LAN adapters in varying combinations, including FDDI, Ethernet and token-ring. The 3174 has a

limit of one LAN adapter. Depending on the model, the 3745 may support from 4 to 8 token-ring adapters. The new 3746-900 supports a very high performance token-ring adapter (TIC3) and may attach up to 23 additional token-ring adapters.

The 3172 and 3745 support host-to-host (INN) and terminal-to-host (BNN) traffic across the same or different adapters. The 3174 supports BNN traffic only.

- Maximum SNA Workstations Attached/Controller

  The 3172 supports the SNA workstation whether it is Ethernet, FDDI or token-ring based. The 3745 and 3174 support SNA in the token-ring world. The 3174 supports TN3270 in Ethernet.

  The 3172 may have up to 255 Physical Units (PUs) per LAN adapter concurrently active. If all four possible LAN adapters are installed then the maximum number of PUs is 1020.

  The 3174 may have 250 PUs *defined* on a token ring. This is the total number of PUs that can exist on a token-ring and is limited by adapter storage for buffers within the 3174.

  The 3745 can have 9999 PUs defined per NCP load module. In addition, the 3745 supports all PU types while the 3174 supports PU2 and PU2.1 only.

  The greatest connectivity is provided by the 3745, followed by the 3172 and then the 3174. Note: the actual number of PUs activated at the same time is dependent upon the traffic scheme and on the level of service requested.

- Maximum TCP/IP Workstations Attached/Controller

  The number of workstations that may attach in a TCP/IP environment is not limited by the products but rather by the addressing scheme used. There are three address classes available: A, B or C. Utilizing a 4-byte field in the dotted decimal notation x.x.x.x, TCP/IP defines the following limitations:

  - Class A allows 1 byte for the number of the network and 3 for the host.

  - Class B allows 2 bytes for the number of the network and 2 for the host.

  - Class C allows 3 bytes for the number of the network and 1 for the host.

- Frame Sizes

  The 3174 supports frame sizes from 256 to 4192 bytes on parallel channels and from 256 to 8192 bytes on ESCON channels. The 3172 and 3745 support frame sizes from 256 to 16,384 bytes.

1.6.5 Downstream Communications

This table shows the 3172 Model 3 capabilities positioned against the IBM 3174 and 3745 gateways.

Table 5. Downstream Communications			
Communication variables	**3172**	**3174**	**3745**
PU 2.0	Yes	Yes	Yes
PU 2.1	Yes	Yes	Yes
PU 4 -or- PU 5	Yes	No	Yes
SDLC	Yes	Yes	Yes
X.25	Yes	Yes	Yes
IPX, Vines, AppleTalk	Yes•	No	No
Frame Relay	Yes	Yes•	Yes
BSC	No	Yes•	Yes•
Async/ASCII	No	Yes	Yes•
X.21	Yes•	Yes•	Yes
Token-Ring	Yes	Yes	Yes
Ethernet/802.3	Yes•	Yes	Yes•
FDDI	Yes	No	No

Note:

•Via frame relay bridge
•Configuration Support C.5
•BSC via EP or NCP(3270)
•Async/ASCII support via NTO and EP
•SDLC support only
•3172 supports ACF/VTAM on 802.3 only
 3172 supports TCP/IP on 802.3 or Ethernet V2
 3745 supports only TCP/IP on 802.3 or Ethernet V2
•TCP/IP and/or ACF/VTAM traffic flow

NOTES

- This chart summarizes the downstream capabilities available on the 3172, 3174 and 3745 controllers. For the most part, these functions represent capabilities beyond those of an SNA/VTAM token-ring gateway. As well, the chart provides the basis for evaluating these controllers in terms of other unique requirements.

- The 3172, 3174 and 3745 all support PU2.0 and PU2.1 nodes together with APPN nodes on attached token-rings (and 3745 links). The 3172 and 3745 support downstream PU4 and PU5 network devices. The 3745 provides for downstream attachment of SDLC, X.25, frame relay, BSC and Async/ASCII links. The 3172 provides frame relay support while the 3174 has Async/ASCII link attachment options.

- The 3172, 3174 and 3745 all support Ethernet in various forms. The 3172 and 3745 support TCP/IP in Ethernet DIX V2 and 802.3 as host gateways. The 3172 with either the Offload or MPE option will route IP using RIP. The 3745 with NCP will also route IP. The 3172 supports the greatest number of LAN topologies, including token-ring, Ethernet DIX V2, 802.3 CSMA/CD, and FDDI. With the MPE option the 3172 supports NetBIOS, IPX**, Vines** and AppleTalk** protocols through bridging (frame relay to token-ring only at present).

1.6.6 Functional Positioning

This chart is designed to put the 3172, 3174 and 3745 functional areas in perspective for simple, at-a-glance viewing. As in the preceding tables, the reader is again cautioned that areas pictured are ever changing and to contact their IBM representative for an update on the current status of these products.
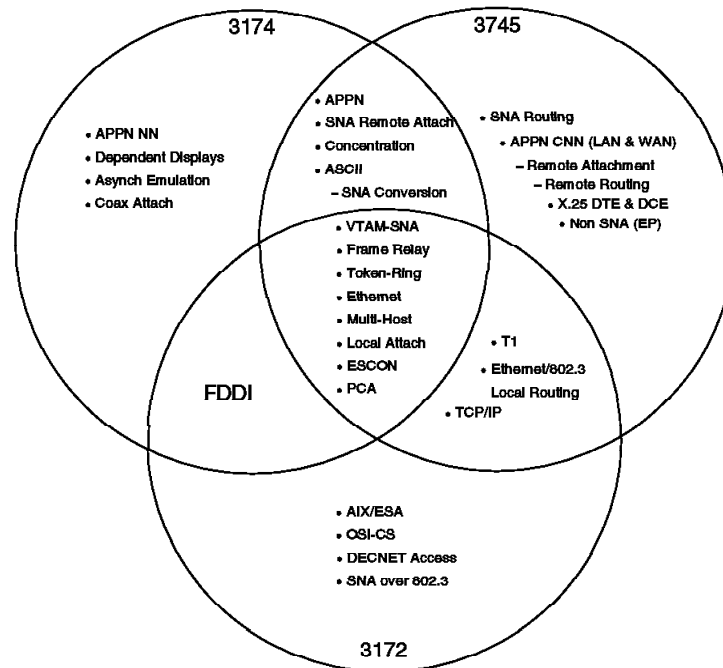
Figure 1. Functional Positioning of the 3172, 3174 and 3745

1.6.7 Operating Platform Decision

While it may not seem an easy task at first glance to choose the proper operating environment for the 3172, there are really only five to choose from. If we work backwards from this, then it becomes a relatively straightforward matter to choose the correct one.

The following decision tree was built to assist you in choosing the correct platform for your needs. Begin at the top and work your way down to one of the ovals at the bottom.
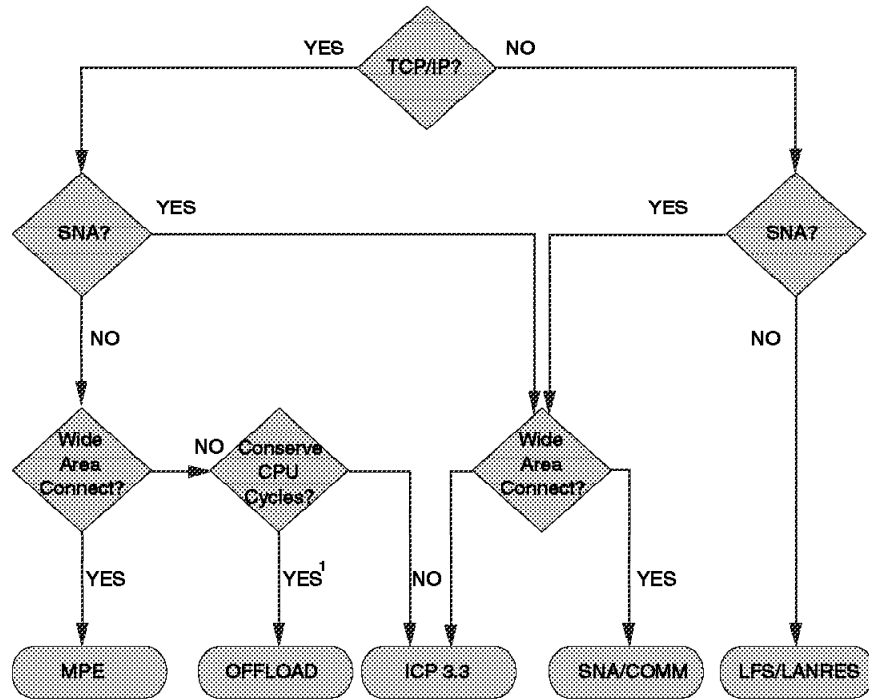
¹See Chapter 3 opening remarks

Figure 2. Decision Tree for 3172 Operating Environments

1.7 ICP Overview

The Interconnect Controller Program is system software that controls operations within the 3172. There have been several releases and the current one as of publication is V3.3. This section is included to provide background information only. There are no user interfaces provided for customization, programming or modification other than through the Operator Facility/2 features and/or the keypad. ICP was designed to be easily installed and maintained with a minimum of user intervention. The following description is not intended to be used as an example of user programming interfaces but rather as background information for those readers who wish to know a little more about what ICP is and how it works.

ICP is an application that runs on MTEX or MultiTasking EXecutive. MTEX was written at the IBM T.J. Watson Research Center in Yorktown Heights, New York. MTEX is a high performance, 32-bit multitasking operating system built to exploit Intel 386/486 architecture. It is not a DOS or OS/2 derivative. MTEX code is modular and divided into logical, functional entities called "tasks." MTEX uses a "round robin" approach within a priority scheduling algorithm for task dispatching.

MTEX provides APIs through a mechanism known as SUDS or Standard Universal Data Switch. Among the program conventions provided are a standard set of function calls and message structures. Intertask communications includes defined message structures and types as well as message handling

rules (that is, what to do when a task receives a specific message). Routines for error handling and logging are included as well as system tasks to control and manage 3172 resources.

An MTEX task is a self-contained code entity that performs some logical function. From a software management perspective, it is easier to divide a large project into smaller, easy to understand, logical components. For the Interconnect Controller Program these components or tasks perform unique functions independent of each other. They are managed in a library as individual tasks. From the MTEX operating system perspective, each task must be loaded, initialized and started before it can be run. Each task is given a time slice to employ the processor. Tasks communicate with other tasks by sending and receiving messages. These tasks are stored, built (compiled and linked) and handled as individual entities. On the ICP working diskettes they are found as **.MTX** files.

Patches to ICP are handled by shipping updates on diskettes. The Operator Facility/2 utility manages the installation process itself. Individual files are overlaid by the APAR installation.

The following diagram provides a modest overview of the inter-relationship of various ICP components.
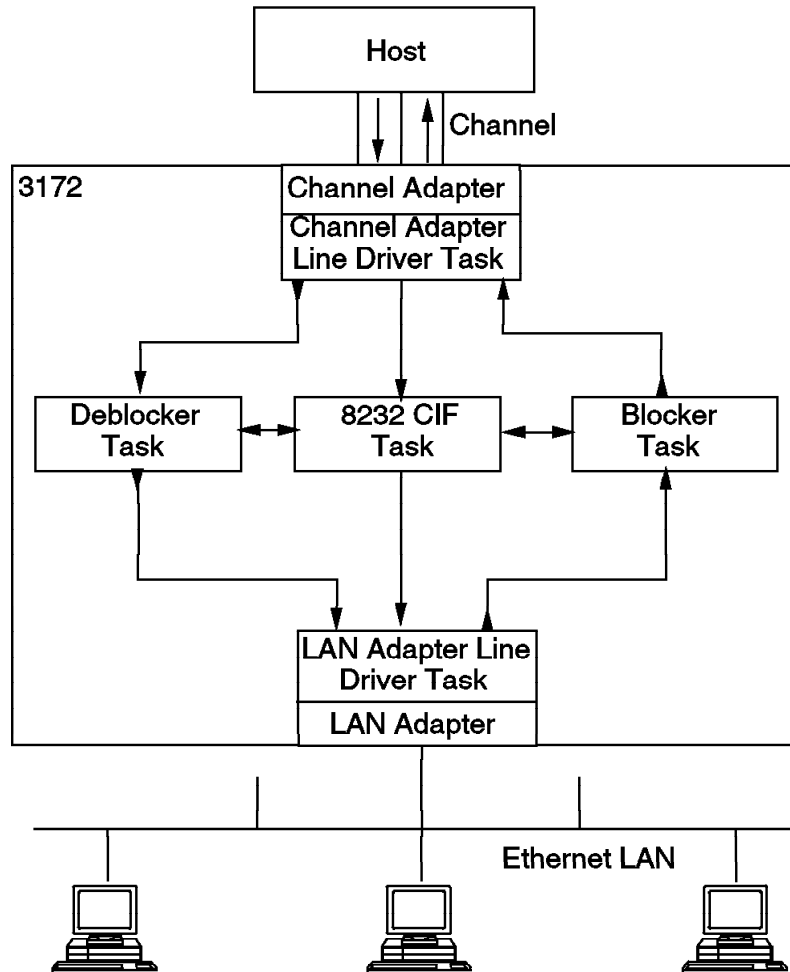
Figure 3. ICP Task Diagram

The diagram in Figure 3 shows the tasks in the ICP that provide gateway functionality. It illustrates how data flows through the 3172 in a typical **TCP/IP** configuration. The Channel Adapter Line Driver Task is the entity that monitors and controls the channel adapter. It sends channel blocks to the Deblocker Task which in turn formats the blocks into LAN frames. The Channel Adapter Line Driver Task is also responsible for forwarding blocks to the host. It receives these from the Blocker Task which has formatted LAN frames into channel blocks. These LAN frames are sent to the Blocker Task by the LAN Adapter Line Driver Task which as the name suggests, controls the LAN adapter. The 8232 CIF Task entity processes 8232 commands. These are sent by the host to the 3172 as specific instructions.

1.7.1.1 Data Flows for the TCP/IP Gateway Function

For TCP/IP traffic destined to a LAN the ICP performs several steps. It first receives a channel block from the host through either a parallel channel adapter or an ESCON adapter. The data is deblocked into the requisite MAC frame for the particular LAN adapter. The frame is routed to this adapter where the LAN adapter line driver then transmits the respective frames.

For traffic destined to a host the ICP converts the MAC frames to channel block format and sends these to the host. The LAN adapter is responsible for receiving the frames. These are then routed to a specific subchannel. Along the way they are blocked together. The channel adapter driver then transmits the blocks on the channel.

1.7.1.2 Data Flows for the SNA Gateway Function

For SNA traffic destined to a LAN the ICP performs several additional steps above those it does for TCP/IP. It provides Logical Link Control support for VTAM for a connection-oriented session. This is the mechanism used for guaranteed delivery of data. The first part of the journey is the same as for TCP/IP. Upon deblocking into MAC frames the LLC application monitors the delivery of frames to the specific destination. Sequencing and retransmission are handled by the LLC code from the LAN Adapter Line Driver.

For traffic destined to a host the ICP code performs the same transformation as for TCP/IP. Once again, it supports LLC on behalf of VTAM. The LLC code routes the frames to a specific subchannel address. Frames are blocked and passed to the channel line driver for transmission to the host. Normal LLC conventions are followed for the life of the session between the workstation and VTAM.

1.8 3172 Network Appearances

1.8.1 SNA Support

As we will see, the 3172 is transparent to an SNA network. Within the SNA network it does not do anything other than pass frames directly between a LAN and a corresponding subchannel. It cannot route (that is, decide where to send a frame on the basis of any addressing information in it). With this simplicity of function there is a corresponding simplicity of definition of *the 3172 itself*. However, within this straightforward environment the host and LAN station definitions are often more involved than for the 3172 itself. It can be said this is a reflection of the protocol and/or architecture being used rather than the 3172.

SNA network management support for NetView* is provided through the Interconnect Enhancement Feature of ICP V3.3 and requires VTAM V3R4 or later in the attached host. SNA connections can be made using token-ring, IEEE 802.3, and FDDI network protocols but not Ethernet DIX V2.

1.8.1.1 Host View and Definitions

To VTAM the 3172 is transparent; that is, in SNA terms it is not addressable. It is not a physical unit (PU) like a 3745 or a 3174. How does the host establish a link to the 3172? Please examine Figure 4 on page 22.

What this shows is that VTAM identifies a LAN through a subchannel. The 3172 is defined to the host control program (MVS or VM) as a channel-to-channel machine (such as a 3088). This gives us the physical connection with the LAN. Over this path VTAM and LAN stations establish switched-like connections. This path is also for one specific SAP, so two VTAMs using different SAPs can share the LAN adapter.

```
┌─────────────────────────────────────────────────────────────────────────────────────────────┐
│   LAN      ·  ·                                       ·    ·                                   │
│   Station  ·  ·                                  · Host(s) ·                                   │
│  ┌───────────────────┐                          ┌───────────────────────┐                     │
│  │ Upper      ·  ·    │                          │  ┌──────┐  ┌──────┐   │                     │
│  │ SNA    ┌───────┐   │                          │  │  PU  │  │  PU  │   │                     │
│  │ Layers │ PU(s) │   │                          │  └──────┘  └──────┘   │                     │
│  │        └───────┘   │      up to 4 subchannels/│     ·         ·       │                     │
│  │            ·  ·    │       channel adapter    │     ·         ·       │                     │
│  ├───────────────────┤  one link station/       │     ·         ·       │                     │
│  │ Path       ·  ·   │  downstream link          │     ·         ·       │                     │
│  │ Control    ·  ·   │          3172             │     ·         ·       │                     │
│  │            ·  ·   │  ┌────────────────────┐   │     ·         ·       │                     │
│  ├───────────────────┤  │→ Link Stations     │   │ VTAM ·     · VTAM     │                     │
│  │ Logical    ·  ·   │  │ ┌──────────────┐   │   │  A   ·     ·  B       │                     │
│  │ Link Ctl.  ·  ·   │  │ ·····SAP'04'●●●●●● │   │     ·         ·       │                     │
│  │ ········          │  │ └──────────────┘   │   │     ·         ·       │                     │
│  │ ┌──────┐ ┌──────┐ │  │ ┌──────────────┐   │   │     ·         ·       │                     │
│  │ │SAP'04'│ │SAP'04'│ │  │ ····SAP'08'●●●  · │   │     ·         ·       │                     │
│  │ └──────┘ └──────┘ │  │ └──────────────┘ · │   │     ·         ·       │                     │
│  │ ·Link Stations·   │  │              Subchannel │     ·         ·       │                     │
│  │ ·          ·  LAN │  │                 A0   │   │     ·         ·       │                     │
│  │ ·          · ·····│····│··················· │   │     ·         ·       │                     │
│  │ ·          ·      │  │                      │   │     ·         ·       │                     │
│  │ ·········· ·······│·····│···················│···│·····          ·      │                     │
│  │          ↕   ↕    │  ┌──│                   │   Subchannel               │                   │
│  │                   │  │  │               C0   │                          │                   │
│  └───────────────────┘  └──────────────────────┘                                               │
│        LAN Adapters                                                                             │
│                                                                                                 │
│     up to 255 link stations/                                                                    │
│           LAN adapter                                                                           │
│                          up to 4 LAN adapters/                                                  │
│                              subchannel                                                         │
│  ┌───────────────────────────────────────────────────────────────────────────────────────┐    │
│  │ Note - If the downstream device is a 3174 using SLMH or similarly implemented device,     │   │
│  │ then it simulates a PU2.0 for each upstream connection with dependent LUs - each of which │   │
│  │ is based on a different SAP.  On the other hand, only a single T2.1 node is required for   │  │
│  │ independent LUs and it must be capable of supporting multiple destination SAPs (which, for │  │
│  │ example, SNA support in OS/2 EE Communications Manager does not provide).                  │   │
│  └───────────────────────────────────────────────────────────────────────────────────────┘    │
└─────────────────────────────────────────────────────────────────────────────────────────────┘
```

Figure 4. 3172 SNA Support - Logical View

Defining this to VTAM is straightforward. The switched connection is standard - so either switched major nodes may be used, or the new switched connection dynamic definition. A new major node type was introduced in VTAM V3R4 to support the physical connection - the external communication adapter (XCA) major node. One XCA major node is required for each LAN adapter that will carry SNA traffic. An example of coding is given in Figure 5 on page 23.

1.8.1.2 LAN Station View and Definitions

Because we are dealing with a logically switched environment, a LAN station has to have some means of finding the gateway. As with a 3745, it must be told the MAC address of the LAN adapter on the 3172 and the SAP that will take it to the desired VTAM. The PU and LU definitions need to correspond to those in VTAM (either in the switched major node or dynamic definition model). See Figure 5 on page 23.

```
CNTLUNIT CUNUMBR=300,PATH=17,SHARED=N,
         UNIT=3088,UNITADD=((00,32)),PROTOCL=S4

IODEVICE UNIT=CTC,ADDRESS=((300,32)),
         STADET=N,CUNUMBR=300
```

```
VBUILD TYPE=XCA            External Comm Adapter (XCA) Major Node

PORT   MEDIUM=RING,        Token-Ring
       SAPADDR=4,          Service Access Point Number
       ADAPNO=0,           Adapter Number                        (1)
       CUADDR=306          Channel Unit Address                  (2)

GROUP  DIAL=YES,           Switched Peripheral Node              (7)
       ANSWER=ON,          Dial Will Accept Calls
       CALL=INOUT,         Dial In And Out
       ISTATUS=ACTIVE

  LINE  ANSWER=ON,         PU Can Dial In
        ISTATUS=ACTIVE
  PU

  VBUILD TYPE=SWNET                                              (3)

  PU     DISCNT=YES,   Disconnect Facility
         DYNLU=YES,    Dynamic Definiton of ILU
         IDBLK=074,    Device ID for OS/2 CM2 Station            (4)
         IDNUM=00020,  Unique Identification Number              (5)
         MAXPATH=1,
         PUTYPE=2      Physical Unit Type

  PATH   DIALNO=00400000032209,    2 digits and MAC address      (6)
         GRPNM=***                 Logical Group Definition      (7)
  LU     LOCADDR=2,                Dependent LU
         ISTATUS=ACTIVE
```

```
ICP Configure 3172:
            INTERCONNECT ENHANCEMENT FEATURE ──── > YES          (8)

ICP Token-Ring Adapter Parameters:
            NODE ADDRESS ────────────────> 4000021B3172          (9)
            HOST PROGRAM ────────────────> VTAM                  (8)
            RELATIVE ADAPTER NUMBER ──── > 0                      (1)


ICP Parallel Channel Adapter Parameters:                         (2)
            TRANSFER MODE AND CHANNEL SPEED - 4.5MB streaming

ICP LAN Gateway Definitions:

SUBCHANNELS    TO CHANNEL    TO LAN    LAN ADAPTER

   06          TOCHN06       TOLAN066    TRA1                     (2)
```

```
3270 feature profiles
    Destination Address        4000021B3172    (9)
SNA feature profiles
    Network Name               USIBMRA         (3)
    Node ID (in hex)           20008           (5)
LAN feature profiles
    Use universal address      NO
        Address                400000032209    (6)
```

MVS/ESA
VTAM

3172
ICP

OS2/CM2
Station

Figure 5 (Part 1 of 2). Sample Definitions for 3172 SNA Support

```
┌─────────────────────────────────────────────────────────────────────────┐
│  Notes - SNA Over 3172/Token-Ring                                         │
│                                                                           │
│   1. The Relative Adapter Number refers to the relative LAN adapter number│
│      generated by the 3172 at ICP configuration time. ″0″ means that this │
│      is the first LAN adapter that was defined at ICP configuration time. │
│      Possible values are 0 to 3 inclusive (for the 4 possible LAN         │
│      adapters in the 3172). For consistency, the ICP adapters should      │
│      always be defined in the same order (preferably slot order).         │
│                                                                           │
│   2. CUADDR, SUBCHANNEL addresses and CHANNEL type and speed are all       │
│      parameters which need to be matched with the appropriate IOCP        │
│      parameters. See 2.8.1, "Host Definitions" on page 80 for the sample  │
│      3172 IOCP definitions.                                               │
│                                                                           │
│   3. If APPN is to be implemented, there are changes to the coding of the │
│      VTAM SWNET major node definitions.                                   │
│                                                                           │
│   4. IDBLK must match the block ID parameter in the CM/2 LAN station.      │
│                                                                           │
│   5. The node ID specified in OS/2 CM/2 must match the IDNUM parameter    │
│      specified at the host. This number is different for each of the      │
│      DSPUs.                                                               │
│                                                                           │
│   6. The DIALNO parameter needs to be coded only if the host will be      │
│      attempting to establish sessions with the DSPU. The last 12 digits   │
│      are the PC′s token-ring network adapter locally administered address.│
│      The first two digits are redundant.                                  │
│                                                                           │
│   7. The GRPNM parameter matches the label on a relevant GROUP statement  │
│      - not shown in this example for simplicity. This number is different │
│      for each of the DSPUs.                                               │
│                                                                           │
│   8. If SNA is to be used over the 3172, then the Interconnect Enhancement│
│      Feature needs to be installed with the base ICP V3.3. You must then  │
│      set the HOST PROGRAM parameter in the ICP to VTAM for the 3172 LAN   │
│      adapter which will support SNA flows.                                │
│                                                                           │
│   9. This is the token-ring network adapter address of the 3172. It is    │
│      locally administered. Universal addresses can be used.               │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 5 (Part 2 of 2). Sample Definitions for 3172 SNA Support

1.8.1.3 Gateway View and Definitions

From the gateway′s point of view, VTAM is a subchannel and a LAN station is a link station (of which a LAN adapter can have a maximum of 255). Definition consists chiefly of associating the LAN adapter with a subchannel on one or both channel adapters. It is up to VTAM and the LAN station to make sure that the right SAP is used. See Figure 5 on page 23.

1.8.1.4 Connection Establishment and Availability

When the XCA major node is activated, VTAM instructs the 3172 as to which SAP to associate with its subchannel. Thus, with two VTAMs (each of which must be defined with a different SAP), the 3172 will know which VTAM control point to associate with each SAP defined.

The method(s) by which a connection and sessions are established in the 3172 environment are almost identical to those used in NTRI for the 3745. The most common way is for the LAN station to ″dial-in″. This is done by having the LAN station establish a link with the 3172 using LLC Type 2 protocols. When this has been done, the LAN station issues a REQCONT (Request Contact) on the link. The 3172 passes the REQCONT to the VTAM which is associated with the SAP used. VTAM sets up the PU and LU definitions according to:

 • *Either* the switched major node entry defined by the XID.
 • *Or* the dynamic switched definition model.

The 3172 sets up a link station for this LAN station. At this point, PU and LU activation and session establishment can take place as normal.

The above applies to any type of LAN. The token-ring environment has some additional capabilities that can enhance the overall availability of the service.

Source routing allows multiple adapters on separate ring segments to have the same MAC address. Switched definitions mean that VTAM does not care which path a device uses to come into the host.

1.8.1.5 Flow Control and Error Recovery

The link between the LAN station and the 3172 is LLC Type 2 (that is, connection oriented) and implements flow control and error recovery techniques. The 3172 (rather than VTAM) provides the function required. The 802.2 standard defines a number of parameters that control the way the link operates, such as window sizes and timers. These are all pre-set in the 3172 environment, including T1, T2 and maximum I-field sizes (transmit and receive). T1, T2, and TI can be set for token-ring networks using the 3172 Operator Facility/2. The settings are shown in Table 6.

Table 6. 3172/VTAM LLC Parameters		
Timers on Token-Ring		
T1 - Response Timer	2 sec	
T2 - Acknowledge Timer	80 ms	
TI - Inactivity Timer	3 sec	
Timers on 802.3, FDDI		
T1 - Response Timer	2 sec	
T2 - Acknowledge Timer	80 ms	
TI - Inactivity Timer	30 sec	
Window	**Size**	
Transmit Window	2	
Receive Window	1	
I-field size in bytes (T-R only)	**Default**	**Max**
Receive	2048	4496 17960
Transmit	2048	4496 17960
Note: The LLC timer values are set in line with the method described in *Local Area Network Technical Reference* - the OPEN ADAPTER sets a series of ″tick″ values and the OPEN SAP (issued by VTAM) selects the ones to be used by **all** LAN stations using this SAP. The reason for the difference between token-ring and other environments is that in the former case the LLC function executes on the adapter with a resultant lower latency. The other adapters do not do this and the timers are set longer to compensate for this subtle difference.		
Note: The maximum I-field numbers refer to 4Mbps and 16Mbps respectively. 802.3 LANs are limited to a maximum I-field size of 1500 bytes.		

The timer values, in particular, have implications for networks that use remote bridging techniques; see 1.8.1.6, "Tuning Considerations" on page 26.

The 3172 does nothing more than provide the LLC function, so other facilities - segmentation in particular - have to be provided by VTAM. As regards segmentation therefore, it is important to ensure that MAXDATA on the PU

definition does not exceed the maximum transmit I-field size in the 3172 or the maximum receive I-field size in the LAN station. Similar considerations apply to inbound traffic.

1.8.1.6 Tuning Considerations
In the case of file transfer throughput using the 3172, care should be taken with 16 Mbps token-rings to ensure that the transmit buffer in the LAN adapter is capable of holding 16KB frames, and that there are enough receive buffers at the destination LAN token-ring adapter to receive large frames.

The fact that the other LLC parameters, especially timers, may now be adjusted means that you must be very careful when using the 3172 in a multisegment LAN, particularly when you are using remote bridges:

- The roundtrip delay (including queueing) must not exceed T1 (1 second); otherwise you will be continually retransmitting frames. As an example, consider a 1KB frame traversing a 9.6 Kbps link - that part alone will take at least .83 sec, leaving next to no time for crossing bridges, rings, adapters or the return trip. One should consider limiting the maximum I-field size severely.
- If you have many DSPUs, there will be a lot of traffic generated by "are you there?" messages - the inactivity timer is set to 3 seconds. If the DSPUs are individual workstations, it is likely that they will trigger this timer very frequently.

In summary, if you are considering remote bridges, plan carefully.

Although it is possible to change certain parameters relating to channel transfer (the block size and the interval), these have been chosen as the optimum. You are advised *not* to change them.

1.8.1.7 Network Management
The 3172 is transparent to VTAM in the sense that no sign of it can be seen when looking at a LAN station. The 3172 does in fact provide facilities to send alerts and other information to NetView but this is not dependent on actually having an SNA network of LAN stations. We will cover this area in more detail in Chapter 7, "3172 Model 3 High-Availability" on page 317.

What is important about this transparency is that VTAM does not know what address corresponds to which PU (which is what it sees) except through manual documentation of the relationship. This can inhibit problem determination of a connection or session nature.

A 3172 with SNA support can obviously provide a connection path for LAN Network Managers to control the LAN itself but it does not implement any token-ring management functions, such as Ring Error Monitor.

1.8.2 TCP/IP Support
TCP/IP has been supported by the 3172 since V1 of ICP. Token-ring, Ethernet V2, IEEE 802.3, and FDDI network protocols may be used. TCP/IP V2 for VM or V1 for MVS is required to provide the host support.

1.8.2.1 Host View and Definitions

The relationship between the different components in this environment are shown in Figure 6.

```
┌─────────────────────────────────────────────────────────────────────────────────────┐
│                 .                                                              .      │
│         LAN     · Station                                     HOST             ·      │
│       ┌─────────·──────────┐                                ┌──────────────────·──┐   │
│       │         ·          │                                │                  ·  │   │
│       │ TCP or  ·   UDP     │                                │                  ·  │   │
│       │         ·          │                                │                  ·  │   │
│       │─────────·──────────│                   Subchannel    │      ·   MVS or     │   │
│       │         ·          │                   Pair C0,C1    │      ·      VM      │   │
│       │   IP    ·          │               3172              │      ·   TCP/IP     │   │
│       │         ·          │                                 │      ·             │   │
│       │─────────·──────────│          ┌──────────┐ ┌─────────│      ·             │   │
│       │         ·          │   LAN    │          │ │    ▼    │      ·             │   │
│       │         ·          ├──────────┤          ├─┤·········▶·········│      ·     │   │
│       │ ········.··········│·········│          │ │         │      ·     │   │
│       │ Link / Physical    ├──────────┤          ├─┤ ········◀·········│      ·     │   │
│       └────────────────────┘          └──────────┘ └─────────┴────────────────┘   │
└─────────────────────────────────────────────────────────────────────────────────────┘
```
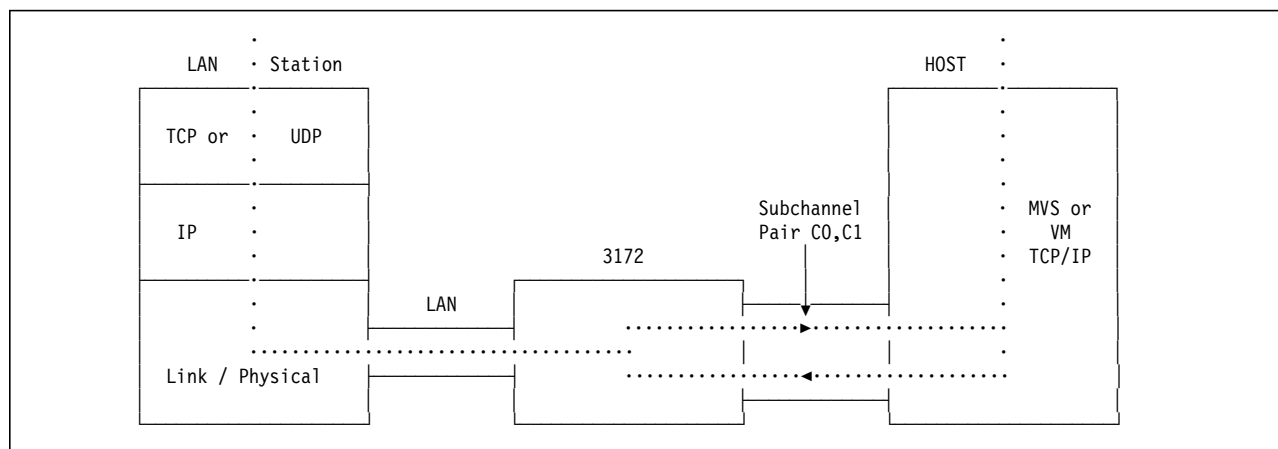
Figure 6. 3172 TCP/IP Support - Logical View

In the first instance, any other TCP/IP LAN station is seen by a TCP/IP host as an IP address. Given this, there are two possibilities:

1. It can see the other TCP/IP host directly, because it has a connection on the same network. If this is the case then the host can determine the MAC address of the LAN station by using the Address Resolution Protocol (ARP). Subsequent messages can address the LAN station directly by its adapter address.

2. It knows that the LAN station is on another network that cannot be directly addressed. Here, the host uses an IP gateway (either explicit or default) that it can address directly. The TCP/IP host sends all traffic to that gateway (having, if necessary, established its MAC address using ARP). The gateway forwards the traffic according to the same algorithm.

TCP/IP for VM or MVS sees the network as a pair of subchannel addresses. The 3172 acts purely as the physical interface to the LAN; taking datagrams from a subchannel, placing them on the LAN and the same in reverse are examples of this. This has no impact on the above alternatives.

Some typical host definitions are shown in Figure 7 on page 28; they establish the relationship between the addressing and the 3172 - at the IP level.

```
┌────────────────────────────────────────────────────────────────────────────────────────┐
│          ┌────────────────────────────────────────────────────────────────────────┐     │
│          │ SYSGEN for the IBM 3172                                                  │     │
│          │     IOCP Definition──────► CNTLUNIT CUNUMBR=EA0,PATH=16,SHARED=N,UNIT=3088,  (1)│
│ ┌──────┐ │                                     UNITADD=((A0,32)),PROTOCL=S4         │     │
│ │MVS/ESA│─┤     I/O Generation on MVS/ESA                                           │     │
│ │      │ │         └──────────────► DEVEA0   IODEVICE UNIT=CTC,ADDRESS=((EA0,32)),   │     │
│ │TCP/IP │ │                                  STADET=N,CUNUMBR=EA0                    │     │
│ ├──────┤ │ TCP/IP Profile for the MVS/ESA:                                          │     │
│ │      │ │          ;Hardware definitions:                                      (2) │     │
│ │ VTAM │ │          ;                                                               │     │
│ └──────┘ │          DEVICE TR1    LCS        EA6                                     │     │
│   │/     │          LINK    LCS1  IBMTR  0   TR1                                     │     │
│   │/     │          .......                                                         │     │
│   │/     │          HOME                                                            │     │
│   │/     │           ; Local Host's Internet Addresses                          (3) │     │
│   │/     │              128.10.1.1     LCS1                                          │     │
│   │/     │              .......                                                     │     │
│   │/     │          GATEWAY                                                     (3) │     │
│   │/     │           ;Network  First hop  Driver  Packetsize  Subnet mask Subnet value│   │
│   │/     │              128.10      =       LSC1      1000         0                 │     │
│   │/     │              .......                                                     │     │
│   │/     │              .......                                                     │     │
│   │/     │          START TR1                                                       │     │
│   │/     │              .......                                                     │     │
│   │/     │              .......                                                     │     │
│   │/     └────────────────────────────────────────────────────────────────────────┘     │
│   │/     ┌────────────────────────────────────────────────────────────────────────┐     │
│ ┌──────┐ │ ICP Token-Ring Adapter Parameters:                                       │     │
│ │ 3172 │─┤                                                                          │     │
│ │ ICP  │ │              HOST PROGRAM ─────────► Other                               │     │
│ └──────┘ │                                                                          │     │
│   │      │ ICP Parallel Channel Adapter Parameters:                             (1) │     │
│   │      │                                                                          │     │
│   │      │              TRANSFER MODE AND CHANNEL SPEED ─────────► 4.5MB data streaming │  │
│   │      │                                                                          │     │
│   │      │ ICP LAN Gateway Definitions:                                         (1) │     │
│   │      │                                                                          │     │
│   │      │     SUBCHANNELS    TO CHANNEL    TO LAN    LAN ADAPTER                    │     │
│   │      │                                                                          │     │
│   │      │     A6-A7          TOCHN0A6      TOLAN0A7     TRA1                        │     │
│   │      └────────────────────────────────────────────────────────────────────────┘     │
│   │  ┌──────┐ ┌──────────────────────────────────────────────────────────────────────┐  │
│   ├──│TCP/IP│─┤ HOME address ─────────► 128.10.1.1                                (3) │  │
│   │  │ PS/2 │ │ GATEWAY address ───────► 128.10                                   (3) │  │
│   │  └──────┘ └──────────────────────────────────────────────────────────────────────┘  │
│   │                                                                                       │
│   └──────────► For running NETBIOS applications in the PS/2 see NOTE ─────────────────►(4)│
└────────────────────────────────────────────────────────────────────────────────────────┘
```

Figure 7 (Part 1 of 2). Workstation TCP/IP to TCP/IP MVS/ESA via 3172 - Key Parameters

Figure 7 (Part 2 of 2). Workstation TCP/IP to TCP/IP MVS/ESA via 3172 - Key Parameters

1.8.2.2 LAN Station View and Definitions

There is no difference in how a LAN station views a host. It knows the IP address it wants to access, and this will either be in the same network and directly addressable, or belong to another network and will need routing through an IP gateway.

In both cases, the host will eventually be identified by a MAC address - that of the 3172 LAN adapter which corresponds with this IP address.

1.8.2.3 Gateway View and Definitions

From the above we can see that, apart from configuring the 3172, the only definition necessary to complete the link is to establish the relationship between a subchannel and LAN adapter combination. Through the use of the *relative adapter number*, it is possible for a subchannel pair to be associated with more than one LAN adapter. Thus, TCP/IP would appear as if it was attached to multiple networks and had an IP address for each one. It is not possible for one LAN adapter to be associated with multiple subchannels (and therefore multiple TCP/IPs).

In the token-ring environment, you have the option to set maximum transmit and receive datagram sizes up to 4496 and 17960 bytes for 4 Mbps and 16 Mbps token-rings respectively.

1.8.2.4 Connection Establishment and Availability

The means by which a LAN station and the TCP/IP host establish contact is no different from that in any other TCP/IP environment. This process does not affect the 3172 at all - it is just a series of frames passing through. In particular, there is no requirement to maintain link stations and so, the 3172 imposes no limit on the number of LAN stations that can access the host.

There is however, a potentially significant impact on the host. This comes from the fact that all ARP activity (broadcast storms) on the LAN requires some involvement from the host (to check or copy addresses).

If some part of a 3172 is broken, and the path to the host represented by a particular IP address is not available, there are two possible approaches to gaining access to an alternate path:

 1. The user or application wishing to use this host can request access through **a different IP address**. They would need to know this address or have it already defined under some alias.

 2. Reconfigure the 3172 to fit in with existing definitions. Any activity of this sort **will disrupt all users** of the 3172 and would involve significant planning and procedural discipline.

1.8.2.5 Flow Control and Error Recovery

With TCP/IP traffic, the 3172 makes no contribution to managing the flow of data in the network. To make sure that it is configured correctly (remember, it won't do any segmentation) ensure that frame sizes fit within the appropriate limits (1500 bytes for Ethernet V2 or IEEE 802.3, as specified for token-ring).

1.8.2.6 Network Management

In Release 2.1 of the 3172 ICP, support was added to provide network management information about the 3172 to the SNMP sub-agent in the host. Private MIB variables were defined for the 3172 information. The host program requests information from the 3172 with a private protocol over the channel, then formats the data as required to be sent to the SNMP entity that requested it (be it NetView or an external host).

1.8.3 OSI Support

With OSI/CS Release 1.1, the 3172 is supported directly by OSI/CS for the LAN gateway function with ICP V1, V2 and V3. The only adapter type supported at the moment is the Ethernet adapter at 802.3 protocol level. Four LAN adapters can be supported; however, they cannot be assigned to more than two subchannel pairs.

The LAN support within OSI/CS can only be used with the connectionless-mode network service (CLNS). The connectionless-mode network protocol (CLNP) defined by ISO 8473 (internet protocol) is used to provide CLNS. Figure 8 on page 31 shows how OSI/CS LAN support conforms to external standards and the OSI Reference Model.

```
       OSI Reference Model                              Open System

                                                 ┌──────────────────────┐
                                                 │  User Application     │
     Layer 7      ◄······Application·······►     ├──────────────────────┤                        ───────
                                                 │        ACSE           │
     ───────────                                 ├──────────────────────┤

     Layer 6      ◄······Presentation······►     │    Presentation       │
                                                 │       Layer           │
     ───────────                                 ├──────────────────────┤

     Layer 5      ◄·········Session········►      │     Session           │    OSI/Communications Subsystem
                                                 │      Layer            │
     ───────────                                 ├──────────────────────┤

                                                 │    Transport          │
     Layer 4      ◄········Transport·······►      │     Layer             │
                                                 │    (Class 4)          │
     ───────────                                 ├──────────────────────┤

                                                 │     Network           │
     Layer 3      ◄·········Network········►      │      Layer            │
                                                 │     (CLNS)            │
     ───────────                                 ├──────────────────────┤                        ───────

     Layer 2      ◄········Data Link·······►      │   ISO 8802-2          │    LAN support and IBM 3172
                                                 │   ISO 8802-3          │
     ───────────                                 ├──────────────────────┤                        ───────

     Layer 1      ◄·········Physical·······►      │     10BASE5           │
                                                 └──────────────────────┘
```
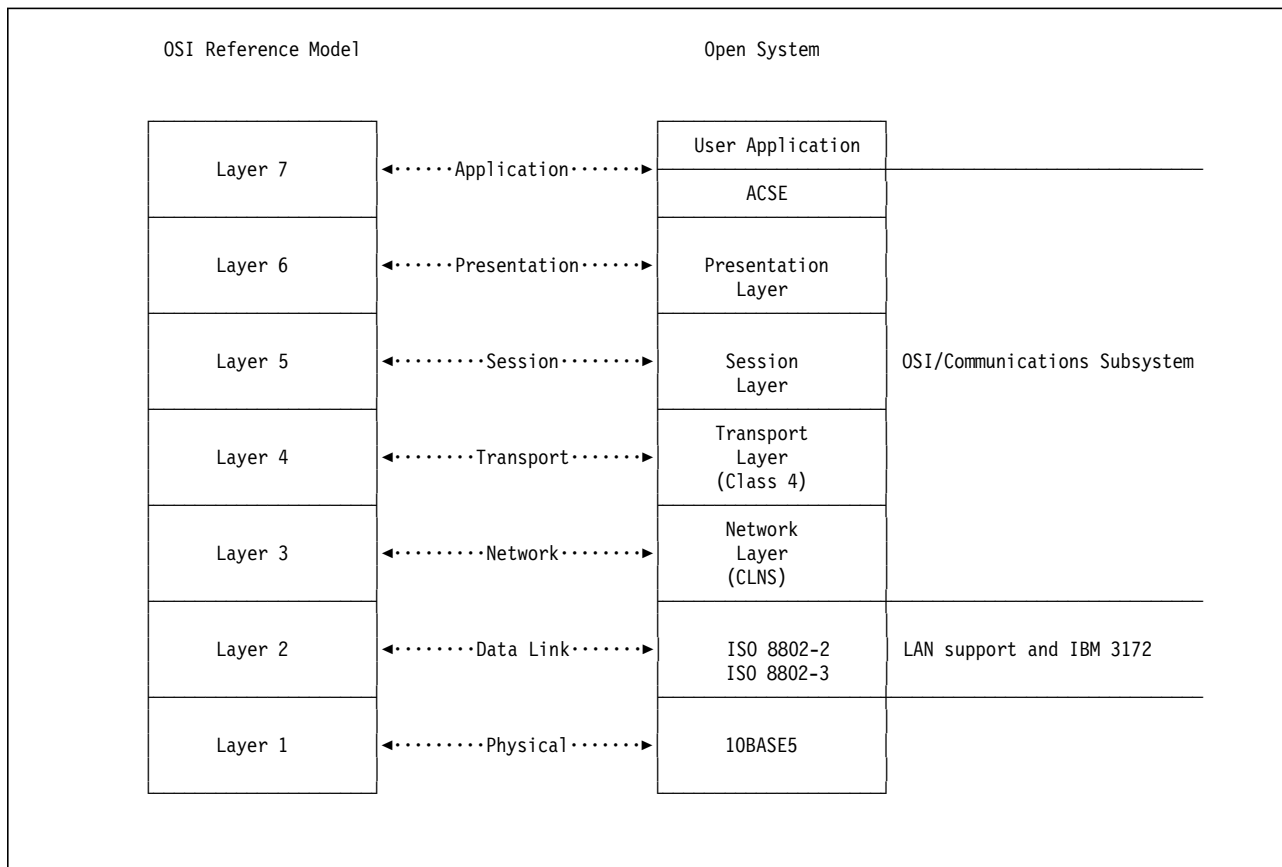
Figure 8. 3172 LAN Support and OSI/CS Mapping to the OSI Reference Model

1.8.3.1 Host View and Definitions

To configure the network topology for the open system, be it host or LAN station, a number of activities need to be done. Following is a summary of the activities required. The summary also includes a sample configuration to define an open system LAN station to a host via a 3172 gateway. Refer to Figure 8 for a pictorial representation of the example.

 1. Identify the network addresses for both the local and remote nodes.

    For example if the LAN station's network address is called **IBMHOST**, it will be defined in OSI/CS as a Local Network Entity Title (LNET) and a Network Services Access Point (NSAP). Similarly, if the LAN station's network address is called **PS2OSIR**, it will be defined as an Adjacent NET (ANET) and a remote NSAP to OSI/CS.

 2. Identify the attached LAN subnetworks and the LAN devices that the local node uses.

    The attached LAN subnetwork provides an identifier for the resources (devices) you define for this particular LAN subnetwork. For example, it may be called **LAN1**. The local devices identify the LAN stations which are attached to the LAN subnetwork. In the host OSI/CS system, this unique name must match the value of the NAME keyword in the LDEFDEV configuration command. See 1.8.3.1, "Host View and Definitions." In our example we have defined one local device **DEVICE03** attached to the LAN subnetwork **LAN1**.

3. Identify characteristics of all remote nodes: adjacent, relay (if used) and destination.

   An adjacent node is a node attached to the same subnetwork as the local node. Therefore the local node can communicate directly through the subnetwork. The adjacent node can be the ultimate destination for communications, or it can be a relay node for a non-adjacent destination node. In our example, **IBMHOST** is defined as an adjacent node on **LAN1**. **IBMHOST** can be accessed via two MAC addresses, either X′00DD00000001′ or X′00DD00000002′.

4. Configure the connectionless-mode network service (CLNS).

   In this case, CLNS is set to **ON** for the adjacent node **IBMHOST**.

5. Identify the path sets used for CLNS.

   CLNS path sets specify which local devices can communicate with which adjacent node devices. If a local LAN device is not part of a CLNS path set, the device cannot be used for outbound connectionless-mode communication. However, these devices may still be used for inbound connectionless communication. For example, the path to **IBMHOST** is defined by **PS2OSIR′s** resource **DEVICE03** traversing LAN subnetwork **LAN1** using either MAC address X′00DD00000001′ or X′00DD00000002′.

PS2OSIR must also configure appropriate transport class 4 modes as described in *OSI/CS Configuration and Administration Guide*.

The above activities are performed for the host and LAN station using the Administrative Facility of OSI/CS or OS/2 OSI CS where appropriate. The host also requires the LAN Configuration Utility of OSI/CS to be run. Following this figure is a discussion of these additional host definitions.
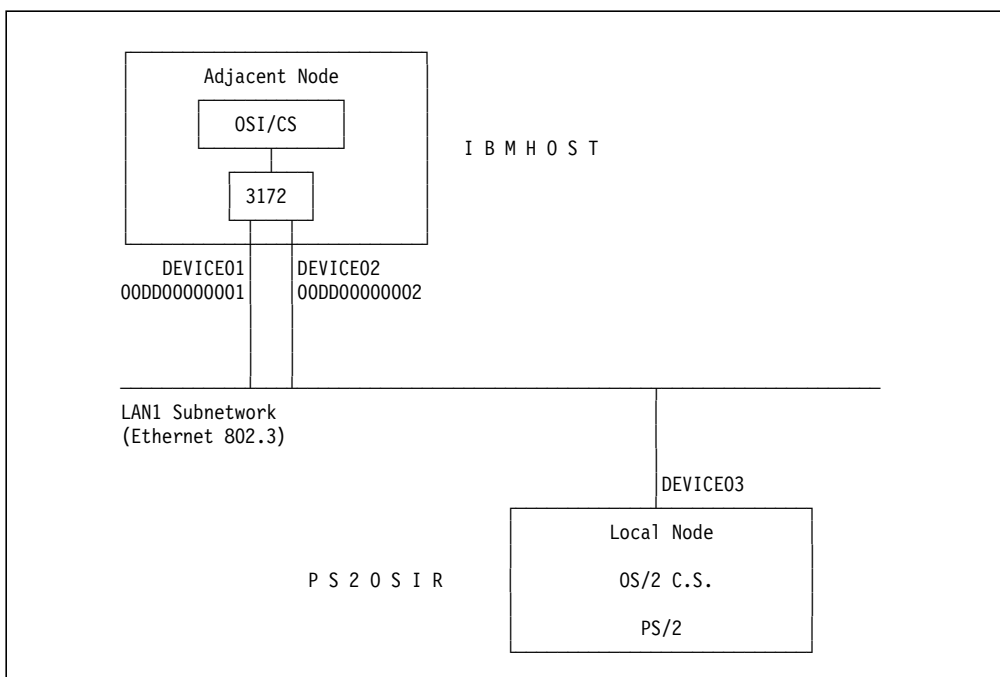
Figure 9. Sample OSI Network for OS/2 OSI C.S. to OSI/CS Connection over 3172 and 802.3

Figure 8 on page 31, together with the previous discussion, shows the necessary information required to configure a LAN station for connection to the

3172. Hence, the local node is the LAN station, and the adjacent node is the host. If you were configuring the host's OSI/CS network configuration, a mirror image of the definitions would be required for defining the LAN station open system to it.

Note that the local system only sees the MAC addresses of the adjacent system and not the device names. Hence, if **IBMHOST** wanted to connect to **PS2OSIR**, (as opposed to FRED wanting to connect to IBMHOST in our example), then **DEVICE03's** MAC address would need to be known and defined to **IBMHOST**.

The configuration file is a sequential file that contains startup information about the LAN channel units and their subordinate devices. Each channel unit corresponds to a channel attachment to the 3172. The logical address of the channel unit is defined in this file. For each device, several attributes are defined, including the adapter number and the MAC device address. To build the configuration file, you create a source file similar to the one shown on page 33. You then run the configuration utility against the source file to produce an object file, which is then specified by the operator at startup. The following example shows the OSI/CS configuration source file for two 3172 Ethernet adapters using the subchannel address ″E0″ on path 9.

```
LDEFCHU,NAME=IVPCHNNL,CHUA=09E0,AUTOSTART=Y
LDEFDEV,NAME=DEVICE01,CHU=IVPCHNNL,ADAPTER=0,
  MACADDRESS=00DD00000001
  AUTOSTART=Y
LDEFDEV,NAME=DEVICE02,CHU=IVPCHNNL,ADAPTER=1
  MACADDRESS=00DD00000002
  AUTOSTART=Y
*
LSETATR,CHU=IVPCHNNL,TINMSGLT=0
LSETATR,CHU=IVPCHNNL,TUNITEXP=0
LSETATR,CHU=IVPCHNNL,INMSGLT=20
LSETATR,CHU=IVPCHNNL,OUTBFTMR=5
LSETATR,CHU=IVPCHNNL,TESTTMR=1000
*
LSETLSAP,LSAP=FE
```

The commands in this source file define your channel units, devices and appropriate attributes for them. For more information refer to *OSI/CS Configuration and Administration Guide*.

1.8.3.2 LAN Station View and Definitions
Since the LAN station is a peer open system to the Host open system, the same configuration activities need to be performed using the Administrative Facility of OS/2 OSI C.S. See 1.8.3.1, "Host View and Definitions" on page 31 for a description of configuration activities required for both the LAN station and host nodes.

1.8.3.3 Gateway View and Definitions
The 3172 sees the host as a channel over which datagram traffic is sent. In other words, since OSI/CS LAN support is connectionless like TCP/IP, the 3172 does not need to do link level pacing for OSI, as it does for SNA. This may provide performance advantages in the connectionless environment for the 3172.

1.8.3.4 Connection Establishment and Availability

The LINIT operator command causes OSI/CS to read the configuration file and initialize LAN support to the 3172. Channel unit and devices configured will then become active. Let's take an example of **PS2OSIR** wishing to transfer or "copy" a file to **IBMHOST** as shown in Figure 8 on page 31. **PS2OSIR** needs to establish an association between the two application entities, OSI FS/2 and OSI/FS. **PS2OSIR** initiates a connection request at the transport layer level (CR-TPDU) which establishes attributes such as window size and flow control parameters which are to be used for the association. **IBMHOST** then responds with a connection confirm (CC-TPDU) and accepts the attributes proposed by **PS2OSIR**. Similar associations are set up at layers 5, 6 and 7 between the two peers to agree on things such as synchronization points, dialog management (FDX in the LAN environment) and presentation context and finally, the application association is established. Since the association is connectionless below layer 4, the NSAP address is sent in each NPDU and the MAC address is sent in each frame for flows between the two open systems. In our example, there are two paths (via two MAC addresses) available for the LAN station NSAP to establish a connection with the host NSAP. **Both** paths can be used for the flow of data for the same session. The choice of path is based on load balancing algorithms and availability. For example, if one of the Ethernet adapters on the 3172 fails, and an alternative path set through the other Ethernet adapter has been defined for the LAN subnetwork, then this path will be used for the duration of the session without disruption to the session.

1.8.3.5 Flow Control and Error Recovery

Since the OSI/CS LAN implementation uses the connectionless mode of service, flow control is implemented at the transport layer in transport class 4. Functions provided by the transport layer include:

- End-to-end sequence control of individual connections

- End-to-end error detection and any necessary monitoring of the quality of service

- End-to-end error recovery

- End-to-end segmenting, blocking and concatenation

- End-to-end flow control on individual connections

These functions are performed independently of the 3172 by the OSI/CS and OS/2 OSI C.S. software, and hence do not use the LLC parameter settings which are fixed in the 3172. See 1.8.1.5, "Flow Control and Error Recovery" on page 25. When configuring the transport class 4 mode using the administrative facility of OSI/CS or OS/2 OSI C.S., note that for LAN subnetworks, both the CLNP segment size and the maximum service data unit size are 1496 bytes. If you specify a larger value, the MAC frame will exceed the maximum allowable size for the LAN.

1.8.3.6 Network Management

OSI/CS and OS/2 OSI C.S. see the 3172 Ethernet adapters and channel addresses together with all MAC addresses of peer open systems. Hence, it is easy to isolate failing components in the network using the System Management Application Entities. Within the OSI/CS and OS/2 OSI C.S. software, OSI resources can be controlled by a defined **manager**, for example in the host, which sends commands to the **agent**, such as the LAN station. Similarly the **agent** can report errors and information to the **manager**.

In addition to the specific functions of the OSI/CS management and directory protocols, OSI/CS uses SNA network management architectures to manage SNA generic alerts sent from the 3172 and LAN stations using NetView facilities.

OSI/CS communicates with NetView through an LU 6.2 session and communicates with other open systems through the OSI SMAEs. NetView operator support is provided on the OSI/CS. Like a local operator, a NetView operator can issue OSI/CS commands to, and receive event reports from, any open systems with which the OSI/CS has a management association. The NetView operator has the capabilities of the local system operator, plus the following additional capabilities:

- Monitoring alerts - a single NetView operator can manage both SNA and OSI systems

- Logging and tracking alerts

- Added online detail about OSI events, such as probable causes and recommended actions

- Automated operation depending on messages, and user exit invocation on receipt of alert

- Filtering of alerts, to suppress those that are of no interest

NetView and OSI/CS can coexist within the same node or can reside in separate nodes.

Chapter 2. 3172 ICP Environment

The ICP environment provides a wide range of networking solutions for customers who require access to host applications from LAN-attached stations operating on heterogeneous physical media and heterogeneous communications protocols.

In the ICP environment, the IBM 3172 Interconnect Controller Model 3 provides the LAN gateway function to token-ring, Ethernet and FDDI LAN-attached stations in order to access host applications using SNA, TCP/IP and OSI protocols.

The Interconnect Controller Program is a highly-tuned, flexible, multitasking operating system for Intel-based computers. It provides services to programs running in an environment of cooperative concurrent tasks. It is intended for high-performance, dedicated applications, such as communications controllers.

This chapter provides information on how to install, configure and use the IBM 3172 Interconnect Controller Model 3 and the Interconnect Controller Program Version 3 Release 2 with the intention to access VTAM, TCP/IP and OSI applications on the host. A number of connectivity scenarios involving a System/390 host, an IBM 3172 Interconnect Controller Model 3 running ICP Version 3 Release 2 and several PS/2 workstations attached to token-ring, Ethernet and FDDI LANs are provided as working examples.

We wrote this chapter using ICP Version 3.2, which at the time of our testing was the most current. However, since the completion of our testing and publication date, IBM has announced a newer, Version 3.3. We have not included testing results for this release in our book in an effort to improve the timeliness of delivery of all the material in the book. In general it can be said that all of the following is still very valid and current. There are newer features and functions provided by ICP 3.3 (for hardware support) and in OF/2 that are not documented here. These features are documented in the appropriate product manuals and we advise you as always, to please read these and not to rely exclusively on any one source (including this reference) for your documentation support.

2.1 General Hardware and Software Environment

This section lists the hardware and software requirements of the 3172 ICP operating environment.

2.1.1 Hardware Requirements

The ICP operating environment requires the following hardware:

3172 Model 3 which includes:

- 25 MHz 80486SX processor card

- 8MB RAM

- 80MB hard disk

One or a combination of the following LAN adapters:

- IBM 3172 Token-Ring 16/4 Busmaster Adapter (FC 2215)

- IBM 3172 Ethernet/802.3 Busmaster Adapter (FC 2225)

- IBM 3172 Token-Ring Auto LANStreamer MC32 Adapter (FC 2235)

  - IBM 3172 Ethernet EtherStreamer MC32 Adapter (FC 2245)

  - IBM 3172 FDDI Adapter (FC 2300)

One or two of this type of adapter:

  - IBM 3172 System/390 Parallel Channel Adapter (FC 2501)

OR, one of this type of adapter:

  - IBM 3172 ESCON Adapter (FC 2800)

Note: The 3172 supports up to two parallel channel adapters. But if you install any parallel channel adapters, you cannot install an ESCON adapter.

2.1.2 Optional Hardware Features

You may upgrade the 3172 Model 3 standard 25 MHz 80486SX processor with one of the following hardware features:

  - 50 MHz 80486DX processor card (FC 2830)

  - 66 MHz Pentium** processor card (FC 2850)

2.1.3 Supported Channel Devices

Using a parallel channel adapter, an IBM 3172 Interconnect Controller can communicate with any of the following IBM channel devices:

  - ES/3090

  - 308x and 309x processor series

  - 4361 and 4381 processor series

  - ES/9021

  - ES/9121

  - ES/9221

  - 3044 Fiber Optic Channel Extender Link, Model D02

  - ESCON Converter Model 1 (9034)

Using an ESCON adapter, an IBM 3172 Interconnect Controller can communicate with any of the following IBM channel devices:

  - ES/3090J (selected models)

  - ES/9021

  - ES/9121

  - ES/9221

  - 9032 and 9033 ESCON Director products

  - ESCON Remote Channel Extender (9036)

2.1.4 Software Requirements

The software requirements depend on the following considerations:

- Physical LAN media

- Installed 3172 adapters

- Operating system running on the host

- Host applications and communications protocols

- Operating system running on the LAN station(s)

The ICP operating environment requires the following software to be installed on the IBM 3172 Interconnect Controller:

- Interconnect Controller Program Version 3 Release 2 (5621-425) or later

2.1.5 Optional Software Features

If you intend to access SNA applications on the host and/or manage your IBM 3172 Interconnect Controller using one of the NetView family of products then you must install the following feature:

- 3172 Interconnect Enhancement Feature (FC 0146)

2.1.6 Limitations of the ICP Environment

The ICP operating environment raises a number of considerations and imposes certain limits, depending on the type and number of channel and LAN adapters and the host programs used on the host(s):

- Maximum adapter combinations

- Parallel channel host connections

- ESCON host connections

- Maximum number of user sessions

- Sharing LAN adapters

- Sharing subchannels

- Data flow between LAN adapters and the host

Maximum Adapter Combinations

Table 7 shows the maximum channel and LAN adapter combinations supported by a single 3172 Model 3 when using ICP.

Table 7. Maximum Adapter Combinations in ICP Environment			
Token Ring or Ethernet/802.3	**FDDI**	**Parallel Channel**	**ESCON Channel**
4	0	2	0
4	0	0	1
2	1	2	0
2	1	0	1

In the ICP environment, the various channel and LAN adapters can be inserted into certain slots depending on their various possible combinations.

Table 8 shows the valid combinations of channel and LAN adapters and pre-assigned slots supported by a 3172 Model 3 using a parallel channel adapter to communicate with the host.

Table 8. IBM 3172 Model 3 ICP Adapter Plugging Chart for Parallel Channel

Gateway Card Slots								
8	7	6	5	4	3	2	1	Combinations
Fixed Disk Adapter	FDDI• T-R Ether	FDDI• NU•	NU•	PCA•	NU•	NU•	PCA•	One LAN Adapter
Fixed Disk Adapter	T-R Ether	T-R Ether	NU•	PCA•	NU•	NU•	PCA•	Two LAN Adapters
Fixed Disk Adapter	FDDI•	FDDI•	NU•	PCA•	T-R Ether	NU•	PCA•	
Fixed Disk Adapter	T-R Ether	T-R Ether	NU•	PCA•	T-R Ether	NU•	PCA•	Three LAN Adapters
Fixed Disk Adapter	FDDI•	FDDI•	NU•	PCA•	T-R Ether	T-R Ether	PCA•	
Fixed Disk Adapter	T-R Ether	T-R Ether	NU•	PCA•	T-R Ether	T-R Ether	PCA•	Four LAN Adapters

Note:

• NU indicates a slot that is not used.

• The FDDI Base and Extender Adapters must occupy slots 6 and 7 respectively.

• The first PCA Adapter must occupy slot 4.

• The second PCA Adapter must occupy slot 1.

Table 9 shows the valid combinations of channel and LAN adapters and pre-assigned slots supported by a 3172 Model 3 using an ESCON adapter to communicate with the host.

Table 9. IBM 3172 Model 3 ICP Adapter Plugging Chart for ESCON Channel

Gateway Card Slots								
8	7	6	5	4	3	2	1	Combinations
Fixed Disk Adapter	FDDI• T-R Ether	FDDI• NU•	NU•	NU•	NU•	ESCON•	ESCON•	One LAN Adapter
Fixed Disk Adapter	FDDI• T-R Ether	FDDI• T-R Ether	NU•	NU•	NU•	ESCON•	ESCON•	Two LAN Adapters
Fixed Disk Adapter	FDDI•	FDDI•	NU•	T-R Ether	NU•	ESCON•	ESCON•	
Fixed Disk Adapter	FDDI•	FDDI•	NU•	T-R Ether	T-R Ether	ESCON•	ESCON•	Three LAN Adapters
Fixed Disk Adapter	T-R Ether	T-R Ether	NU•	T-R Ether	NU•	ESCON•	ESCON•	
Fixed Disk Adapter	T-R Ether	T-R Ether	NU•	T-R Ether	T-R Ether	ESCON•	ESCON•	Four LAN Adapters

Note:

• NU indicates a slot that is not used.

• The FDDI Base and Extender Adapters must occupy slots 6 and 7 respectively.

• The ESCON Adapters must occupy slots 1 and 2.

Parallel Channel Host Connections

A 3172 Model 3 supports up to two parallel channel adapters. Each parallel channel adapter supports one host connection. Therefore, a 3172 Model 3 with two parallel channel adapters supports at most two host connections.

ESCON Host Connections

The 3172 supports up to 16 VTAM subchannels or 4 TCP/IP subchannel pairs. Each subchannel for VTAM or subchannel pair for TCP/IP, maps to a unique host. So with an ESCON director, one 3172 with one ESCON channel can support 16 VTAM hosts or 4 TCP/IP hosts. The director allows you to connect more than one host to the 3172 ESCON adapter.

Note: ESCON with the Multiple Image Facility (EMIF) supports only 15 LPARs. Today, EMIF is supported by ICP V3.3 only. But if you use an ESCON director, you can still connect up to 16 hosts with ICP 3.2.

A 3172 Model 3 supports one ESCON adapter. Each ESCON adapter supports a maximum of 16 SNA host connections or 4 TCP/IP host connections. For each TCP/IP host connection, you lose 2 subchannel connections. Table 10 shows maximum possible host connection combinations. VTAM uses 1 subchannel to send and receive on. TCP/IP has a separate send and receive channel. TCP/IP always uses a pair. The relationship between the send and receive subchannels is as follows:

- TCP/IP's receive subchannel is always an even number.

- The send subchannel is always 1 greater than the receive subchannel number. (For example, if the receive subchannel is 2 then the send subchannel is 3. Thus, TCP/IP subchannel pairs are always 0,1 or 2,3 or 4,5 etc.)

The resulting relationship between VTAM and TCP/IP is that if you pick subchannel 2 for VTAM, then you cannot assign subchannel 3 to TCP/IP since TCP/IP expects the first number to be even. The next number pair you can pick for TCP/IP is 4,5. You have lost 1 subchannel number. But if you had 2 VTAMs and put them on subchannels 0 and 1, then TCP/IP can use 2,3 or 4,5 and so on. In this way one does not lose any subchannels.

Table 10. ESCON Host Connection Combinations		
VTAM Subchannels	TCP/IP Subchannel Pairs	Total Hosts
16	0	16
14	1	15
12	2	14
10	3	13
8	4	12

Maximum Number of User Sessions

Table 11 on page 42 shows the maximum number of user sessions that can be established through a number of LANs and access host applications through a 3172 Model 3 gateway, depending on communications protocol:

Table 11. Maximum Number of User Sessions by Communications Protocol	
Protocol	**User Sessions**
VTAM	1020 PU sessions (255 per adapter)
TCP/IP for MVS	5000 sessions (number of sockets)
TCP/IP for VM	2000 sessions (number of sockets)
OSI/CS	64 end systems per subnetwork

Refer to Chapter 2 of the *IBM 3172 Interconnect Controller Interconnect Controller Program Planning Guide (GA27-4002)* for more information on the number of hosts, host programs and 3172 Model 3 LAN gateway limits.

Sharing LAN Adapters

A highlight of ICP Version 3 Release 2 is its ability to share LAN adapters by VTAM and TCP/IP applications. ICP Version 3 Release 2 provides this support for all LAN adapters supported by the IBM 3172 Interconnect Controller Model 3.

However, two instances of TCP/IP running on different hosts cannot share the same adapter. This is due to the way ICP routes IP to the appropriate host. The decision is based on the SAP value carried in the MAC frame and the associated channel adapter for the LAN adapter. All instances of TCP/IP use the same SAP (AA) and thus preclude more than one channel adapter to SAP association.

However, ICP can route SNA traffic to different VTAM hosts by using distinct destination SAP values.

Sharing Subchannels

ICP Version 3 Release 2 supports the sharing of subchannels by some or all the 3172 LAN adapters.

For example, all the LAN adapters can send and receive VTAM traffic through one subchannel and TCP/IP traffic through another, distinct pair of subchannels. Three subchannels suffice to route all VTAM and TCP/IP traffic.

Note: Using one subchannel for all VTAM traffic and one pair of subchannels for all TCP/IP traffic is not recommended because it degrades performance.

Important

- VTAM traffic cannot share a subchannel with TCP/IP traffic.

- The subchannel used by SNA Management Services cannot be used for normal data, like VTAM and TCP/IP traffic.

Data Flow between LAN Adapters and the Host

VTAM sends and receives on one subchannel and ICP routes that traffic internally to the appropriate 3172 LAN adapter.

TCP/IP on the host sends to the 3172 on the odd subchannel and receives on the even subchannel and ICP routes that traffic internally to the appropriate LAN adapter.

When frames arrive from the LAN, ICP determines if they carry SNA or TCP/IP data. SNA frames are passed to the Logical Link Control (LLC) task. TCP/IP frames are sent to the host through the appropriate subchannel.

For example, let us suppose that VTAM and TCP/IP on a host are sharing a token-ring LAN adapter with VTAM using subchannel 308 and TCP/IP using subchannels 304 and 305. The host sends and receives VTAM traffic on subchannel 308. But for TCP/IP, the host sends traffic to the 3172 on subchannel 305 and receives on subchannel 304.

2.2 ITSO ICP Environment

The purpose of this section is to describe the ICP environment that we used to verify the ICP connectivity scenarios.

2.2.1 ITSO ICP Hardware Configuration

The scope of our testing in this environment was limited to the 3172 parallel channel adapter. We did not use the 3172 ESCON adapter.

The ITSO ICP environment as shown in Figure 10 included the following hardware configuration.

```
                  ┌────────────────────┐
                  │                    │   9121-320
                  │                    │   CPU
                  │   ┌──────────────┐ │
                  │   │ 17 │ ChPID   │ │
                  │   └──────────────┘ │
                  └──────────┬─────────┘
                             │
        Parallel Channel     │   Subchannel addresses = 300-31F
                             │
                  ┌──────────┴─────────┐
        Adapter   │        PCA         │   3172-003
        Slot No.  │         4          │   Interconnect
                  │                    │   Controller
        Adapter   │   2      3    6 & 7│
        Slot No.  │  Eth    T-R   FDDI │   Eth  LAA : 4000 012B 3172
                  │                    │   T-R  LAA : 4000 021B 3172
                  └───┬──────┬──────┬──┘   FDDI LAA : 4000 033B 3172
                      │      │      │
```
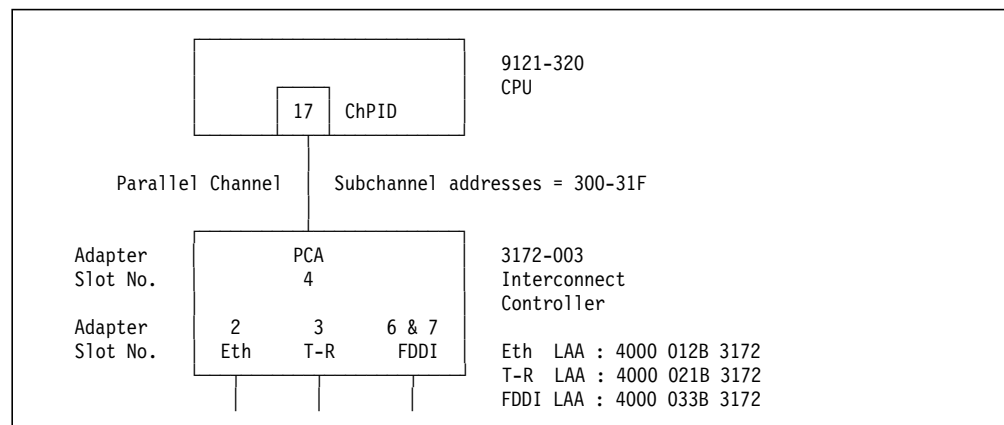
Figure 10. ITSO ICP Hardware Environment. A single LAN station on each of the token-ring, Ethernet and FDDI LANs accesses MVS host applications via an IBM 3172 Interconnect Controller gateway.

Host

We used an MVS/ESA system running as a guest under VM/ESA on a 9121 Model 320 host.

3172 Controller

This was an IBM 3172 Interconnect Controller Model 3 with the following hardware and software configuration:

- 25 MHz 80486SX processor
- 8MB RAM
- 80MB hard disk
- IBM 3172 System/390 Parallel Channel Adapter (FC 2501)
- IBM 3172 Token-Ring 16/4 Busmaster Adapter (FC 2215)

- IBM 3172 Ethernet/802.3 Busmaster Adapter (FC 2225)

- IBM 3172 FDDI Adapter (FC 2300)

- ICP Version 3 Release 2 with the 3172 Interconnect Enhancement Feature (FC 0146)

Local Area Networks

- Token-Ring LAN operating at a 4 Mbps data rate

- Ethernet LAN operating at a 10 Mbps data rate

- Fiber Distributed Data Interface LAN operating at a 100 Mbps data rate

LAN Stations

A different PS/2 workstation was attached to each of the three LANs:

- PS/2 Model 80 on the token-ring LAN

- PS/2 Model 65 on the Ethernet LAN

- PS/2 Model 80 on the FDDI LAN

  This station was attached to the FDDI LAN in Single Attachment Station (SAS) mode through an IBM 8240 FDDI concentrator.

2.2.2 ITSO ICP Software Configuration

We used the following operating systems and networking products to configure and test our ICP environment. It is not to be viewed as an exhaustive list but simply as an indication of how diverse software requirements can be in such a flexible environment.

```
┌────────────────────────────────────────────────────────────┐
│                                                              │
│   ┌──────────────────────┐                                  │
│   │ MVS/ESA 4.3          │      9121-320                    │
│   │ VTAM 3.4.2           │                                  │
│   │ TCP/IP 2.2.1         │                                  │
│   │ OSI/CS 1.1           │                                  │
│   │ OSI/FS 1.1           │                                  │
│   └──────────┬───────────┘                                  │
│              │                                               │
│   ┌──────────┴───────────┐                                  │
│   │                      │      3172-003                    │
│   │ ICP 3.2              │                                  │
│   │ ICP Enhancement Feature │                               │
│   └──────────┬───────────┘                                  │
│              │                                               │
│   ┌──────────┴───────────┐                                  │
│   │ OS/2 2.1             │      Workstations                │
│   │ OF/2                 │                                  │
│   │ TCP/IP for OS/2 2.0  │                                  │
│   │ CM/2 1.0             │                                  │
│   │ OSI/CS for OS/2      │                                  │
│   │ OSI/FS for OS/2      │                                  │
│   └──────────────────────┘                                  │
│                                                              │
└────────────────────────────────────────────────────────────┘
```
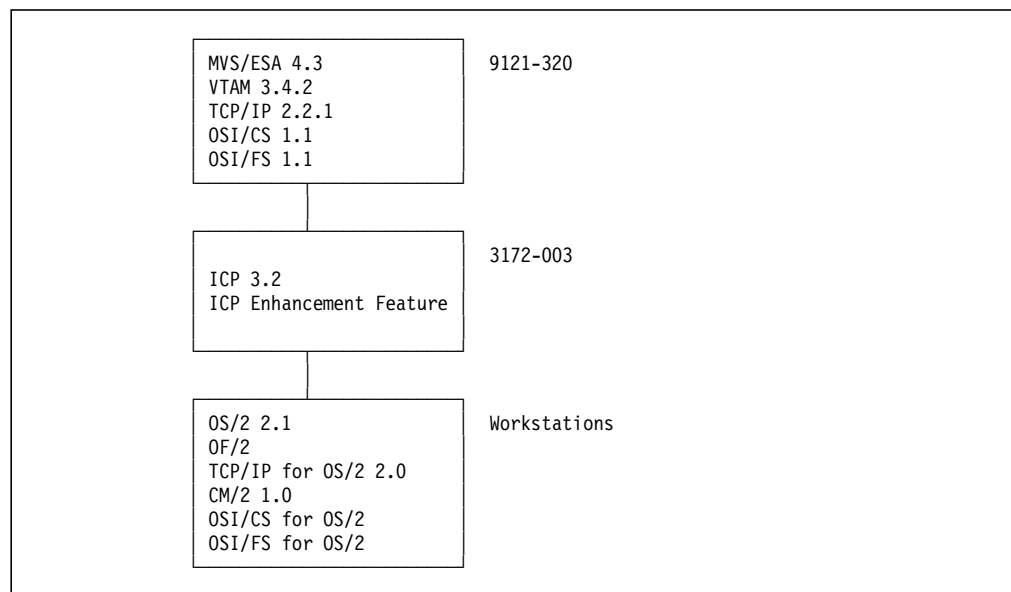
Figure 11. ITSO ICP Software Environment

Note: OF/2 was installed only on the PS/2 Model 80 attached to the token-ring LAN. This workstation was a LAN-attached operator station using OF/2 to monitor the 3172 Model 3.

Host

- MVS/ESA Version 4 Release 3 (5695-047)

- ACF/VTAM Version 3 Release 4.2 for MVS/ESA (5685-085)

- IBM TCP/IP Version 2 Release 2.1 for MVS (5735-HAL)

- OSI/CS Version 1 Release 1 for MVS (5685-014)

- OSI/FS Version 1 Release 1 for MVS (5685-046)

3172 Controller

- ICP Version 3 Release 2 (5621-425)

- 3172 Interconnect Enhancement Feature (FC 0146)

We applied the PTFs to address the following ICP Version 3 Release 2 APARs and distributed them to the 3172:

- APAR IR24278

- APAR IR24319

- APAR IR24541

- APAR IR24815

LAN Stations

Although many alternatives exist when it comes to selecting stations for LAN attachment, we used PS/2 workstations because they were available. We installed the following products, as required, to verify our scenarios.

- Operating System/2 Version 2.1 (5604-467)

  This product is a basic requirement on the PS/2 workstation.

- Network Transport Services/2 (5622-002)

  This product provides the LAN Adapter and Protocol Support (LAPS) to bind LAN adapters and communications protocols.

- Communications Manager/2 Version 1 Release 1 (5622-078)

  This product is used to configure and test SNA scenarios.

- IBM TCP/IP Version 2.0 for OS/2 (5622-086)

  This product is used to configure and test TCP/IP scenarios.

- OSI/Communications Subsystem for OS/2 (5601-124)

  This product is used to configure and test OSI scenarios.

- OSI/File Services for OS/2 (5601-211)

  This product includes the client and server functions.

2.3 Configuration Worksheets

We recommend that careful consideration be given to the choice of using LAAs or UAAs for your adapter addresses. TCP/IP in the 3172 is very removed from the physical layer. Recovery implications for TCP/IP using multiple adapters is covered in Chapter 7, "3172 Model 3 High-Availability" on page 317. SNA straddles the physical layer and using LAAs will buffer it from address change

implications for network users. See Chapter 7 for more information on recovery implications for SNA as well.

These are the completed worksheets for our 3172 Model 3 configured for ICP Version 3 Release 2. It is recommended that you take the time to fill out these worksheets before you use the Operator Facility/2 to configure your 3172. The exercise will help you specify the correct subchannels, adapter addresses and other related information during 3172 configuration.

IBM 3172 Profile Worksheet

Date: _____ / _____ / _____   **Signature:** _____

IBM 3172 System Information

System name given to this IBM 3172:   3172 ICP

IBM 3172 Profile name: 3172 ICP

Type of IBM 3172:

☐ 3172-2 LAN Gateway
☒ 3172-3 LAN Gateway

Interconnect Enhancement Feature:

☒ Yes
☐ No

Operator Facility LAN adapter:

☒ Relative adapter 0
☐ Relative adapter 1
☐ No LAN connection

User data: 3172 Model 3 with ICP 3.2

Location: ITSO Raleigh Lab

Figure 12. IBM 3172 System Information.   The completed worksheet for the 3172 Model 3 running ICP Version 3 Release 2 with the Interconnect Enhancement Feature.

IBM 3172 Profile Worksheet (continued)

Date: ____ / ____ / ____   **Signature:** _____

Parallel Channel Adapter Information

Channel adapter name: PC1 _____

Slot number: 4 _____

Transfer mode and
channel transfer speed:

    ☐ DC Interlock
    ☐ 2 Mb data streaming
    ☐ 3 Mb data streaming
    ☒ 4.5 Mb data streaming

SNA management services:

    ☒ Yes
    ☐ No

VTAM IDNUM: 00020 _____

Reporting subchannel: 01 _____

Figure 13. Parallel Channel Adapter Information. The completed worksheet for the parallel channel adapter installed in the 3172 Model 3.

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Token-Ring 16/4 Adapter Information

Adapter name: TR1 _____   Relative adapter number: _____ 0 _____

Slot number: 3 _____

Node address: 4000021B3172 _____

Data rate:

    ☒ 4 Mbps
    ☐ 16 Mbps

IEEE 802.2 (LLC) parameters:

    Response timer (T1) _____
    Acknowledgement timer (T2) _____
    Inactivity timer (Ti) _____

To Operator Facility:

    ☒ Yes
    ☐ No

Combined Functional Addresses

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Figure 14. Token-Ring 16/4 Adapter Information. The completed worksheet for the token-ring adapter installed in the 3172 Model 3.

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   Signature: _____

Ethernet/802.3 Adapter Information

Adapter name: EN1   Relative adapter number: 0

Slot number: 2

Node address: 4000012B3172

Transceiver type:

☐ DIX
☒ BNC

Receive mode:

☒ S
☐ P

IEEE 802.2 (LLC) parameters:

Response timer (T1)   _____

Acknowledgement timer (T2) _____

Inactivity timer (Ti)   _____

To Operator Facility:

☐ Yes
☒ No

Multicast addresses:

Address 1: _____	Address 2: _____
Address 3: _____	Address 4: _____
Address 5: _____	Address 6: _____
Address 7: _____	Address 8: _____

Figure 15. Ethernet/802.3 Adapter Information. The completed worksheet for the Ethernet adapter installed in the 3172 Model 3.

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Model 3 FDDI Adapter Information

Adapter name: FD1   Relative adapter number: 0

Slot number: 6

Node address: 4000033B3172

PMF password: 0000000000000000

IEEE 802.2 (LLC) parameters:

    Response timer (T1)   _____

    Acknowledgement timer (T2)   _____

    Inactivity timer (Ti)   _____

Group addresses:

Address 1: _____	Address 2: _____
Address 3: _____	Address 4: _____
Address 5: _____	Address 6: _____
Address 7: _____	Address 8: _____

Figure 16. Model 3 FDDI Adapter Information. The completed worksheet for the FDDI adapter installed in the 3172 Model 3.

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   Signature: _____

IBM 3172 Parallel Channel Definition Parameters ─────────────────────────────

LAN function name: LANGATE

Channel adapter name: PC1

LAN adapter	Host program	Subchannels	Block delay time	Maximum response length
EN1	OTHER	02-03	10	100
TR1	OTHER	04-05	10	100
FD1	OTHER	06-07	10	100
TR1	VTAM	08	10	100
EN1	VTAM	09	10	100
FD1	VTAM	0A	10	100

Figure 17. Parallel Channel Definitions Parameters. The completed worksheet for the LAN adapter functions enabled in the 3172 Model 3.

2.4 Defining Your 3172 to the Host

The 3172 channel path, LAN adapters and LAN stations must be defined to the host system in the following areas:

- Host Channel Subsystem
- Host Operating System
- Host Program

Host Channel Subsystem

These definitions are coded in the Input/Output Control Program (IOCP). The subchannel range reserved for the 3172, the type of channel and channel speed are specified there.

Host Operating System

The IBM 3172 must be defined to the MVS/ESA operating system. This definition is accomplished by updating the MVS Control Program (CP) with an entry for the IBM 3172 in the IODEVICE macro.

Refer to "MVS/ESA Definitions" on page 81 for the definitions we used to attach the IBM 3172 running ICP.

TCP/IP Host Program

If TCP/IP is the host program, then the TCPIP.PROFILE data set must be customized to start the TCP/IP applications and provide the necessary routing on the network.

VTAM Host Program

If VTAM is the host program, you must code a subset of the following VTAM major nodes, to activate the channel path for SNA Management Services, the 3172 LAN adapters and LAN stations (DSPUs):

- XCA major node for each parallel channel adapter
- XCA major node for ESCON adapter
- XCA major node for SNA Management Services
- XCA major node for each token-ring adapter
- XCA major node for each Ethernet adapter
- XCA major node for each FDDI adapter
- Switched major node for each token-ring LAN
- Switched major node for each Ethernet LAN
- Switched major node for each FDDI LAN

Note: The number of major nodes you have to code depends on the number and type of channel and LAN adapters installed in the 3172.

VTAM Storage Considerations

The 3172 Model 3 with ICP 3.2 supports a maximum of 1020 DSPUs based on a maximum configuration of four LAN adapters, or 255 DSPUs per adapter.

Note: This number is reduced to 245 DSPUs for a LAN adapter used by an operator station.

Since DSPUs and their associated LUs are not defined in the 3172 but only in VTAM, there is essentially no storage overhead in the 3172 for this configuration.

VTAM provides the boundary node function for the 3172 and all its downstream PUs (DSPUs). The downstream PUs are all the LAN-attached stations supported by a particular 3172.

To provide the boundary node function to the 3172 and its attached PUs and LUs, VTAM allocates storage in the IOBUF pool and a number of NCBs (node control block). The NCBs and IOBUF pool are all in fixed, real storage.

NCB Storage Requirement

NCBs are required for the 3172 and all the DSPUs on the LANs.

- 3172 XCA

  The NCB storage for the 3172 XCA major node is included in the I/O buffer allocation below.

- Adapter XCAs

  In addition to the NCB for the XCA major node, VTAM requires 8232 bytes of ECSA (extended common service area) storage to support any number of XCA major nodes (adapters) plus 3232 bytes for each adapter XCA.

- 3172 LINEs

  Lines defined in XCA major nodes have an NCB storage requirement of 1680 bytes each.

- SNA DSPUs

  Each SNA DSPU requires 2564 bytes.

I/O Buffer Requirement

For each 3172 unique adapter address, VTAM allocates 43KB of ECSA (extended common service area) storage which includes an I/O buffer and, as previously mentioned, this storage includes the NCB for the 3172.

VTAM uses the same NCB size for all 3172 models. For 3172 connections, the NCB is represented by an LSNCB (LSA node control block). This contains a VLNCB which contains the NCB. The length of the LSNCB for SNA connections is 1796 bytes.

2.5 Preparing Your 3172 for the ICP Environment

The preparation of your 3172 Model 3 to operate in the ICP environment requires that you complete the following tasks at the PS/2 workstation where you install OF/2:

1. Estimate NetBIOS resources required by the Operator Facility/2.

   It is important to increase the NetBIOS resources sufficiently to enable other NetBIOS applications to run concurrently.

   This is only required if you intend to manage your 3172 from a LAN-attached operator station.

2. Install the Operator Facility/2 Version 3 Release 2 code.

3. Receive the ICP Version 3 Release 2 base code.

4. Receive the Interconnect Enhancement Feature code.

5. Define your 3172 to the Operator Facility/2.

6. Create at least one 3172 profile.

   A profile is one combination of hardware (adapters and subchannels) and function (protocols) that can be supported on a particular 3172.

   ┌─ **Important** ───┐

   1. Only one profile can be active on any 3172 at any time.

   2. Up to 8 profiles can be defined for each 3172 in your installation, allowing for quick reconfiguration of your 3172 to satisfy changing requirements.

   └───┘

7. Receive the ICP code at the operator station.

This step involves copying the ICP code from backup diskettes to the operator station hard disk. This Operator Facility/2 function is very useful if you want to migrate to another release of ICP base code.

Note: You need not execute this step if you installed the ICP code when you installed the Operator Facility/2.

8. Create the working diskettes.

   If you use a stand-alone operator station, you must create working diskettes each time you reconfigure your 3172 and manually load them into the 3172 using the keypad and disk drive.

   If you use a LAN-attached operator station, you must create working diskettes and manually load them into the 3172 the first time you use ICP. Subsequent reconfigurations can be performed from the operator station by sending the configuration information to the 3172 from the operator station.

2.5.1 Planning NetBIOS Requirements for Operator Facility/2

If you plan to use the Operator Facility/2 at a LAN-attached operator station to operate your 3172(s), NetBIOS names and resources become a consideration because your operator station uses the NetBIOS protocol to communicate with your 3172(s). You must plan the name(s) and resource(s) that you will assign to your 3172(s) *before* you install the Operator Facility/2 at the operator station.

3172 NetBIOS Name

The first column of the primary Operator Facility/2 window displays the name(s) of your 3172(s). Remember that an operator station can support up to 16 3172s. When you add a 3172 to the Operator Facility/2, you assign it a name that identifies it uniquely to your LAN, as shown in Figure 24 on page 63. From then on, that name is considered to be the NetBIOS name of that 3172.

> **Important**
>
> The NetBIOS name of each 3172 must be unique in the overall network and not just in your LAN segment.

When you start the Operator Facility/2, your operator station initiates a NetBIOS session with each 3172 that you have defined to the Operator Facility/2. If the NetBIOS name that you assigned to a particular 3172 is already in use in the network, then your session will fail with status code **1b06**.

Operator Facility/2 NetBIOS Resources

A LAN-attached operator station using NetBIOS protocol to communicate with your 3172(s) over the LAN requires certain NetBIOS resources. You must ensure that the Operator Facility/2 has sufficient NetBIOS resources to coexist with other NetBIOS applications at the operator station.

The Operator Facility/2 requires the following NetBIOS resources in addition to those required by other NetBIOS applications:

```
┌─────────────────────────────────────────────────────────────────┐
│                                                                   │
│  SESSIONS    - 16   ▣1                                            │
│                                                                   │
│  LINKSTATIONS - 16   ▣2                                          │
│                                                                   │
│  COMMANDS    - 20   ▣3                                           │
│                                                                   │
│  NAMES       -  9   ▣4                                           │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```

▣1 The Operator Facility/2 workstation needs 16 NetBIOS sessions to ensure the connectivity capability for the potential maximum of 16 3172s that may be monitored by any single station.

▣2 The same applies to the number of link stations.

▣3 The Operator Facility/2 requests a default of 20 commands.

▣4 The Operator Facility/2 requests a default of 9 names.

The number of LINKSTATIONS can be set using the LAPS component found in Network Transport Services/2 (NTS/2). This is the bare minimum product requirement to support the Operator Facility/2. NTS/2 is a program that provides a user interface, LAN Adapter and Protocol Support (LAPS), a NetBIOS driver and an 802.2 driver for Token-Ring (and Ethernet). LAN Adapter and Protocol Support will build an NDIS protocol stack for the LAN adapter which offers the ability to share the adapter with multiple communication protocols. While Operator Facility/2 will run on either Ethernet or Token-Ring, its main requirement is for NetBIOS connectivity. We have configured it here for Token-Ring as described in the following procedure:

Step 1. At an OS/2 command line prompt and in the \IBMCOM directory, type laps and press Enter.

Step 2. Click on **Configure** on the LAPS panel.

Step 3. Click on **Configure LAN transports** to turn on the radio button if not already selected and then click on **Continue**
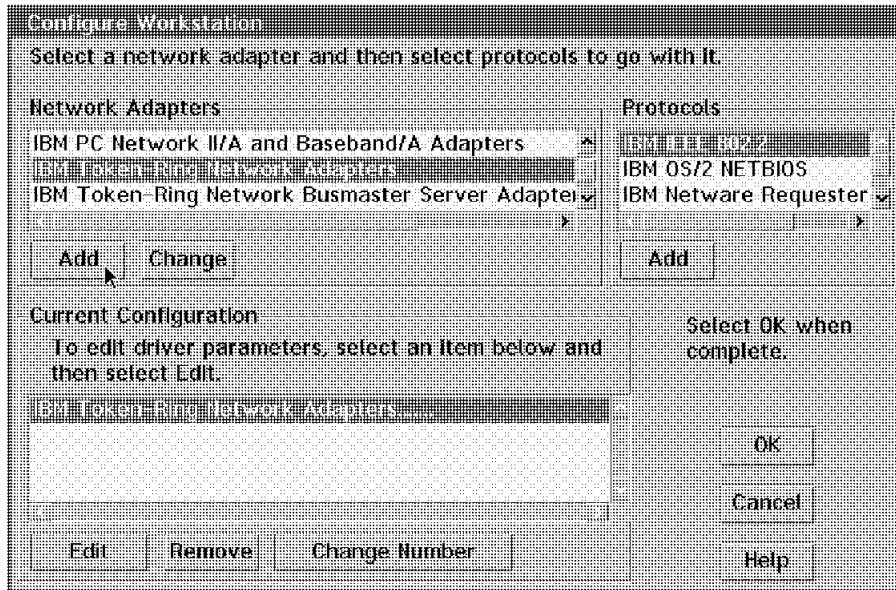
Figure 18. LAN Adapter and Protocol Support Configure Workstation Panel

Step   4. Select **IBM Token-Ring Network Adapter** from the Network Adapters
           window in the upper left corner of the panel.

           Click on **Add** as shown in the picture by the pointer. Your screen
           should resemble the picture in Figure 18. You must now add IBM IEEE
           802.2 support to this adapter as well as the IBM OS/2 NetBIOS driver.
           Do so by continuing with the steps below.
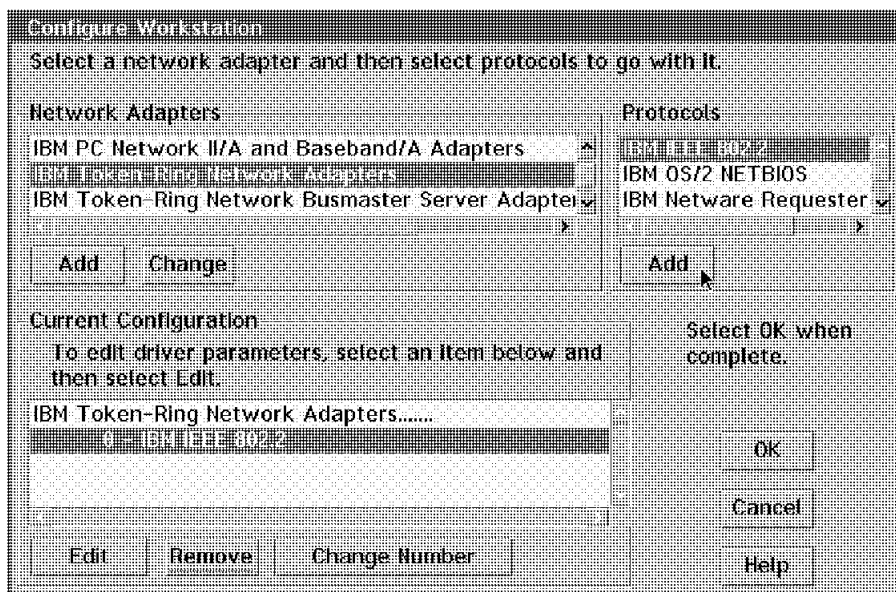
Figure 19. Adding 802.2 and NetBIOS to a Token-Ring Adapter

Step   5. Select **IBM IEEE 802.2** from the panel in the upper right corner as
           shown in Figure 19 and click on **ADD** as shown by the pointer.

Step   6. Repeat the above step to add **IBM OS/2 NetBIOS**.

           Your screen when complete, should look like Figure 20 on page 57.
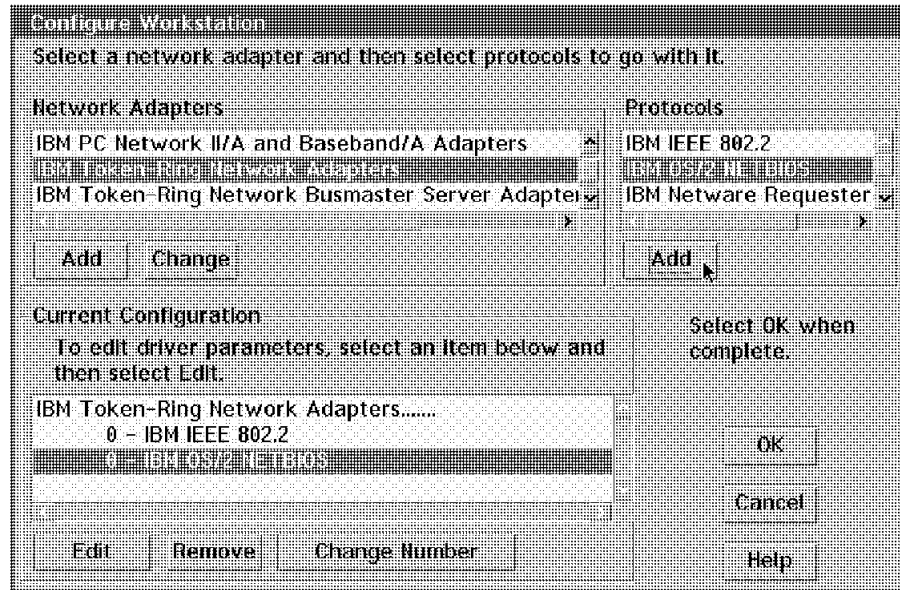
Figure 20. IBM IEEE 802.2 and IBM OS/2 NetBIOS added to Token-Ring Adapter

Step 7. To set the number of LINK STATIONS double-click on **IBM IEEE 802.2** under **Token-Ring Network Adapters ...** or highlight the **IBM IEEE 802.2** selection by single-clicking on it and then clicking on **Edit** immediately below.

The panel shown in Figure 21 on page 58 appears.

Step 8. You must manually change the number of **Maximum Link Stations** to 16 in the field shown by the pointer in the figure.

Please note that Operator Facility/2 will work with fewer link stations. Error symptoms will manifest themselves when one tries to connect to more 3172s than link stations are configured. If it is desirable you may also specify a Locally Administered Address (LAA) for your workstation in this same panel, as shown by the field with ″**400000000000**.″

Step 9. Click on **OK** to return to the previous panel.

Step 10. Click on **OK** once more to return to a previous panel.

Step 11. Click on **Exit** to begin saving your changes.

Step 12. Click on **Continue** to complete the saving of your changes.
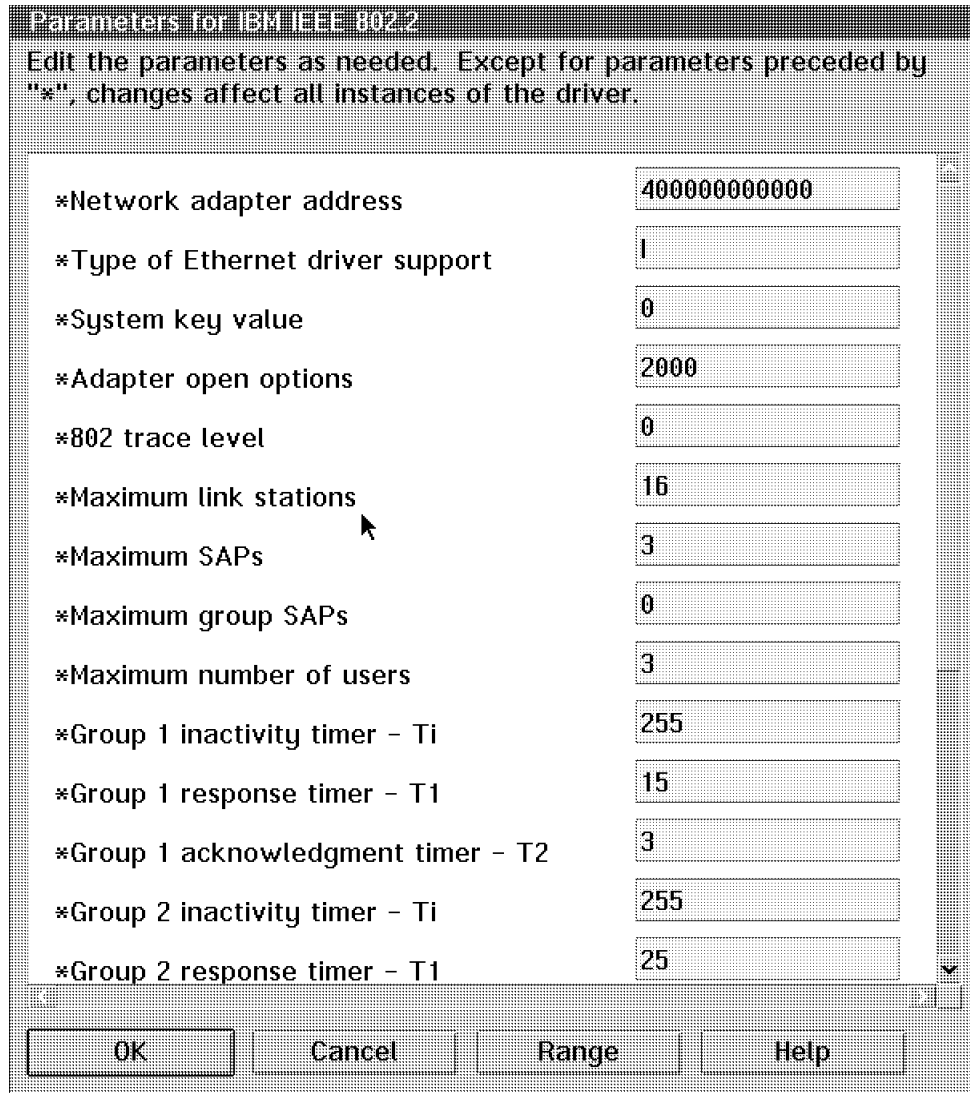
Figure 21. Specifying the Number of Link Stations for IBM IEEE 802.2

In a similar fashion to the above procedures the number of NetBIOS SESSIONS, COMMANDS and NAMES can be set using LAPS as detailed in 2.5.2, "Installing Operator Facility/2 Version 3 Release 2" on page 59. If the "16 link stations" requirement is not satisfied, the operator station may not be able to establish a session with your 3172. If that happens, the status of the 3172 becomes **NetBIOS problem** and the status code **1b08** is displayed. This indicates one or more inadequate NetBIOS resources. A file, NETBIOS.OUT, is written to the OF2VER3 directory detailing the inadequate resource(s). The following is a sample NETBIOS.OUT file:

```
OS2 C:\of2ver3>type netbios.out
Reset RC=0x38
Requested resources not available
OF/2 NetBIOS Resources:
          Requested Received
 Sessions     16        08
 Commands     16        16
 Names         8        06
```

An operator station can attach to either a token-ring or an Ethernet LAN. If it will attach to an Ethernet LAN, the following conditions must be satisfied:

- For OS/2 Version 1.3, when configuring the IEEE 802.2 interface for the Ethernet/802.3 adapter, IEEE 802.3 must be specified as the protocol, not Ethernet DIX Version 2.0.

- For OS/2 Version 2.0 or later, when configuring the IEEE 802.2 protocol for the Ethernet/802.3 adapter, IEEE 802.3 must be specified as the type of Ethernet driver support, not Ethernet DIX Version 2.0.

2.5.2 Installing Operator Facility/2 Version 3 Release 2

Before you proceed with this task, obtain the ICP Version 3 Release 2 product diskette set (5 diskettes) which includes:

- 1 Operator Facility/2 code diskette

- 3 ICP base code diskettes

- 1 Interconnect Enhancement Feature code diskette (if ordered)

You must install the Operator Facility/2 at your operator station before you can create the first set of working diskettes for your 3172. Use the following procedure to install the Operator Facility/2:

Step   1. Access the disk drive on which you want to install Operator Facility/2.

Step   2. Create a backup copy of the Operator Facility/2 diskette and ensure it is not write-protected. Label it *Operator Facility/2 Backup Diskette*.

Step   3. Insert the backup copy of the Operator Facility/2 diskette into the diskette drive of the operator station.

Step   4. At an OS/2 prompt, access the source drive.

Step   5. If you want to install Operator Facility/2 on your C drive, type **install a: c:** and press Enter.

   You do not have to install Operator Facility/2 on your C drive. You can install it on any valid drive on your workstation. You would then substitute the letter designating the preferred drive in the command.

The installation procedure creates directory OF2VER3 on the selected target drive and the Operator Facility/2 files are copied to it. The completion of the installation will be clearly indicated to you. At this point you have installed Operator Facility/2.

Configuring Your PS/2 Token-Ring Adapter for NetBIOS

If you want to attach your operator station to the token-ring LAN, you must use LAPS to configure the token-ring LAN adapter for the NetBIOS protocol. The Operator Facility/2 uses NetBIOS to communicate with the 3172(s) over the LAN.

Step   1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the \IBMCOM directory.

Step   2. Type laps and press Enter.

   Wait for a few seconds until startup has completed. You are then presented with two panels in succession.

Step   3. Click on **Configure** on the first panel.

Step   4. Select **Configure LAN Transports** and click on **Continue** on the second panel.

The panel shown in Figure 22 appears.
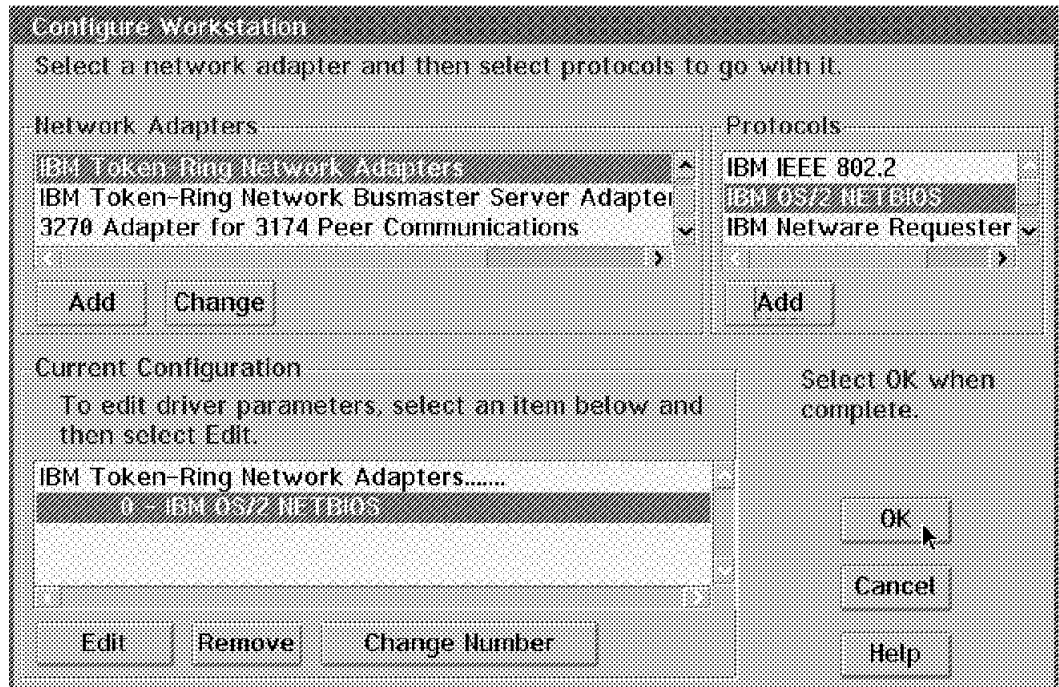
Figure 22. Configuring Your Token-Ring LAN Adapter for NetBIOS

Step   5. Select **IBM Token-Ring Network Adapters** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step   6. Select **IBM OS/2 NETBIOS** from the Protocols window and click on **Add**.

Your adapter is now enabled for the NetBIOS protocol. The panel shown in Figure 23 on page 61 appears. You can now increase the NetBIOS resources to allow the Operator Facility/2 to coexist with other NetBIOS applications on your operator station.
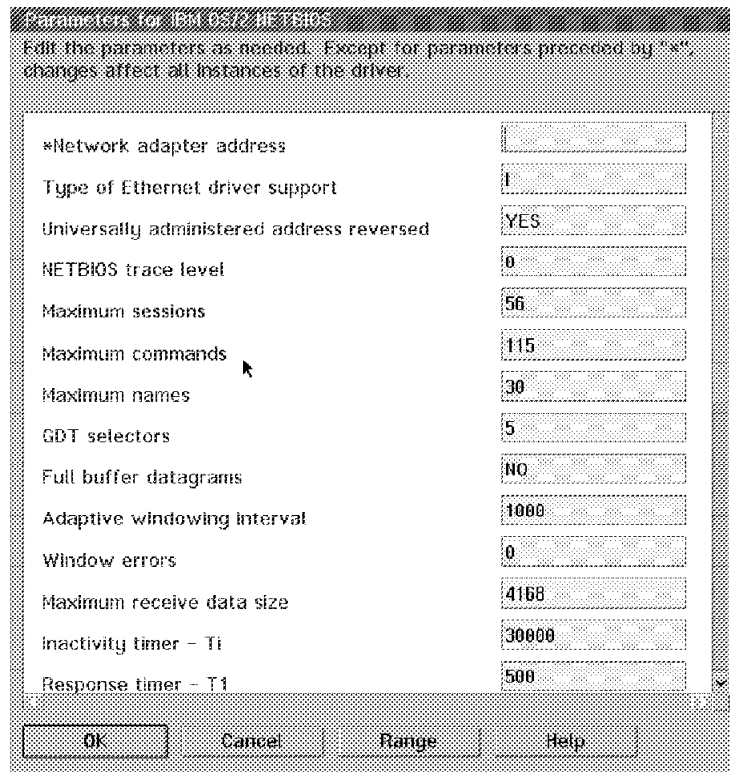
Figure 23. Increasing NetBIOS Resources for Operator Facility/2

Step 7. Increase the current **Maximum sessions** value by 16.

Step 8. Increase the current **Maximum commands** value by 20.

Step 9. Increase the current **Maximum names** value by 9.

Step 10. Click on **OK** to save your NetBIOS resource changes and return to the Configure Workstation window.

Step 11. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 12. Follow the online instructions to save your changes in the appropriate system files and exit LAPS.

2.5.3 Installing ICP Version 3 Release 2

After installing the Operator Facility/2 successfully on your operator station, you can proceed to install the ICP base code. When the Operator Facility/2 installation completes successfully, you are asked whether you want to install the ICP base code next.

Step 1. Type Y and press Enter to proceed with ICP base code installation.

You will be prompted to insert each of the three product diskettes into the source drive in sequence.

After all three diskettes have been processed, the installation procedure informs you that it has completed successfully.

2.5.4 Installing the Interconnect Enhancement Feature

The installation of the feature code is optional. But you **must** install the feature code if you plan to use SNA Management Services (NetView) to monitor your network and/or intend to communicate with VTAM applications on the host.

When the ICP base code installation completes successfully, you are prompted whether you want to install the feature code next.

Step 1. Type N and press Enter if you do not want to install the feature code.

Step 2. Type Y and press Enter if you want to install the feature code,

You will be prompted to insert the single feature code product diskette into your source drive.

After the diskette has been processed, the installation procedure informs you that it has completed successfully.

2.5.5 Starting the Operator Facility/2

After you install the Operator Facility/2 you can start it at an OS/2 prompt by changing to the OF2VER3 directory, typing csp and pressing Enter. To make the Operator Facility/2 startup easier for you, we recommend that you make the effort to set up an Operator Facility/2 icon.

When you start the Operator Facility/2, a **Password** window appears and prompts you for a password. In order to protect your operator station and your 3172(s) from unauthorized access, we recommend that you take the time to specify a password. Every time you access the Operator Facility/2 the same window will prompt you for the password.

You can monitor up to 16 different 3172s from your operator station but access only one 3172 at a time. Your operator station must be able to establish a NetBIOS session with a particular 3172 before you can initiate an operation on it. This operator station-to-3172 connection is supported on either a token-ring or an Ethernet LAN. If you intend to operate multiple 3172s from your operator station, the 3172s must be attached to the same LAN.

2.5.6 Defining Your 3172 to the Operator Facility/2

We recommend that you define your 3172 to the Operator Facility/2 so that you may control it to a considerable degree from your operator station and avoid having to use the 3172 keypad. Refer to the prepared worksheet shown in Figure 12 on page 46 to help you step through the following procedure:

Step 1. Start the Operator Facility.

Step 2. Select **Configure** from the action bar and **Add 3172** from the pull-down menu.

The panel shown in Figure 24 on page 63 appears.
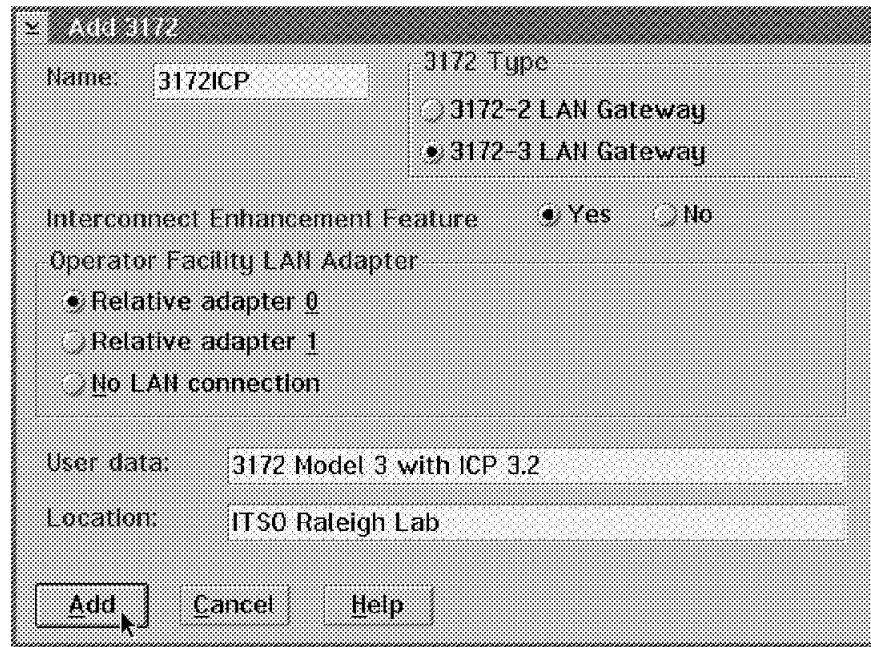
Figure 24. Defining Your 3172 to the Operator Facility/2

Step 3. Type a name for your 3172.

This name must be unique within the group (maximum of 16) of 3172s managed from your operator station. It is checked for uniqueness at this point.

Note: This name forms a portion of the NetBIOS name of your 3172 and must be unique within the network. The Operator Facility/2 can not check and ensure this level of uniqueness.

Step 4. Select **3172-3 LAN Gateway** to indicate that you are defining a 3172 Model 3.

Step 5. Select **Yes** if you installed the Interconnect Enhancement Feature and intend to use SNA Management Services and/or communicate with VTAM applications on the host.

We selected **Yes**.

Step 6. Select the appropriate option from the Operator Facility LAN Adapter window.

The number refers to the adapter in the operator station that is used to attach to the LAN. Check the LAPS configuration of the operator station for the correct adapter number, if you are in doubt. Usually **Relative adapter 0** is the correct choice and that is what we specified. If you do not want to attach to the LAN, you select **No LAN connection** to operate as a standalone operator station. This is your decision but we recommend that you attach to the LAN to manage your 3172 remotely through a user-friendly interface.

Note: OS/2 used to support only 2 LAN adapters. This explains why 0 and 1 are presented as the only relative adapter numbers here.

Step 7. Enter a description of your 3172 in the User data field.

We entered **3172 Model 3 with ICP 3.2**.

Step   8. Enter the location of your 3172 in the Location field.

We entered **ITSO Raleigh Lab**.

Step   9. Click on **Add** to define your 3172 and return to the primary Operator Facility/2 panel.

2.5.7 Creating Profiles for Your 3172

The Operator Facility/2 supports the definition of up to 8 profiles for each 3172 defined to the network.

Note: Only one profile can be active at any time for a particular 3172.

Profiles provide the flexibility to switch quickly from one physical and logical configuration to another on a particular 3172. A profile is a unique combination of hardware (adapters and subchannels) and function (communications protocols). The hardware and function(s) being defined in a profile do not have to match the installed hardware and functions in your 3172. However, when the profile is activated, the defined and installed hardware and function must be compatible. This ″delayed check″ offers the operator an opportunity to plan ahead and prepare profiles that will address future 3172 operational requirements.

Use the following procedure to define a profile for your 3172. Refer to the prepared worksheet shown in Figure 13 on page 47 to help you with this task.

Step   1. Start the Operator Facility.

Step   2. Select **Configure** from the action bar and **Profiles** from the pull-down menu.

Another panel appears.

Step   3. Select **Profiles** from the action bar and **New** from the pull-down menu.

The panel shown in Figure 25 appears.
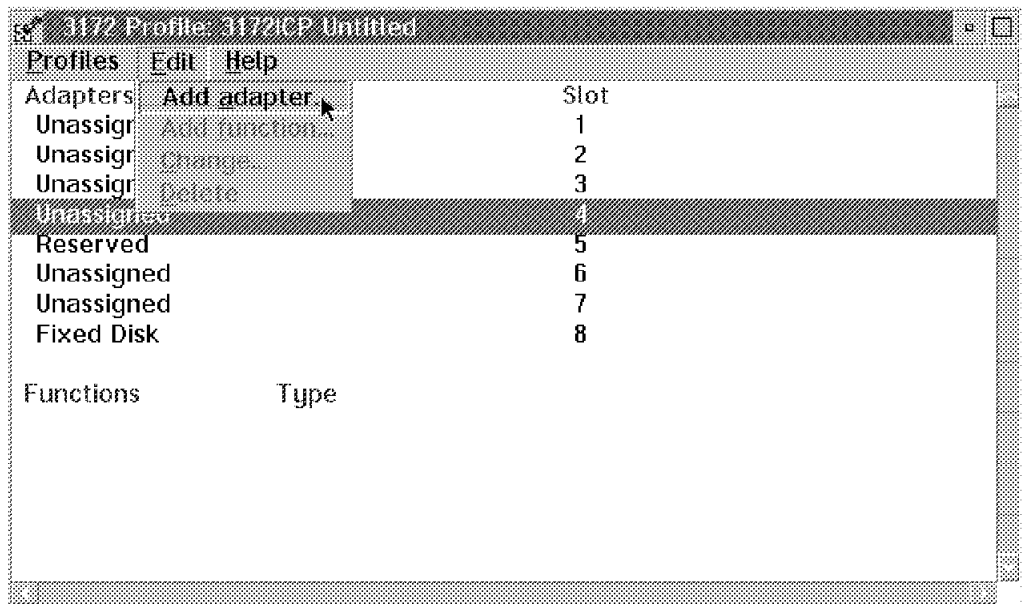
Figure 25. Selecting Adapter Slot

At this point you want to choose a valid adapter slot for the parallel channel or ESCON adapter for this profile.

Step 4. Select the appropriate slot.

We installed one parallel channel adapter in slot 4 of our 3172.

Step 5. Select **Edit** from the action bar and **Add adapter** from the pull-down menu.

The panel shown in Figure 26 appears.
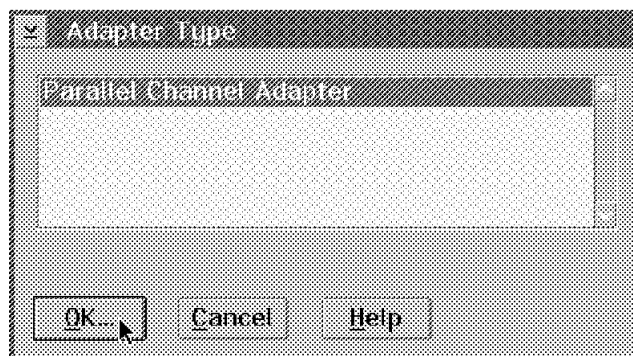
Figure 26. Selecting Adapter Type

Step 6. Select the adapter you want and click on **OK**.

For slot 4, the only valid choice is **Parallel Channel Adapter**.

The panel shown in Figure 27 appears.
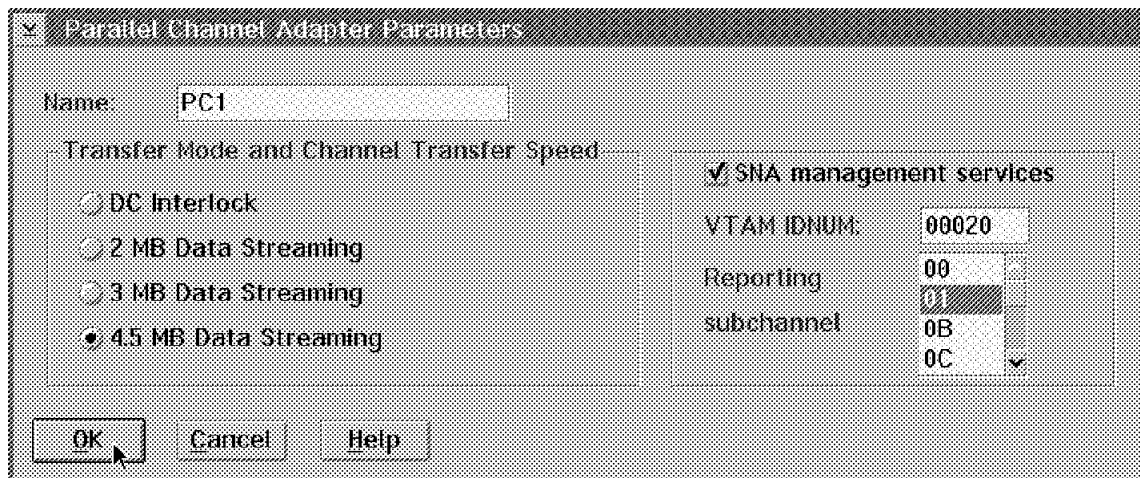
Figure 27. Parallel Channel Adapter Parameters

Step 7. Type a symbolic name for the parallel channel adapter.

We entered **PC1**.

Step 8. Select the transfer mode and channel transfer speed to match the values specified in the host IOCP.

The IOCP definitions are shown in "IOCP Definitions" on page 80. In our case, we selected **4.5 MB Data Streaming**.

Step 9. If you plan to use NetView to manage your 3172 in the network, select **SNA management services**.

When you select SNA management services, you must also select the following:

- IDNUM value to define your 3172 uniquely to the network.

  We specified **00020** to match the value specified in the 3172 switched major node, as shown in "VTAM Definitions" on page 116.

- A subchannel that the adapter will use to report network information to the host.

  We specified **01** to match the value specified in the XCA major node for the 3172, as shown in "VTAM Definitions" on page 116.

Step 10. Click on **OK**.

The panel shown in Figure 28 appears.

```
┌─────────────────────────────────────────────────────────────────┐
│  3172 Profile: 3172ICP Untitled                              · □ │
├───────────────────────────────────────────────────────────────────┤
│ Profiles   Edit   Help                                            │
│ Adapters            Type                 Slot                     │
│  Unassigned                               1                       │
│  Unassigned                               2                       │
│  Unassigned                               3                       │
│  PC1                 Parallel Channel     4                       │
│  Reserved                                 5                       │
│  Unassigned                               6                       │
│  Unassigned                               7                       │
│  Fixed Disk                               8                       │
│                                                                   │
│ Functions           Type                                          │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
└───────────────────────────────────────────────────────────────────┘
```
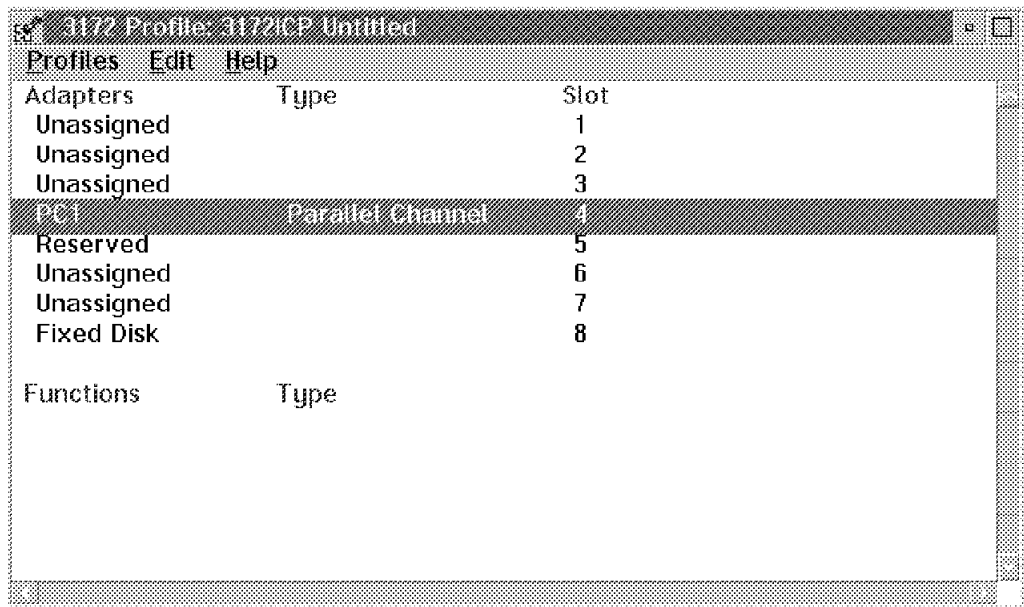
Figure 28. Profile with Parallel Channel Adapter

Step 11. Select **Profiles** from the action bar and **Exit** from the pull-down menu to exit. ;p.Another panel appears where you confirm that you want to save the current profile data. Finally, the panel shown in Figure 29 appears.

```
┌─────────────────────────────────────────────────────────────────┐
│  ⌄  Save As                                                       │
│                                                                   │
│  Profile name:      3172ICP                                       │
│                                                                   │
│   ┌────────┐   ┌────────┐   ┌────────┐                           │
│   │  Save  │   │ Cancel │   │  Help  │                           │
│   └────────┘   └────────┘   └────────┘                           │
│                                                                   │
└───────────────────────────────────────────────────────────────────┘
```
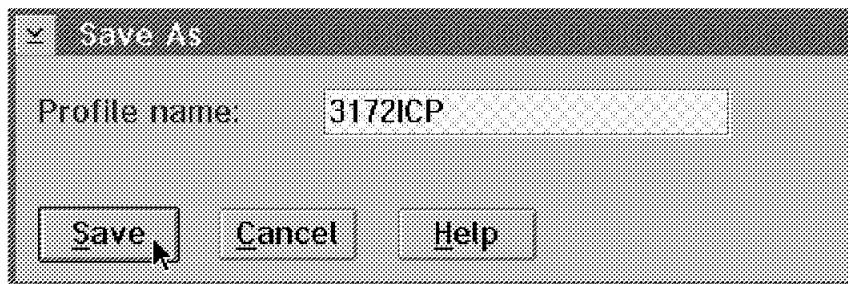
Figure 29. Selecting a Profile Name

Step 12. Type a name for your new profile and click on **Save** to return to the primary Operator Facility/2 panel. Here we created a new profile and named it 3172ICP.

Up to this point, you used OF/2 to configure the parallel channel adapter which is installed in slot 4 and save it in profile 3172ICP. The LAN adapters and their associated protocol functions will be configured as required in the connectivity scenarios described in subsequent sections.

2.5.8 Receiving the ICP Code at the Operator Station

You may receive the ICP code at the operator station at the same time that you install the Operator Facility/2, or delay it for a later time, for whatever reason. We received the ICP code at the same time we installed the Operator Facility/2 but we will describe how to receive it using the Operator Facility/2, as described below:

Note: You do not need to receive the code if you have already done so during installation.

Step 1. Insert *ICP Base Diskette 1* into the operator station diskette drive (A).

Step 2. Start the Operator Facility at the operator station.

Step 3. Select **Code** from the action bar and select **Receive ICP code** as shown in Figure 30.
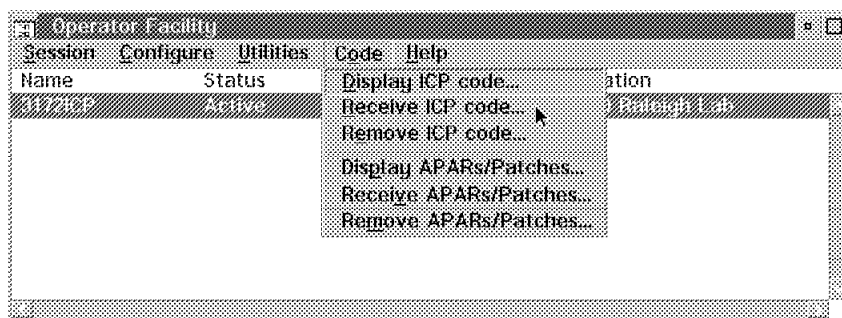
Figure 30. Selecting Receive ICP Code

The panel shown in Figure 31 appears.
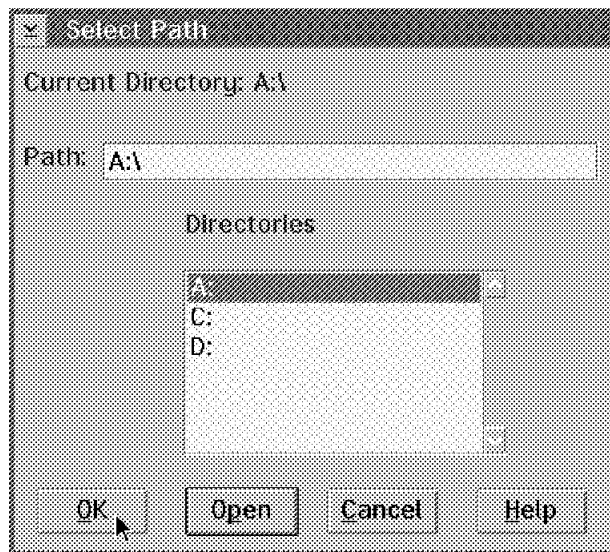
Figure 31. Selecting Path to Receive ICP Code

Step 4. Select source drive **A** and click on **OK** to indicate that you will receive the ICP code from diskettes in drive A.

The panel shown in Figure 32 appears.
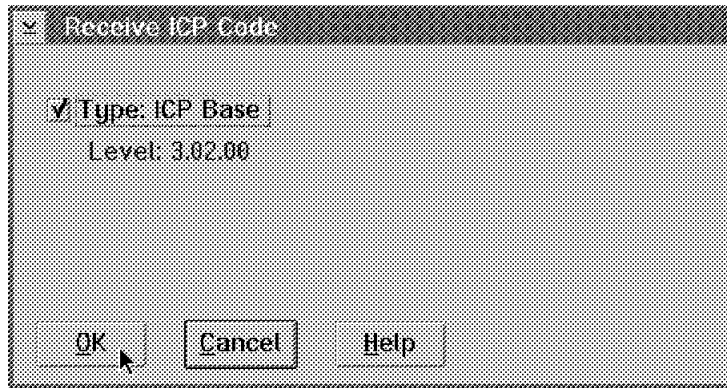
Figure 32. Receive ICP Code

Step 5. Select **OK** to receive the first portion of the ICP code.

After the code in *ICP Base Diskette 1* has been received, you are prompted to insert *ICP Base Diskette 2*.

Step 6. Remove *ICP Base Diskette 1* from drive A, insert *ICP Base Diskette 2* and select **OK** to receive the next portion of the ICP code.

After the code in *ICP Base Diskette 2* has been received, you are prompted to insert *ICP Base Diskette 3*.

Step 7. Remove *ICP Base Diskette 2* from drive A, insert *ICP Base Diskette 3* and select **OK** to receive the last portion of the ICP code.

Step 8. Remove *ICP Base Diskette 3* from drive A.

If the 3172 profile for which you are creating Working Diskettes includes the Interconnect Enhancement Feature, insert the *Interconnect Enhancement Feature Backup Diskette* into drive A.

Step 9. Select **Code** from the action bar and select **Receive ICP code** as shown in Figure 30 on page 67.

The panel shown in Figure 31 on page 67 appears.

Step 10. Select source drive **A** and click on **OK** to indicate that you will receive the Interconnect Enhancement Feature code from the diskette in drive A.

The panel shown in Figure 33 on page 69 appears.
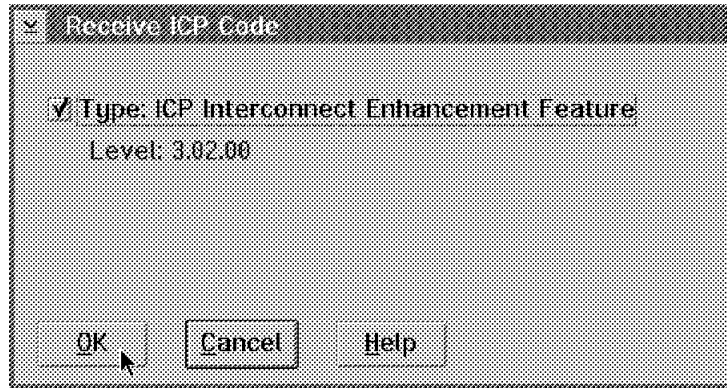
Figure 33. Receive Interconnect Enhancement Feature Code

Step 11. Select **OK** to receive the Interconnect Enhancement Feature code.

Step 12. After the code in the diskette has been received, remove it from the drive.

If you want to verify that Version 3.2 of the ICP base code and the Interconnect Enhancement Feature code has been received, proceed as follows.

Step 13. Select **Code** from the action bar and select **Display ICP code** as shown in Figure 34.
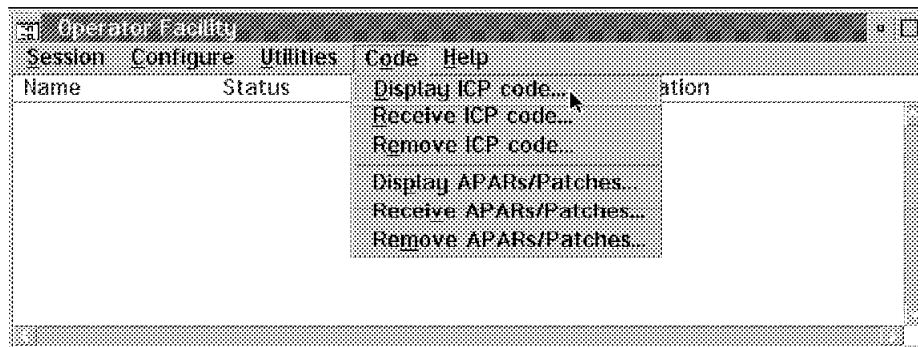
Figure 34. Selecting Display ICP Code

The panel shown in Figure 35 on page 70 appears.
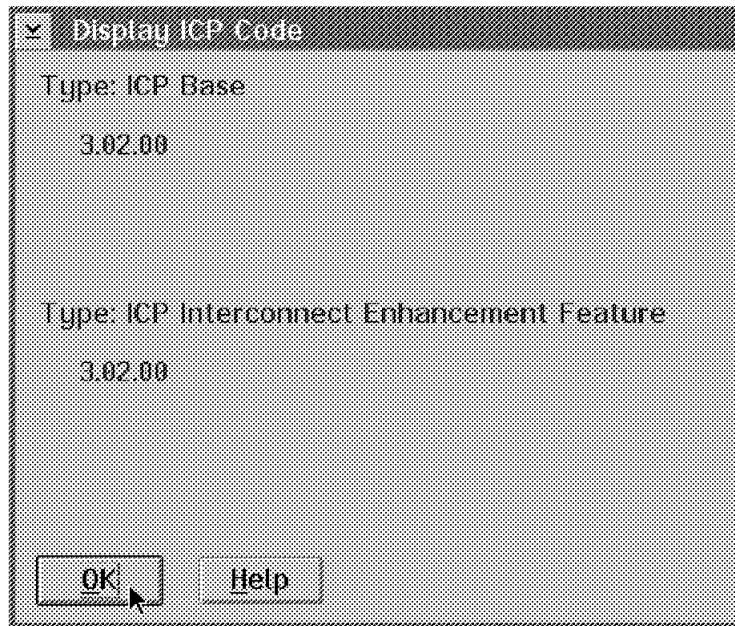
Figure 35. Verifying ICP Code Received at the Operator Station

Step 14. Select **OK** to return to the primary window of the Operator Facility/2.

2.5.9 Creating Working Diskettes for Your 3172

The Working Diskettes contain the active ICP configuration that is loaded into and operates your 3172. This configuration includes the ICP base code, the Interconnect Enhancement Feature code and operator-defined profiles.

To create the Working Diskettes, use the following procedure:

Step 1. Format 3 high-density (2.0MB) diskettes for use as 3172 Working Diskettes. Do *not* provide volume labels.

Step 2. Label the diskettes to indicate their sequence and the name of your 3172.

Step 3. Select the 3172 for which you want to create the Working Diskettes, from the primary Operator Facility/2 panel.

Step 4. Select **Utilities** from the primary panel action bar.

Step 5. Select **Create Working Diskettes** from the pull-down menu.

The panel shown in Figure 36 on page 71 appears.
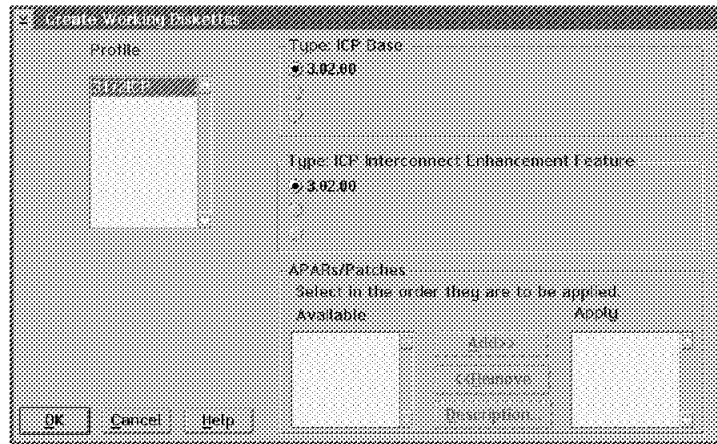
Figure 36. Creating Working Diskettes for Your 3172

Step 6. Refer to your IBM 3172 System Information worksheet and specify the desired profile name in the Profile window on this panel.

Step 7. Select the ICP base code level.

Step 8. Select the ICP Interconnect Enhancement Feature code level.

The Operator Facility/2 creates three Working Diskettes based on the profile information for the profile name selected, the level of ICP Base code selected and the level of Interconnect Enhancement Feature code selected (if installed).

Step 9. Select the APARs and patches to apply to the ICP base from the Available list box and click on **Add** to add them to the Apply list box.

You can click on **Description** to review a description of the APAR or patch.

Step 10. Insert **3172 Working Diskette 1** in drive A and click on **OK**.

When the diskette is processed the Operator Facility/2 prompts you for the next diskette.

Step 11. Remove **3172 Working Diskette 1** from drive A and insert **3172 Working Diskette 2** in drive A and click on **OK**.

When the diskette is processed the Operator Facility/2 prompts you for the next diskette.

Step 12. Remove **3172 Working Diskette 2** from drive A and insert **3172 Working Diskette 3** in drive A and click on **OK**.

Step 13. Click on **OK** on the Working Diskette Created message box to return to the Create Working Diskettes panel.

Step 14. Select **Cancel** to return to the primary panel.

For instructions on loading the Working Diskettes in your 3172, refer to 2.5.11, "Loading the Working Diskettes in Your 3172" on page 72.

2.5.10 Formatting the 3172 Hard Disk

We recommend that you format the 3172 hard disk before you install the Working Diskettes. Format the 3172 hard disk using the following procedure:

Step   1. Vary off the 3172 subchannel addresses assigned to the 3172.

Step   2. Turn the 3172 ON/OFF switch to OFF (O).

Step   3. Remove the plastic front panel of the 3172.

Step   4. Insert the *Operator Facility/2 Backup Diskette* into the 3172 diskette drive.

Step   5. Turn the 3172 ON/OFF switch to ON (|). **0000** appears on the display.

Successful loading of the formatting program is indicated when the code on the display changes from **0000** to **FF00**.

Unsuccessful loading of the formatting program is indicated by the code on the display remaining unchanged or changing to a code other than **FF00**.

Step   6. On the Operator Panel, key in **1** to format the hard disk. **0001** appears on the display. Press Enter. **FF01** appears on the display and the 3172 displays status code **FFC2**.

The formatting process takes several minutes. If the code on the display changes from **FF01** to **FF02**, the fixed disk has been formatted successfully. Remove the *Operator Facility/2 Backup Diskette* from the 3172 diskette drive and turn the 3172 ON/OFF switch to OFF (O).

If the display changes to any code other than **FF02**, the formatting process has failed.

2.5.11 Loading the Working Diskettes in Your 3172

To load the ICP configuration (ICP code and profiles) on your 3172, enter this sequence of commands using the 3172 keypad:

Step   1. Vary off the 3172 subchannel addresses assigned to the 3172.

Step   2. Turn the 3172 ON/OFF switch to OFF (O).

Step   3. Insert *Working Diskette 1* into the 3172 diskette drive.

Step   4. Turn the 3172 ON/OFF switch to ON (|).

Step   5. When **2000** appears on the display, continue with the next step.

It should take a few minutes for **2000** to appear.

Step   6. Key in **CCA** and press Enter.

FCCA will appear on the display.

Step   7. Key in **CCA** and press Enter again.

This command causes all the configuration information to be copied from *Working Diskette 1* to the 3172 fixed disk. If the command is successful, code **FCCA** on the display will change to **0000**.

Step   8. Key in **CCD** and press Enter.

FCCd will appear on the display.

Step   9. Key in **CCD** and press Enter again.

This command causes code to be copied from *Working Diskette 1* to the 3172 fixed disk.

Note: This step may take 5 minutes or longer.

Step 10. When **FCCE** appears on the display, remove *Working Diskette 1* from the diskette drive.

Step 11. Insert *Working Diskette 2* and press Enter to copy the code from this diskette to the 3172 fixed disk.

Note: This step may take 5 minutes or longer.

Step 12. When **FCCF** appears on the display, remove **Working Diskette 2** from the diskette drive.

Step 13. Insert *Working Diskette 3* and press Enter to copy the code from this diskette to the 3172 fixed disk.

Step 14. When **FCd0** appears on the display, remove *Working Diskette 3* from the diskette drive.

Step 15. Turn the ON/OFF switch to OFF (O).

Step 16. Vary on the 3172 subchannel addresses assigned to the 3172.

Note: If any problem occurs during this procedure, refer to Chapter 2 of the *IBM 3172 Interconnect Controller Interconnect Controller Program Version 3.2 User′s Guide (SC30-3572)*.

2.6 Using Your 3172

In this section we describe the following basic tasks related to the daily operation of your 3172:

- Starting your 3172
- Restarting your 3172
- Shutting down your 3172

2.6.1 Starting Your 3172

Install all required channel and LAN adapters in your 3172 before you start it.

To start your 3172 for the first time or with a new set of working diskettes, use the following procedure:

Step 1. Plug your 3172 into a power outlet.

Step 2. Format the hard disk of your 3172.

Use the procedure described in 2.5.10, "Formatting the 3172 Hard Disk" on page 72. This step is recommended for the first time or if you suspect a problem with the hard disk.

Step 3. Load the Working Diskettes in your 3172.

Use the procedure described in 2.5.11, "Loading the Working Diskettes in Your 3172" on page 72.

Step 4. Turn the 3172 ON/OFF switch to ON (|).

Step 5. Turn the channel bypass switch at the back of the parallel channel adapter to the **S** position to enable the physical attachment to the host.

Step 6. Vary on the 3172 subchannel addresses assigned to the 3172.

2.6.2 Restarting Your 3172

A 3172 restart condition occurs in one of the following ways:

- An intentional power-down of the 3172 from the power switch

- A re-IPL of the 3172 using the keypad, Operator Facility or NetView

- An unexpected interruption to the power supply of the 3172

To restart your 3172, use the following procedure:

Step   1. Plug your 3172 into a power outlet

Step   2. Turn the 3172 ON/OFF switch to ON (|).

Step   3. Vary on the 3172 subchannel addresses assigned to the 3172.

Recovering the TCP/IP Links

When you restart or re-IPL your 3172, the TCP/IP links recover automatically.

If any TCP/IP link does not recover, check the status of the device (subchannel) used by the link and vary online if necessary. You should also check the START statement of the device in the TCP/IP profile to ensure it is being started every time.

Recovering the VTAM Links

The VTAM links do not recover automatically.

If you display the XCA and switched major nodes of the various LAN adapters from NetView, they will not be found (recognized). You must reactivate the XCA and switched major nodes of each LAN adapter defined in the active profile of your 3172. It is recommended that you activate the XCA major nodes first, followed by the switched major nodes.

While any links remain inactive, the keypad displays **200n** where n is the number of inactive links. As each XCA major node is reactivated, this number is decremented by one until it becomes 2000. The next operation performed through the keypad or the Operator Facility/2 changes this value to **0000**. Following reactivation of the link, its status changes from **Offline** to **Active** when viewed from the Operator Facility/2.

2.6.3 Shutting Down Your 3172

Before you shut down (power down) your 3172, stop all active host connections:

Step   1. For your TCP/IP connections, use the OBEYFILE command to stop each active device that is started by your TCP/IP profile.

Step   2. For your VTAM connections, use the NetView or MVS system console to vary off the XCA and switched major node for your 3172 and each installed LAN adapter.

Vary off the switched major node first, followed by the XCA major node in each case. The 3172 display shows the number of inactive host connections in the status code. For example, if four connections are rendered inactive, the status code is **2004**.

Step   3. Turn the 3172 ON/OFF switch to OFF (O).

2.7 Applying Service to ICP and the Operator Facility/2

Operator Facility/2 Version 3 Release 2 has been enhanced with service capabilities and we strongly recommend that you use the Operator Facility/2 to apply service to the Interconnect Controller Program. The Operator Facility/2 is considered to be the preferred service facility.

2.7.1 Applying Service to the Operator Facility/2

The Operator Facility/2 is shipped with ICP but is serviced separately. You can not apply cumulative service to the Operator Facility/2. Service involves a total reinstallation of the Operator Facility/2 in the OF2VER3 directory.

The reinstallation replaces the Operator Facility/2 code but preserves existing 3172 definitions like profiles. To service (reinstall) the Operator Facility/2, use the following procedure:

Step   1. Insert the Operator Facility/2 service diskette in drive A of your operator station.

Step   2. At an OS/2 prompt, type install a: c: to reinstall the Operator Facility/2 on the C drive.

If the Operator Facility/2 is installed on another drive, specify the appropriate target drive in this command.

Note: The Operator Facility/2 code is not distributed to the 3172 because it runs in the operator station only.

2.7.2 Applying Service to the Interconnect Controller Program

Servicing ICP involves applying APARs/patches to the current base code. Service is applied to ICP at installation time and thereafter whenever it is deemed necessary. Here we describe post-installation service only. The Operator Facility/2 provides support to receive ICP APARs/patches from service diskettes to the operator station disk and then distributes the new code to your 3172(s). To service ICP, use the following procedure:

Step   1. Prepare the service diskettes with the ICP APARs/patches.

Step   2. Start the Operator Facility on your operator station.

Step   3. Insert the first service diskette in drive A of the operator station.

Step   4. Select **Code** from the Operator Facility/2 action bar and click on **Receive APARs** as shown in Figure 37.
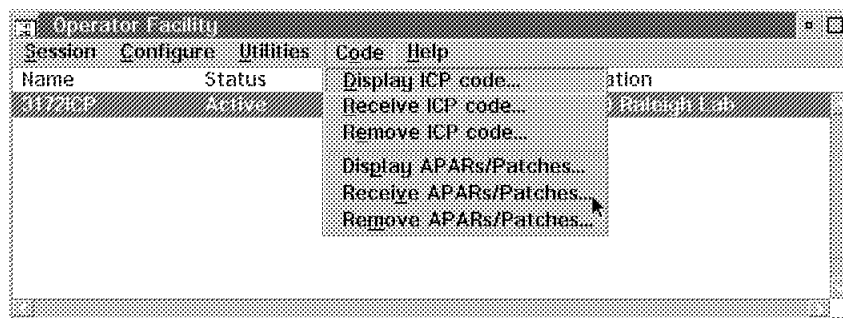
Figure 37. Selecting Receive APARs/Patches

The panel shown in Figure 38 on page 76 appears.
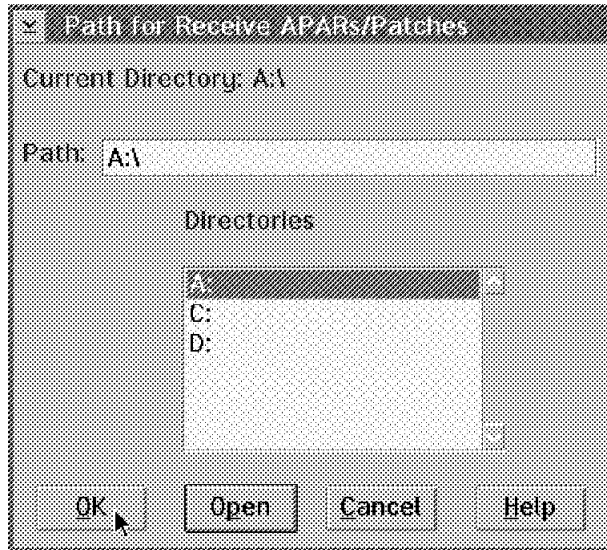
Figure 38. Path for Receive APARs

Step 5. Select source drive **A** and click on **OK**.

The panel shown in Figure 39 appears.
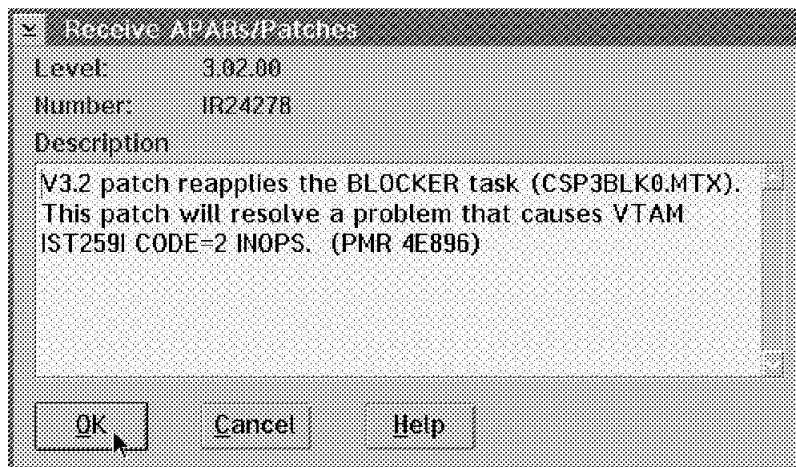
Figure 39. Receive APARs/Patches

Step 6. Review the description to ensure you want to apply this service and click on **OK** to apply it.

The service (APAR/patch) is copied from the service diskette to the OF2VER3\APAR subdirectory. For example, the APAR/patch IR24278 is copied into its private subdirectory OF2VER3\APAR\IR24278 and the APAR.DAT file is updated with the new service information, as shown below:

```
OS2 C:\of2ver3\apar>dir

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is E60E:8814
 Directory of C:\of2ver3\apar

 1-19-94   5:51p    <DIR>         0  .
 1-19-94   5:51p    <DIR>         0  ..
 1-23-94   1:20p      48          0  APAR.DAT
 1-23-94   1:20p    <DIR>         0  IR24278
 1-19-94   7:06p    <DIR>         0  IR24319
 1-19-94   7:19p    <DIR>         0  IR24815
           6 file(s)        48 bytes used
                       16164864 bytes free

OS2 C:\of2ver3\apar>type apar.dat
IR24319 3.02.00 IR24815 3.02.00 IR24278 3.02.00
```

2.7.3 Verifying Applied Service

After applying service to ICP, use the Operator Facility/2 to verify the results:

Step   1. Start the Operator Facility and establish a session with the particular 3172.

Step   2. Select the **Display** option from the action bar.

Step   3. Select the **Current ICP code** option from the pull-down menu.

A new panel will be presented with the following information:

- ICP base code level (3.02.00)

- ICP Interconnect Enhancement Feature code level (3.02.00)

- A window listing all the installed ICP APARs and patches

2.7.4 Copying 3172 Profiles to Another Operator Station

If you maintain more than one operator station, at some point you may need to copy 3172 profiles from one to another. Use the following procedure to perform this task:

Step   1. Start the Operator Facility.

Step   2. Open the 3172 profile you want to copy, and save it.

   This will change the date and time of the profile file in the OF2VER3\CONFIG subdirectory.

Step   3. At an OS/2 prompt, change to the x:\OF2VER3\CONFIG subdirectory where x is the drive on which you have installed OF/2. Search the subdirectory for the original name.* file that has the most recent date and time.

Step   4. Copy this file to a diskette and give it the new name (3172NEW) with the extension of .001 (that is, 3172NEW.001).

Step   5. Repeat steps 1 through 3 for each profile you have defined for the original name that you would like to have under the new name.

   When you copy these files, name them 3172NEW.002, 3172NEW.003, and so on.

Step   6. Proceed to the target operator station, access the Operator Facility and add a 3172 with the new name (3172NEW) and the same parameters (3172 Type and Interconnect Enhancement Feature) as the original.

Step   7. Create as many new 3172 blank profiles for the new name as you have copied from the original name.

Step   8. Copy the profile files from the backup drive/diskette to the x:\OF2VER3\CONFIG subdirectory. This will replace the blank profiles you defined with the original profile information.

Step   9. Create **Working Diskette 1** only for the new name.

Step 10. Go to your 3172, insert **Working Diskette 1** into the 3172 drive and key in the command **CCA** twice.

This command will copy the configuration (with the new name) to the 3172 hard disk.

Step 11. When the copy completes, **0000** should appear on the 3172 display.

Step 12. Remove the diskette from the drive and power down the 3172.

Step 13. Power up the 3172 to activate it with the new name on the LAN.

2.7.5 Copying 3172 Profiles to Another 3172 Name

If you need to copy 3172 profiles from an operator station to another name on the same operator station, use the following procedure to perform the task:

Step   1. Start the Operator Facility.

Step   2. Add a 3172 with the new name (3172NEW) with the same parameters (3172 Type and Interconnect Enhancement Feature) as the original.

Step   3. Create as many new 3172 blank profiles for the new name as you will copy from the original name.

Step   4. Open the profile from the original name you want to copy and save it.

This will change the date and time of the profile file in the OF2VER3\CONFIG subdirectory.

Step   5. At an OS/2 prompt, change to the x:\OF2VER3\CONFIG subdirectory where x is the drive on which you have installed OF/2. Search the subdirectory for the original name.* file that has the most recent date and time.

Step   6. Copy this file and give it the new name (3172NEW) with the extension of .001 (that is, 3172NEW.001).

Step   7. Repeat steps 3 through 5 for each profile you have defined for the original name that you want to have under the new name.

When you copy these files, name them 3172NEW.002, 3172NEW.003, and so on.

This will replace the blank profiles you have defined.

Step   8. Create **Working Diskette 1** only for the new name.

Step   9. Go to your 3172, insert **Working Diskette 1** into the 3172 drive and key in the command **CCA** twice.

This command will copy the configuration (with the new name) to the 3172 hard disk.

Step 10. When the copy completes, **0000** should appear on the 3172 display.

Step 11. Remove the diskette from the drive and power down the 3172.

Step 12. Power up the 3172 to activate it with the new name on the LAN.

2.8 Scenario 1: TCP/IP over Token-Ring

The purpose of this connectivity scenario is to describe how a token-ring LAN-attached workstation can use the TCP/IP protocol to communicate with MVS host applications through an IBM 3172 Interconnect Controller running ICP Version 3 Release 2 as shown in Figure 40.

```
              ┌──────────────────────┐
              │      MVS/ESA 4.3      │
              │                      │
              ├──────────────────────┤
              │     TCP/IP  2.2.1    │
              └──────────────────────┘
      Parallel │    Subchannel
      Channel  │    Addresses:
      Attached │    304 (data from 3172)
               │    305 (data to 3172)
                                                  ┌──────────────────────┐
                                                  │    PS/2 Model 80     │
              ┌──────────────────────┐            │                      │
              │     PC Adapter       │            │       OS/2 2.1       │
              │                      │            │      TCP/IP 2.0      │
              ├──────────────────────┤            ├──────────────────────┤
              │     3172 Model 3     │            │     Token Ring       │
              │                      │ * * * * * *─│      Adapter         │
              ├──────────────────────┤   *       *└──────────────────────┘
              │       ICP 3.2        │   * Token Ring *  IP Addr : 9.67.38.28
              │                      │   * LAN  4 Mb *   LAA     : 4000 0003 2209
  IP Addr : 9.67.38.21   ├───────────┤   *       *
  LAA     : 4000 021B 3172│Token Ring │   * * * * * *
                         │ Adapter    │──────────────
              └──────────────────────┘
```
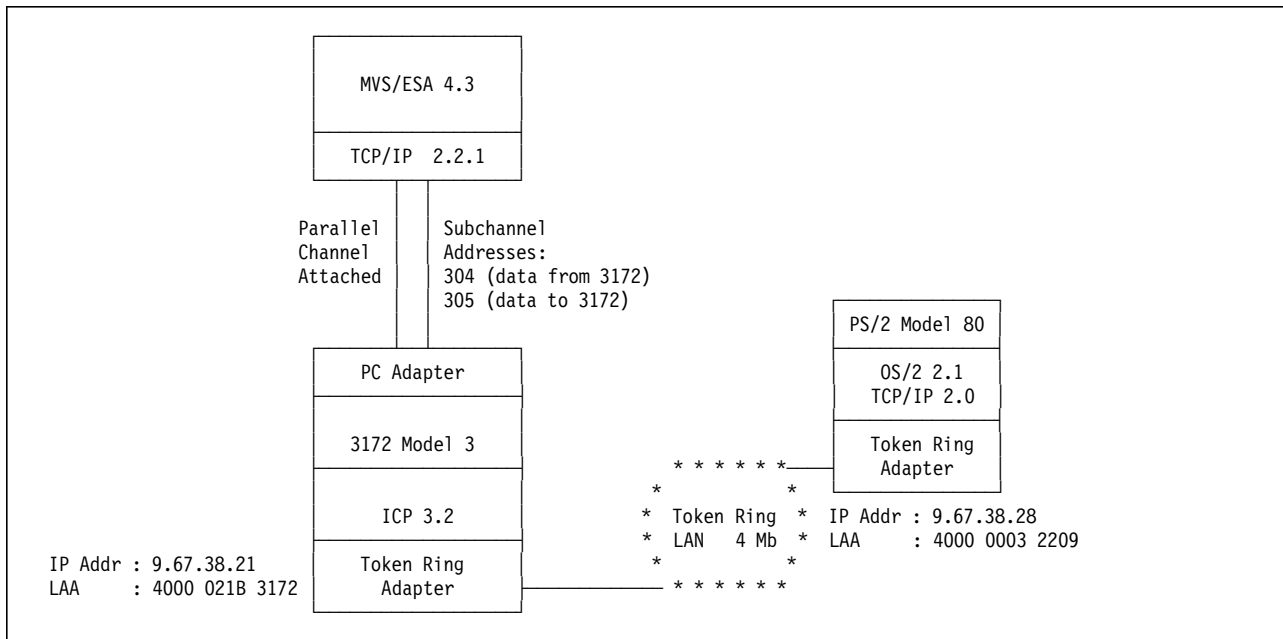
Figure 40. TCP/IP over Token-Ring LAN.   A token-ring LAN-attached PS/2 workstation accessing TCP/IP applications on the MVS host via an IBM 3172 Interconnect Controller gateway.

2.8.1 Host Definitions

You must define your IBM 3172 Interconnect Controller Model 3 connection to the host in the following areas:

1. Host channel subsystem

   These definitions are coded in the Input/Output Control Program (IOCP).

2. Host operating system

   MVS/ESA and VM/ESA are examples of IBM operating systems.

3. Host Program

   TCP/IP, VTAM and OSI/CS are examples of IBM host programs.

IOCP Definitions

The channel path used by the host to communicate with the 3172 is defined to the operating system in the IOCP.

```
        CHPID PATH=((17)),       1                    X
              TYPE=BL

        CNTLUNIT CUNUMBR=300,     2                    X
              SHARED=N,                                X
              UNIT=3088,                               X
              PATH=(17),                               X
              UNITADD=((00,32)),                       X
              PROTOCL=S4

        IODEVICE UNIT=CTC,        3                    X
              ADDRESS=(300,32),                        X
              CUNUMBR=(300),                           X
              STADET=N
```

1　The CHPID macro specifies a parallel block multiplexer on channel path 17 for the 3172.

2　The CNTLUNIT macro defines the 3172 as a 3088-type device and reserves subchannels 300 to 31F to communicate with it. A data streaming channel using a transfer rate of 4.5MB is specified.

3　The IODEVICE macro specifies the 3172 as a channel-attached device.

MVS/ESA Definitions

For MVS/ESA you define the IBM 3172 Interconnect Controller Model 3 by updating the MVS Control Program (CP) with the following entry:

```
    IODEVICE UNIT=CTC,                                 X
          ADDRESS=(300,32)
```

Note: For more information about 3172 definitions on other IBM operating systems, refer to *Chapter 4, IBM 3172 Interconnect Controller Interconnect Controller Program Version 3.2 User's Guide (SC30-3572)*.

TCP/IP Definitions

TCP/IP on the host requires the following definitions for the token-ring LAN.

```
 DEVICE ICPTR304 LCS 304 NETMAN      1

 LINK TR304 IBMTR 0 ICPTR304         2

 HOME                                3
  9.67.38.21     TR304

 GATEWAY                             4
  9.67.38.28  =  TR304   DEFAULTSIZE   HOST

 START ICPTR304                      5
```

1　The DEVICE statement specifies the pair of devices (subchannels) the host uses to communicate with the 3172. In our case, inbound data to the host uses subchannel 304 and outbound data uses subchannel 305. The second subchannel is not specified explicitly on this statement.

The LINK statement identifies the interface as a token-ring LAN adapter attached to the host using the devices specified in the DEVICE statement.

 The HOME section specifies the IP address assigned to the Token-Ring LAN adapter on the 3172.

 The GATEWAY section specifies a direct route to our LAN-attached PS/2 client workstation using its IP address.

 The START statement causes the 3172 token-ring adapter to insert on the LAN and activates host-to-3172 communication.

2.8.2 3172 Definitions

2.8.2.1 Defining the token-ring LAN Adapter to Your 3172

To attach the 3172 to the token-ring LAN you must install a token-ring LAN adapter in a valid 3172 slot according to the plugging chart for parallel channel adapters shown in Table 8 on page 40.

We installed the token-ring LAN adapter in slot 3 and used the Operator Facility/2 operator station to define it to ICP in the following manner:

Step   1. Start the Operator Facility.

Step   2. Select **3172ICP**.

Step   3. Select **Configure** from the action bar.

Step   4. Select **Profiles** from the pull-down menu.

Step   5. Select **Profiles** from the action bar.

Step   6. Select **Open** from the pull-down menu.

Step   7. Select **3172ICP** and click on **OK** from the Open Profile menu.

        The panel shown in Figure 41 appears.
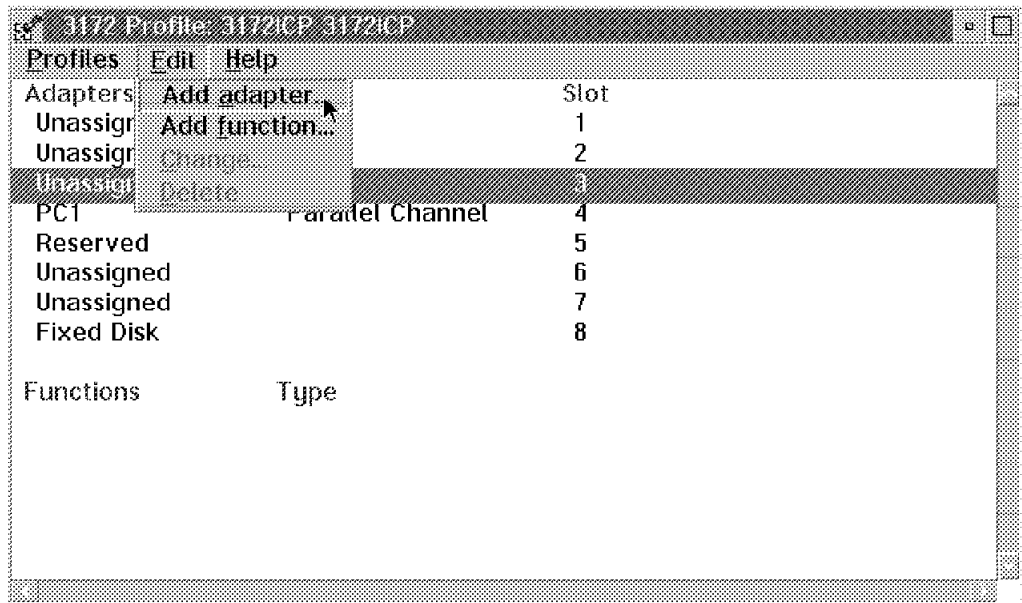
Figure 41. Adding Token-Ring LAN Adapter to 3172

Step   8. Select the appropriate slot for token-ring.

We installed the token-ring adapter in slot 3.

Step   9. Select **Edit** from the action bar.

Step 10. Select **Add adapter** from the pull-down menu.

The panel shown in Figure 42 appears.
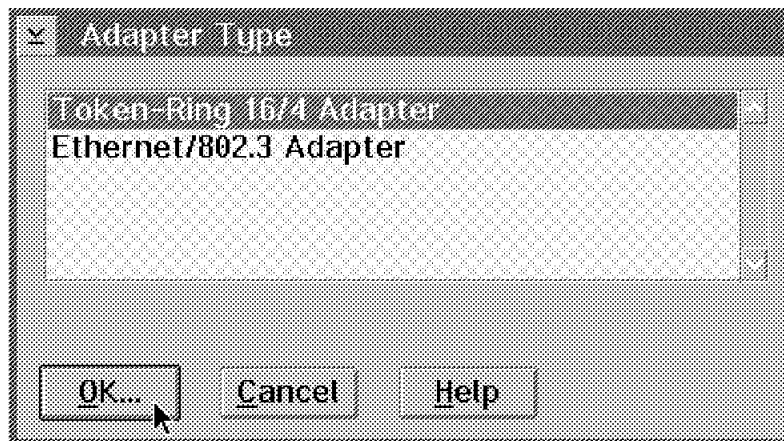
Figure 42. Selecting Token-Ring LAN Adapter

Step 11. Select **Token-Ring 16/4 Adapter** on this panel and click on **OK** to indicate that we are defining a token-ring LAN adapter.

The panel shown in Figure 43 appears.
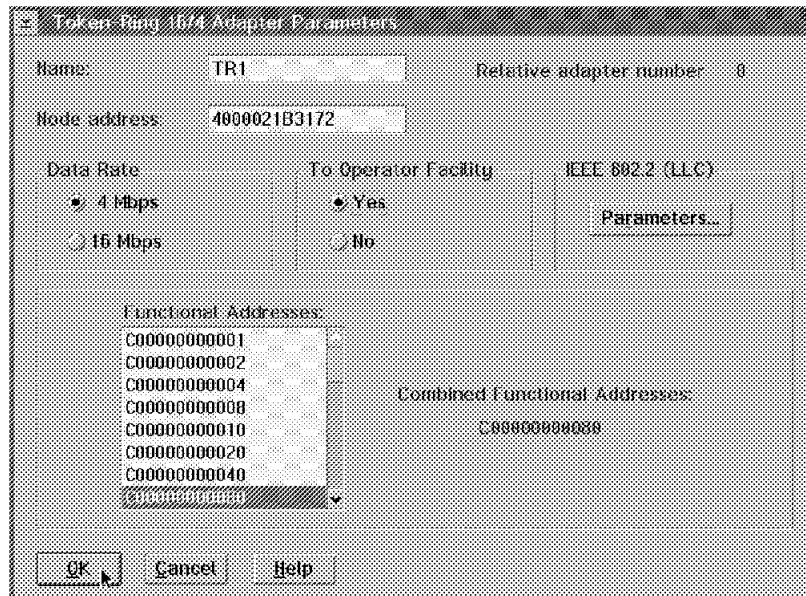
Figure 43. Token-Ring 16/4 Adapter Parameters

Step 12. Type in a symbolic name for your token-ring LAN adapter.

We specified **TR1** here.

Step 13. Type in the locally administered address (LAA) of your token-ring LAN adapter in the Node address field.

The LAA of our token-ring LAN adapter was 4000021B3172.

Step 14. Select the appropriate data rate from the Data Rate window to set the data rate used by your token-ring LAN adapter.

We tested on a token-ring LAN running at a rate of 4 Mbps.

Step 15. Select **Yes** if you want to indicate that the 3172 will be managed by this workstation acting as Operator Facility/2 operator station attached to the token-ring LAN.

We specified **Yes**.

Step 16. Click on **OK** to save your token-ring LAN adapter definitions and exit.

Note: We recommend that you accept the default link control 802.2 (LLC) parameters and Functional Address of C00000000080.

2.8.2.2 Adding TCP/IP Function to Your 3172 Token-Ring Adapter

To add TCP/IP function to your 3172 token-ring adapter, use this procedure:

Step 1. Start the Operator Facility.

Step 2. Select **3172ICP**.

Step 3. Select **Configure** from the action bar.

Step 4. Select **Profiles** from the pull-down menu.

Step 5. Select **Profiles** from the action bar.

Step 6. Select **Open** from the pull-down menu.

Step 7. Select **3172ICP** and click on **OK** from the Open Profile menu.

The panel shown in Figure 44 appears.
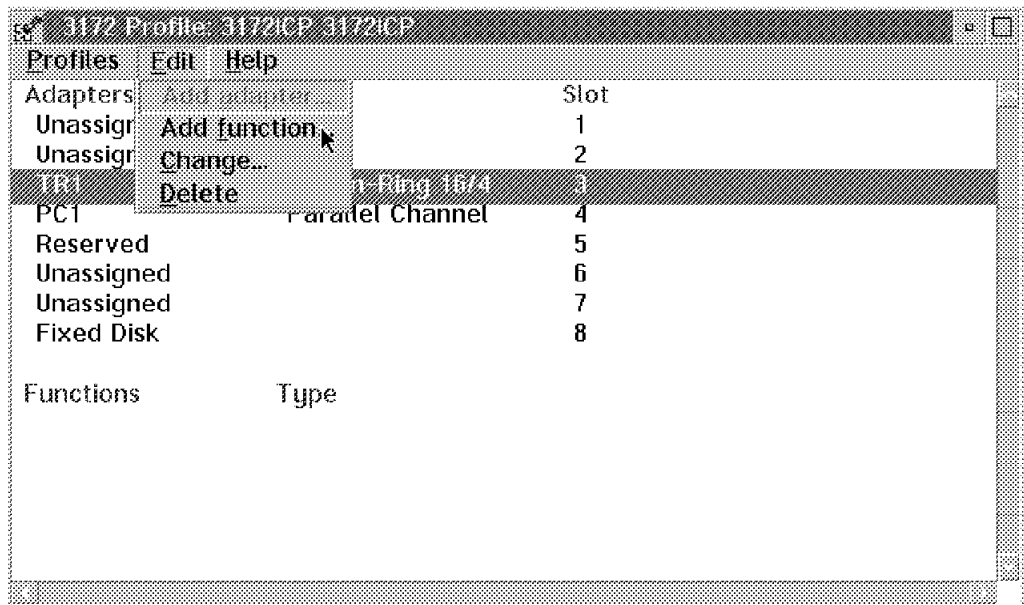
Figure 44. Add Function

Step 8. Select the 3172 slot where the token-ring adapter is installed.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Add function** from the pull-down menu.

The panel shown in Figure 45 on page 85 appears.
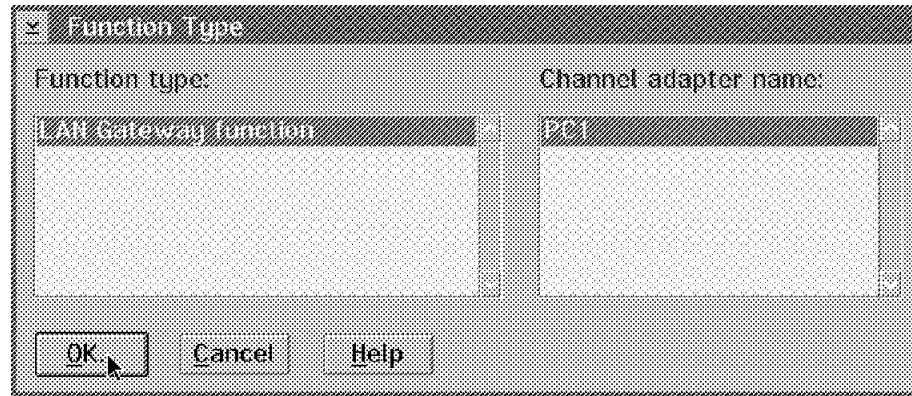
Figure 45. Function Type

Step 11. Select LAN Gateway function and channel adapter PC1 and click on **OK**.

The panel shown in Figure 46 appears.
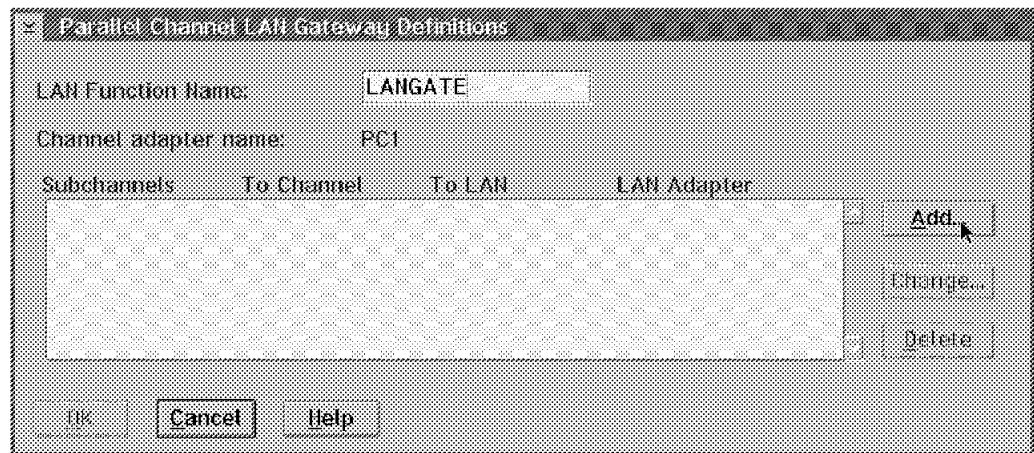
Figure 46. Parallel Channel LAN Gateway Definitions

Step 12. Type a name in the LAN Function Name field.

We entered the name **LANGATE**.

Step 13. Click on **Add**.

The panel shown in Figure 47 on page 86 appears.
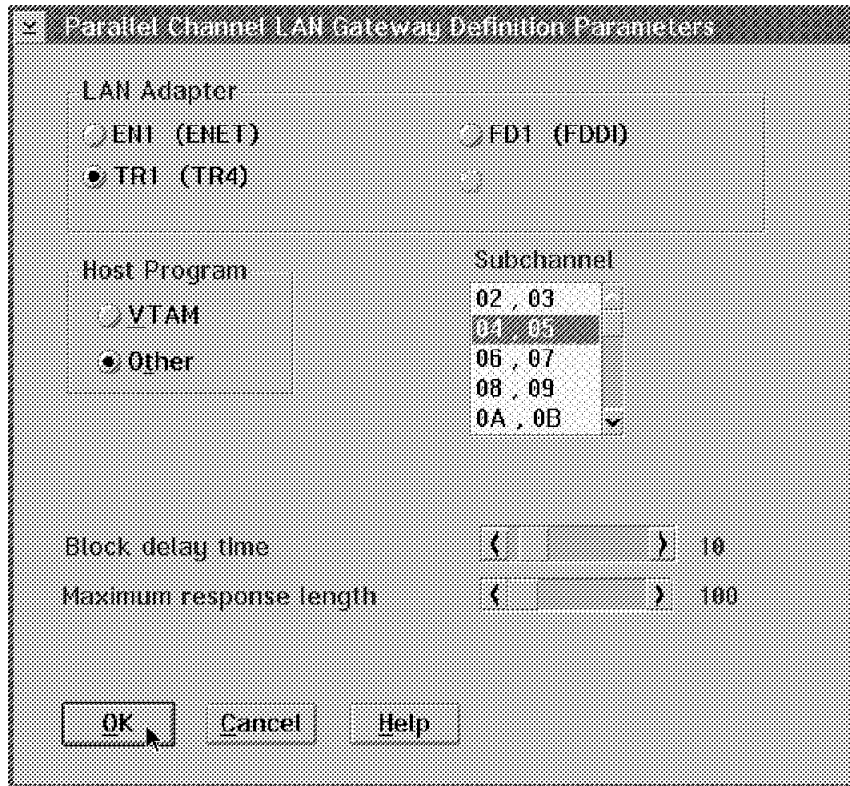
Figure 47. Parallel Channel LAN Gateway Definition Parameters

Step 14. Select LAN Adapter **TR1**.

Step 15. Select Host Program **Other**.

Other indicates a protocol other than VTAM.

Step 16. Select the subchannel pair to be used for TCP/IP traffic to and from the host. One subchannel is used to send and one to receive data.

We used subchannels 04 and 05.

Step 17. Click on **OK** to save your changes and exit.

The token-ring LAN adapter in your 3172 is now enabled for TCP/IP.

Note: It does not matter whether you add the TCP/IP or VTAM function to your Ethernet LAN adapter first. You can always add the other one later. To add the other host program to your adapter, you must return to the panel shown in Figure 44 on page 84 and step through the procedure again.

2.8.3 Workstation Definitions

To prepare your PS/2 workstation for attachment to the token-ring LAN using the TCP/IP protocol, you must perform the following tasks:

- Configure your token-ring LAN adapter for TCP/IP protocol using the LAPS application.

- Assign your token-ring LAN adapter an IP address and a subnet mask using TCP/IP configuration.

- Select the TCP/IP applications to be autostarted for the connectivity verification step.

2.8.3.1 Configuring Your PS/2 Token-Ring LAN Adapter for TCP/IP

The token-ring adapter installed in your PS/2 workstation can support a variety of communications protocols, such as TCP/IP, NetBIOS and IEEE 802.2. To enable the necessary protocols for your adapter, in this case TCP/IP and NetBIOS, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step 1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step 2. Type laps to start LAPS.

Wait for a few seconds until startup has completed. You are then presented with two panels in succession. **Configure** on the first panel.

Step 3. Click on **Configure** on the first panel.

Step 4. Select **Configure LAN Transports** and click on **Continue** on the second panel.

The panel shown in Figure 48 appears.
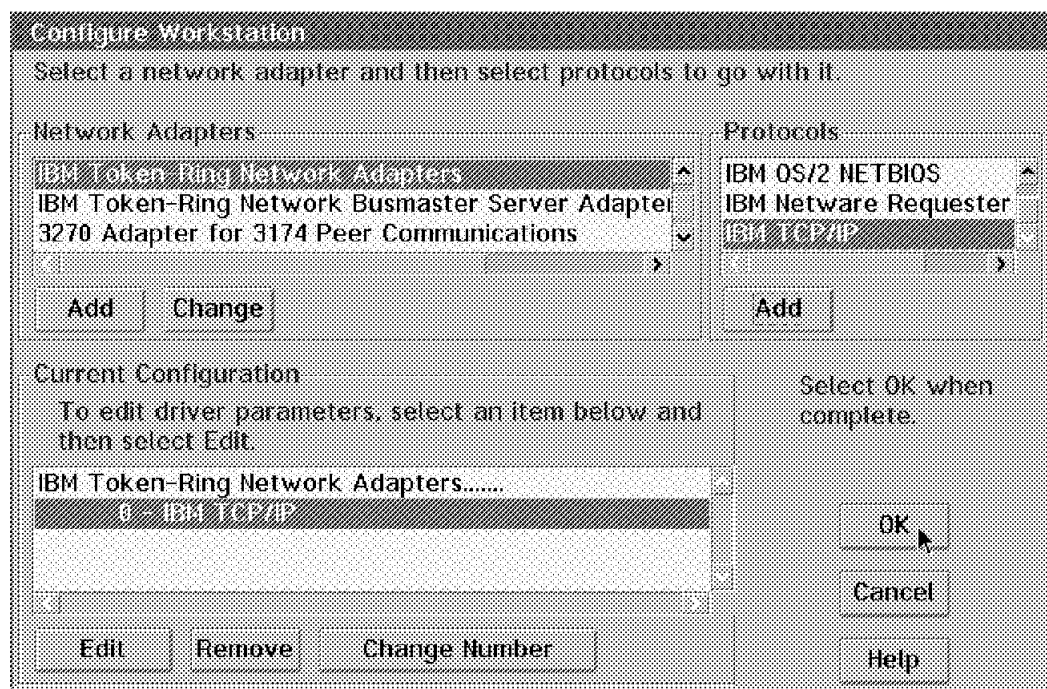
Figure 48. Configuring Your Token-Ring LAN Adapter for TCP/IP

Step 5. Select **IBM Token-Ring Network Adapters** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step 6. Select **IBM TCP/IP** from the Protocols window and click on **Add**.

Your adapter is now enabled for the TCP/IP protocol.

> **Important**
>
> The protocol enabled for your token-ring adapter is now shown in the Current Configuration window preceded by the number **0** to indicate the **relative adapter number**. Take note of this number because you need it during TCP/IP configuration.

Step 7. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 8. Click on **Exit** on each of these panels to exit from LAPS.

2.8.3.2 Assigning an IP Address to Your Token-Ring Adapter

To enable your workstation to communicate with other stations over the token-ring LAN using the TCP/IP protocol, you must assign an IP address to the token-ring LAN adapter. Use the following procedure to perform this task:

Step 1. If TCP/IP has not been started on your workstation already, go to an OS/2 prompt, type tcpstart and press Enter to start it now.

Wait until TCPIP/IP startup has completed.

Step 2. At an OS/2 prompt, access the drive on which IBM TCP/IP Version 2.0 for OS/2 is installed and type tcpipcfg to start the TCP/IP configuration process.

Wait until the panel shown in Figure 49 appears.
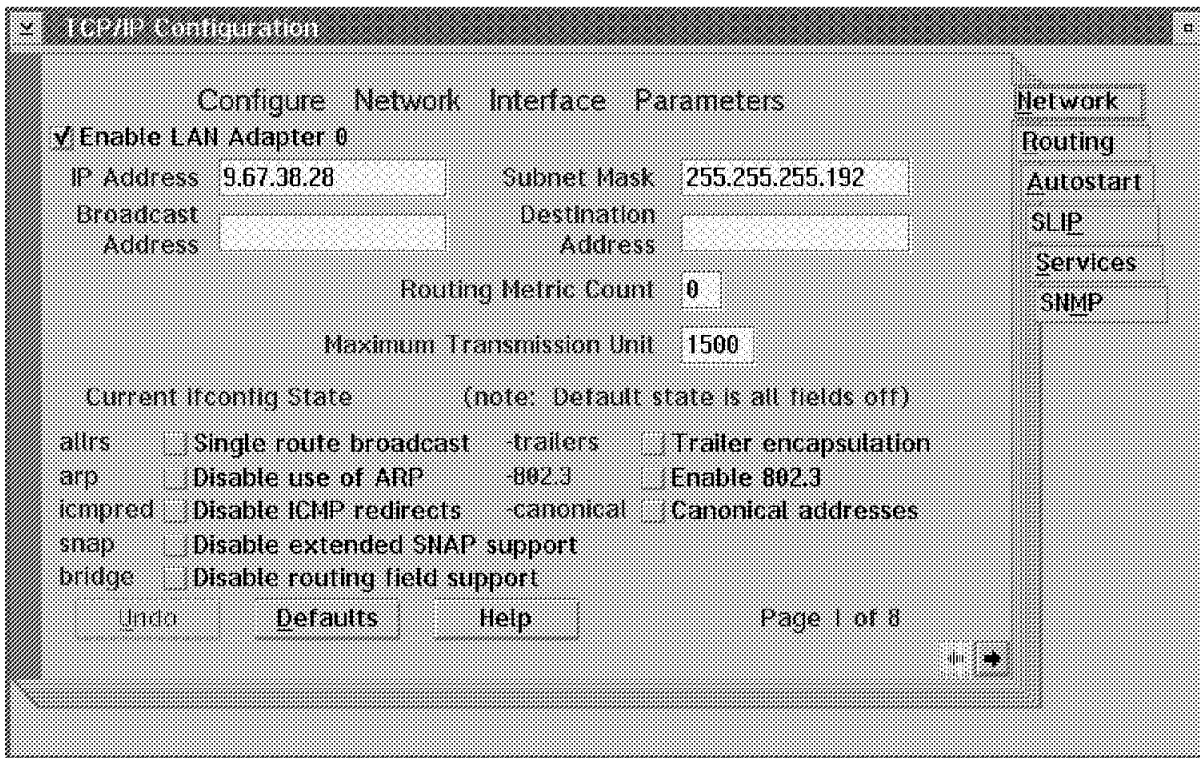
Figure 49. Assigning an IP Address to Your Token-Ring Adapter. Enable your token-ring LAN adapter, and assign it an IP address and subnet mask.

Step 3. Click on **Enable LAN Adapter 0**.

You must use the relative adapter number referred to in 2.8.3.1, "Configuring Your PS/2 Token-Ring LAN Adapter for TCP/IP" on page 87 to select and enable the correct token-ring LAN adapter. In this case, it happens to be relative adapter number 0.

```
┌─ Important ──────────────────────────────────────────────┐
│                                                           │
│  If you have multiple LAN adapters installed in your workstation use │
│  the right-pointing arrow at the bottom right-hand corner of this │
│  panel to advance to the next available (unused) LAN adapter and │
│  select it.                                               │
│                                                           │
└───────────────────────────────────────────────────────────┘
```

Step 4. We typed 9.67.38.28 in the IP Address field.

The IP Address of our token-ring LAN adapter is 9.67.38.28.

Step 5. We typed 255.255.255.192 in the Subnet Mask field.

The mask of our token-ring subnet is 255.255.255.192.

Note: Now your workstation is known in the TCP/IP network by this IP address with the given subnet mask. Consult with your network administrator to obtain your IP address and subnet mask.

2.8.3.3 Autostarting TCP/IP Applications

We intend to use the TCP/IP applications FTP and TELNET to verify our workstation-to-host connectivity. Therefore, we want to "autostart" these applications whenever TCP/IP is started. We proceed as follows:

Step 1. At the TCP/IP Configuration panel, click on **Autostart**.

The panel shown in Figure 50 appears.
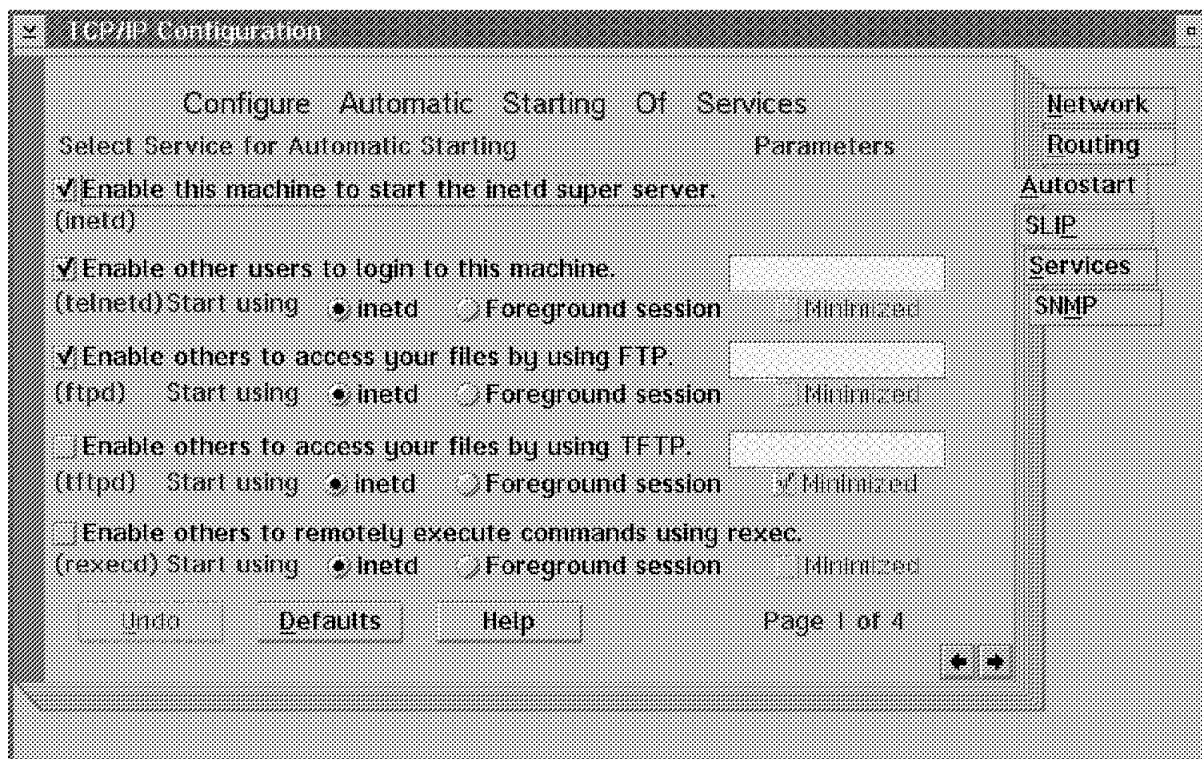
Figure 50. Autostarting FTP and TELNET Applications. These TCP/IP applications will be automatically started every time TCP/IP is started at your workstation.

Step   2. Click on **Enable this machine to start the inetd super server**.

Step   3. Click on **Enable other users to login to this machine**.

Step   4. Click on **Enable others to access your files by using FTP.**

Step   5. Double-click on the title bar icon.

Another panel appears and prompts you to Save or Discard your changes.

Step   6. Click on **Save** to save your TCP/IP changes and exit from TCP/IP configuration.

At this point, your PS/2 workstation is ready to attach to the token-ring LAN.

2.8.4 Verification

To verify TCP/IP connectivity between OS/2 and MVS we use PING, TELNET and FTP.

Ping from OS/2

```
OS2 C:\>ping 9.67.38.21
PING 9.67.38.21: 56 data bytes
64 bytes from 9.67.38.21: icmp_seq=0. time=32. ms
64 bytes from 9.67.38.21: icmp_seq=1. time=0. ms

----9.67.38.21 PING Statistics----
2 packets transmitted, 2 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/16/32

The external process was cancelled by a Ctrl+Break or another process.
^C
```

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:


===> ping 9.67.38.28




TCPPNG015I Ping V2R2.1: Pinging host 9.67.38.28.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.059 seconds. Successes so far 1
***
```

FTP from OS/2

```
OS2 C:\>ftp 9.67.38.21
Connected to 9.67.38.21.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 16:24:30 on 01/08/94
220 Connection will close if idle for more than 10 minutes.
Name (9.67.38.20): soutsos
331 Send password please.
Password:
230 SOUTSOS is logged on.
ftp> pwd
257 "'SOUTSOS.'" is working directory
ftp> quit
221 Quit command received. Goodbye.

OS2 C:\>
```

FTP from TSO

```
---------------------- TSO COMMAND PROCESSOR ----------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.38.28

FTPALL001I MVS TCP/IP FTP V2R2.1
FTPALL105I Connecting to 9.67.38.28, port 21
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
FTPALL010I USER (identify yourself to the host):
soutsos
FTPALL252I >>>USER soutsos
331 Password required for soutsos.
FTPALL228I Password:

FTPALL252I >>>PASS ********
230 User soutsos logged in.
FTPALL011I Command:
pwd
FTPALL252I >>>PWD
257 "C::" is current directory.
FTPALL011I Command:
quit
FTPALL252I >>>QUIT
221 Goodbye.
***
```

TELNET (PMANT) from OS/2

PMANT is a OS/2 TCP/IP implementation of the TELNET TN3270 protocol that uses Presentation Manager to display the 3270 screens. To invoke PMANT, enter:

```
OS2 C:\>pmant 9.67.38.21
```

In our scenario the TELNET default application in MVS TCP/IP is NetView Access Services:

```
                                        Hot Line: 17-6666
                                        Date . .: 01/08/94
                                        Time . .: 16:29:55
                                        Terminal: RAIAE001
     N E T V I E W
     *******    *******    *******   *********   *******    *******
   **     **  **     **  **     **  **          **    **  **     **
  **     **  **         **         **          **    **  **
  *********  **         **         *********   *******   ******
  **     **  **         **         **          **    **        *
  **     **  **     **  **     **  **          **    **  **     **
  **     **  ******    ******    *********   *******   *******
                                        S E R V I C E S
   NetView Access Services, Release 3.1 - Program Number 5665-365
      (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

            Enter Logon information:
              User . . . . . .          (User ID/LOGOFF)
              Password . . . .          New Password . .

              Application  . .
              Group  . . . . .
              Location . . . .
  PF 1=Help 2=Language
```

TELNET from TSO

```
  ------------------------ TSO COMMAND PROCESSOR  ------------------
  ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

  ===> telnet 9.67.38.28

  TCPTEL001I MVS TCP/IP Telnet V2R2.1
  TCPUTM110I Connecting to 9.67.38.28, port TELNET (23)
  ***
```

```
  TCPUTM118I
  TCPUTM119I Using Line Mode...
  TCPUTM120I
  TCPUTM121I Notes on using Telnet when in Line Mode:
  TCPUTM122I - To hide Password, Hit PF3 or PF15
  TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
  ***
```

```
  OS/2 Version 2.1 (Soutsos)

  Enter your password: ....

  <Soutsos>-C:\

  Telnet command: quit
```

Note: The **Telnet command** prompt is invoked by pressing PF4.

2.9 Scenario 2: TCP/IP over Ethernet

The purpose of this connectivity scenario is to describe how an Ethernet LAN-attached workstation can use the TCP/IP protocol to communicate with MVS host applications through an IBM 3172 Interconnect Controller running ICP Version 3 Release 2 as shown in Figure 51.
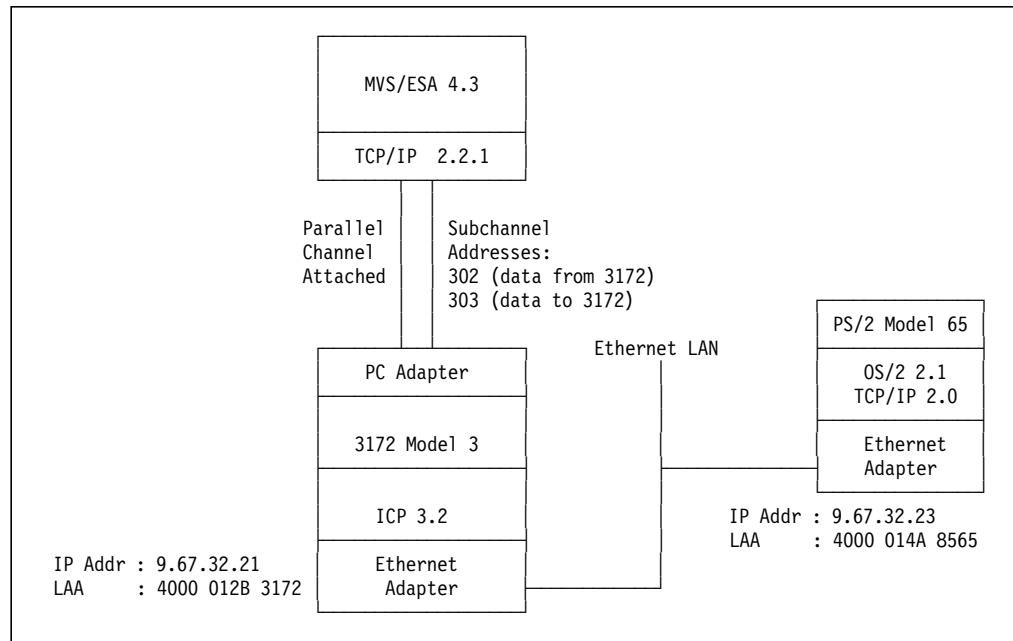
Figure 51. TCP/IP over Ethernet LAN. An Ethernet LAN-attached PS/2 workstation accessing TCP/IP applications on the MVS host via an IBM 3172 Interconnect Controller gateway.

2.9.1 Host Definitions

IOCP Definitions

Refer to "IOCP Definitions" on page 80 for these definitions.

Operating System Definitions

Refer to "MVS/ESA Definitions" on page 81 for these definitions.

TCP/IP Definitions

TCP/IP on the host requires the following definitions for the Ethernet LAN.

```
DEVICE ICPEN302 LCS 302 NETMAN      1

LINK EN302 ETHEROR802.3 0 ICPEN302  2

HOME                                3
  9.67.32.21    EN302

GATEWAY                             4
  9.67.32.23 = EN302  DEFAULTSIZE   HOST

START ICPEN302                      5
```

1 The DEVICE statement specifies the pair of devices (subchannels) the host uses to communicate with the 3172. In our case, inbound data to the host uses subchannel 302 and outbound data uses subchannel 303. The second subchannel is not specified explicitly on this statement.

2 The LINK statement identifies the interface as an Ethernet LAN adapter attached to the host using the devices specified in the DEVICE statement.

3 The HOME section specifies the IP address assigned to the Token-Ring LAN adapter on the 3172.

4 The GATEWAY section specifies a direct route to our LAN-attached PS/2 client workstation using its IP address.

5 The START statement causes the 3172 Token-Ring adapter to insert on the LAN and activates host-to-3172 communication.

2.9.2 3172 Definitions

2.9.2.1 Defining the Ethernet LAN Adapter to Your 3172

To attach the 3172 to the Ethernet LAN you must install an Ethernet LAN adapter in a valid 3172 slot according to the plugging chart for parallel channel adapters shown in Table 8 on page 40.

We installed the Ethernet LAN adapter in slot 2 and used the Operator Facility/2 operator station to define it to ICP in the following manner:

Step 1. Double-click on the **OF/2** icon to open it.

Step 2. Click on **3172ICP**.

Step 3. Select **Configure** from the action bar.

Step 4. Click on **Profiles** from the pull-down menu.

Step 5. Select **Profiles** from the action bar.

Step 6. Click on **Open** from the pull-down menu.

Step 7. Click on **OK** on the Open Profile menu.

The panel shown in Figure 52 on page 95 appears.
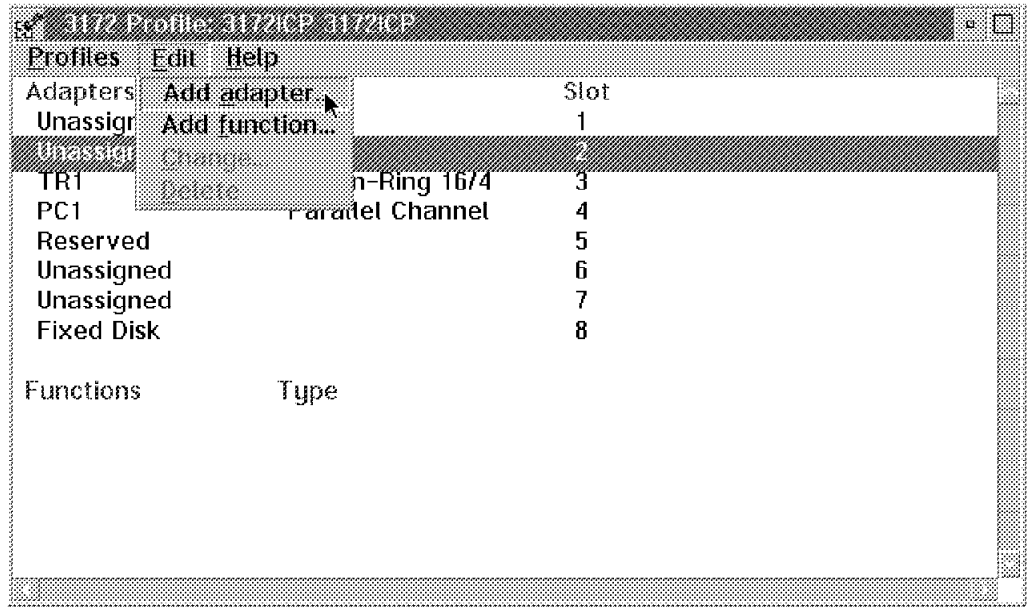
Figure 52. Adding Ethernet LAN Adapter to 3172

Step 8. Select the appropriate slot for Ethernet.

We installed the Ethernet adapter in slot 2.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Add adapter** from the pull-down menu.

The panel shown in Figure 53 appears.

Figure 53. Selecting Ethernet LAN Adapter

Step 11. Select **Ethernet/802.3 Adapter** on this panel and click **OK** to indicate that we are defining an Ethernet LAN adapter.

The panel shown in Figure 54 on page 96 appears.
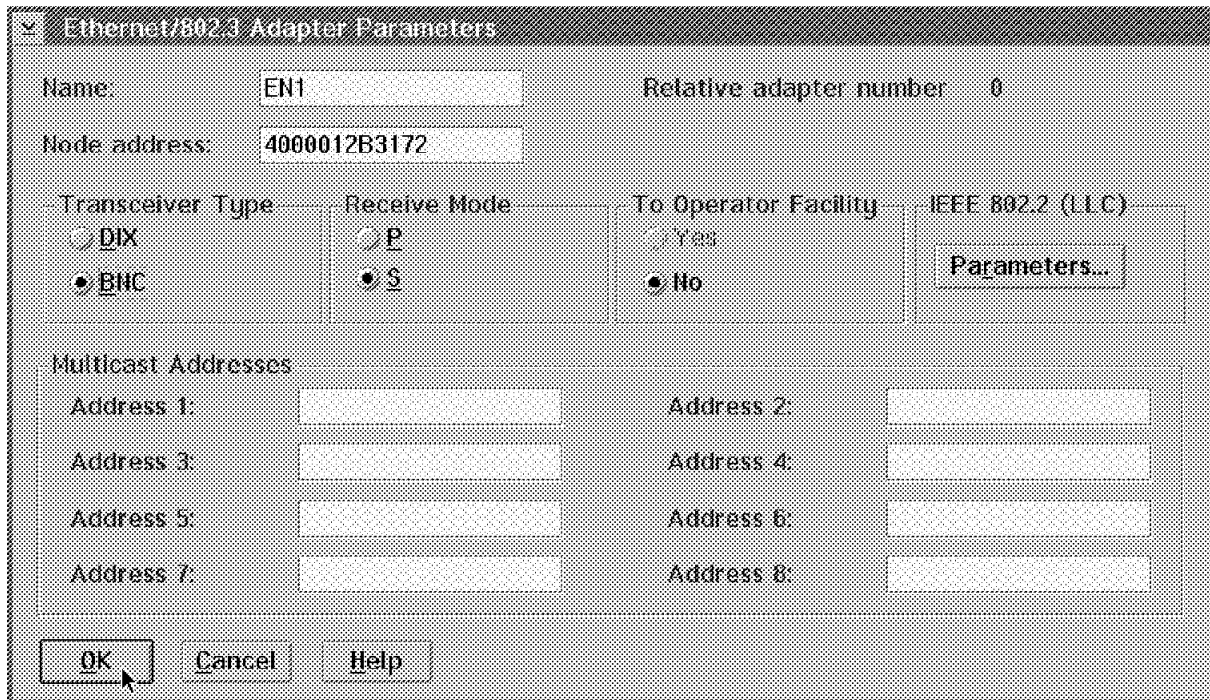
Figure 54. Ethernet/802.3 Adapter Parameters

Step 12. Type in a symbolic name for your Ethernet LAN adapter.

We specified **EN1** here.

Step 13. Type the locally administered address (LAA) of your Ethernet LAN adapter in the Node address field.

The LAA of our Ethernet LAN adapter was 4000012B3172.

Step 14. Select **BNC** from the Transceiver Type window to indicate that the transceiver on the adapter will be used.

We chose BNC because we used 10Base2-type cable for our Ethernet LAN. If you use 10BaseT (twisted pair) choose **DIX** to use an external transceiver.

Step 15. Select **S** from the Receive Mode window to indicate that only frames addressed to this adapter will be received.

Step 16. Select the appropriate option from the To Operator Facility window to indicate whether the 3172 will be managed by this workstation.

We specified No because we chose to manage the 3172 from a workstation attached to the token-ring LAN.

Note: We recommend that you accept the default 802.2 link control (LLC) parameters.

Step 17. Click on OK to save your changes and then exit.

2.9.2.2 Adding TCP/IP Function to Your 3172 Ethernet LAN Adapter

Step 1. Double-click on the **OF/2** icon.

Step 2. Click on **3172ICP**.

Step 3. Select **Configure** from the action bar.

Step 4. Click on **Profiles** from the pull-down menu.

Step 5. Select **Profiles** from the action bar.

Step 6. Click on **Open** from the pull-down menu.

Step 7. Click on **OK** on the Open Profile menu.

Step 8. Select the LANGATE function.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Change** from the pull-down menu.

   The Parallel Channel LAN Gateway Definitions panel appears.

Step 11. Click on **Add**.

   The panel shown in Figure 55 appears.
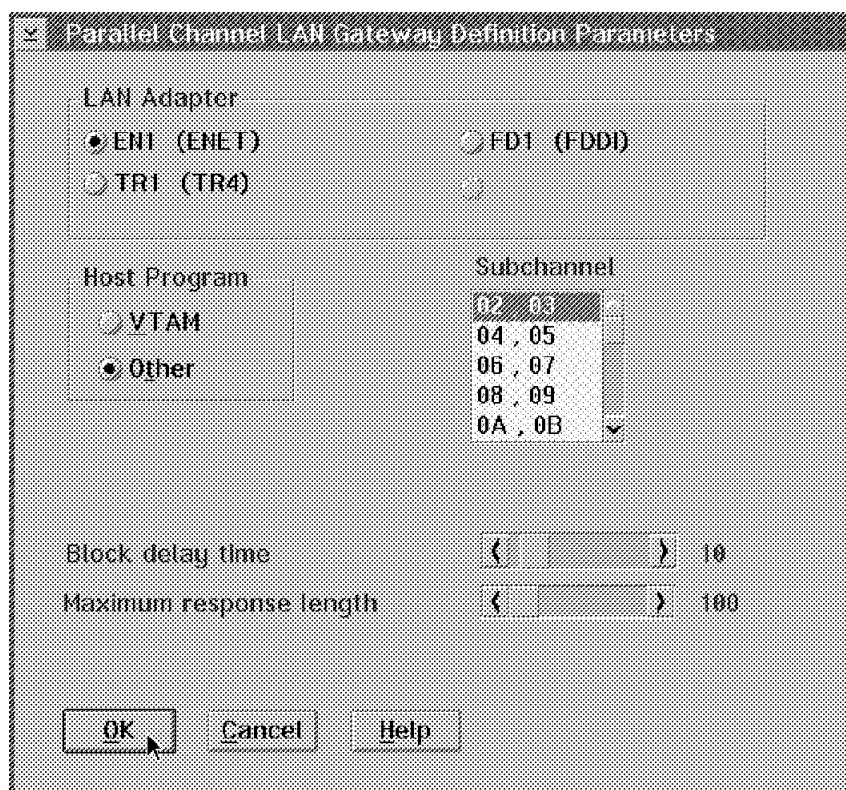
Figure 55. Adding TCP/IP Function to Ethernet LAN Adapter

Step 12. Select LAN Adapter **EN1**.

Step 13. Select Host Program **Other**.

   Other indicates a protocol other than VTAM.

Step 14. Select the subchannel pair to be used for TCP/IP traffic to and from the host. One subchannel is used to send and one to receive data.

   We used subchannels 02 and 03.

Step 15. Click on **OK** to save your changes and exit.

The Ethernet LAN adapter in your 3172 is now enabled for TCP/IP.

Note: It does not matter whether you add the TCP/IP or VTAM function to your Ethernet LAN adapter first. You can always add the other one later.

2.9.3 Workstation Definitions

To prepare your PS/2 workstation for attachment to the Ethernet LAN using the TCP/IP protocol, you must perform the following tasks:

• Configure your Ethernet LAN adapter for TCP/IP protocol using the LAPS application.

• Assign your Ethernet LAN adapter an IP address and a subnet mask using TCP/IP configuration.

• Select the TCP/IP applications to be autostarted for the connectivity verification step.

2.9.3.1 Configuring Your Ethernet LAN Adapter for TCP/IP

The Ethernet adapter installed in your PS/2 workstation can support a variety of communications protocols, such as TCP/IP, NetBIOS and IEEE 802.2. To enable the necessary protocols for your adapter, in this case TCP/IP, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step 1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step 2. Type laps to start LAPS.

Wait for a few seconds until startup has completed. You are then presented with two panels in succession.

Step 3. Click on **Configure** on the first panel.

Step 4. Click on **Continue** on the second panel.

The **Configure LAN Transports** option is selected on this panel.

Step 5. The panel shown in Figure 56 on page 99 appears.

Step 6. Select **IBM PS/2 Adapter for Ethernet Networks** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step 7. Select **IBM TCP/IP** from the Protocols window and click on **Add**.

Your adapter is now enabled for the TCP/IP protocol.

> ── **Important** ──────────────────────────────────
>
> The protocol enabled for your Ethernet adapter is now shown in the Current Configuration window preceded by the number **0** to indicate its **relative adapter number**. Take note of this number because you need it during TCP/IP configuration.

Step 8. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 9. Click on **Exit** on each of these panels to exit from LAPS.
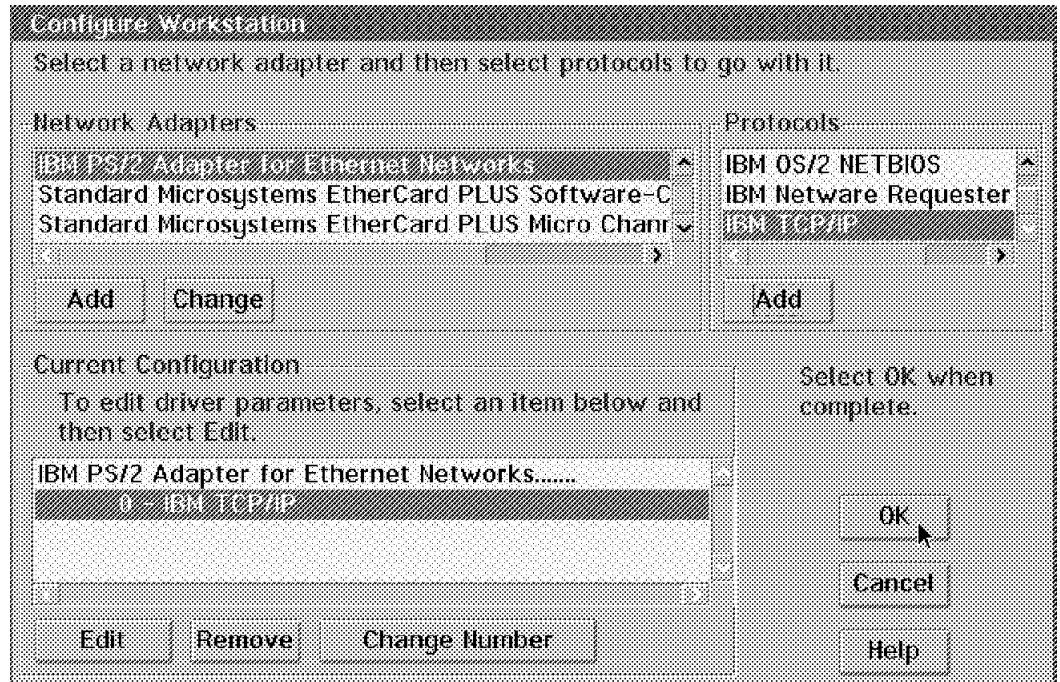
Figure 56. Configuring Your Ethernet LAN Adapter for TCP/IP

2.9.3.2 Assigning an IP Address to Your Ethernet Adapter

To enable your workstation to communicate with other stations over the Ethernet LAN using the TCP/IP protocol, you must assign an IP address to the Ethernet LAN adapter. Use the following procedure to perform this task:

Step 1. If TCP/IP has not been started on your workstation already, go to an OS/2 prompt, type tcpstart and press Enter to start it now.

Wait until TCPIP/IP startup has completed.

Step 2. At an OS/2 prompt, access the drive on which IBM TCP/IP Version 2.0 for OS/2 is installed and type tcpipcfg to start the TCP/IP configuration process.

Wait until the panel shown in Figure 57 on page 100 appears.
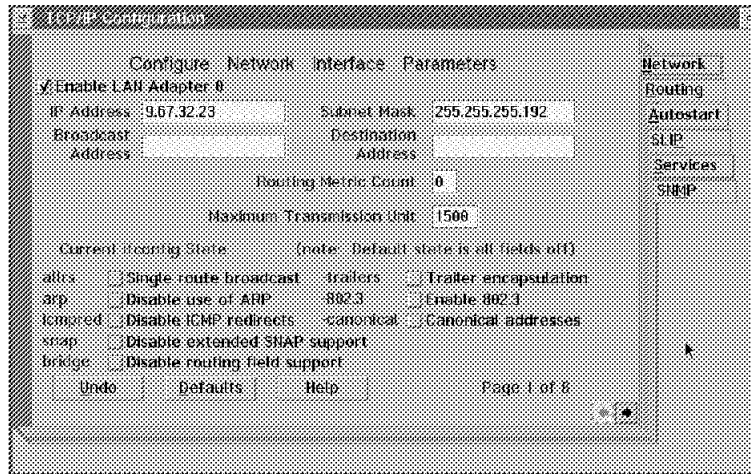
Figure 57. Assigning an IP Address to Your Ethernet Adapter. Enable your Ethernet LAN Adapter and Assign It an IP Address and Subnet Mask.

Step 3. Click on **Enable LAN Adapter 0**.

You must use the relative adapter number referred to in 2.9.3.1, "Configuring Your Ethernet LAN Adapter for TCP/IP" on page 98 to select and enable the correct Ethernet LAN adapter. In this case, it happens to be relative adapter number 0.

```
┌─ Important ──────────────────────────────────────────────┐
│                                                            │
│  If you have multiple LAN adapters installed in your       │
│  workstation use the right-pointing arrow at the bottom    │
│  right-hand corner of this panel to advance to the next    │
│  available (unused) LAN adapter and select it.             │
│                                                            │
└────────────────────────────────────────────────────────────┘
```

Step 4. Type 9.67.32.23 in the IP Address field.

The IP Address of our Ethernet LAN adapter is 9.67.32.23.

Step 5. Type 255.255.255.192 in the Subnet Mask field.

The mask of our Ethernet subnet is 255.255.255.192.

Note: Now your workstation is known in the TCP/IP network by this IP address with the given subnet mask. Consult with your network administrator to obtain your IP address and subnet mask.

2.9.3.3 Autostarting TCP/IP Applications

We intend to use the TCP/IP applications FTP and TELNET to verify our workstation-to-host connectivity. Therefore, we want to "autostart" these applications whenever TCP/IP is started. We proceed as follows:

Step 1. At the TCP/IP Configuration panel, click on **Autostart**.

The panel shown in Figure 50 on page 89 appears.

Step 2. Click on **Enable this machine to start the inetd super server**.

Step 3. Click on **Enable other users to login to this machine**.

Step 4. Click on **Enable others to access your files by using FTP**.

Step 5. Double-click on the title bar icon.

Another panel appears and prompts you to Save or Discard your changes.

Step 6. Click on **Save** to save your TCP/IP changes and exit from TCP/IP configuration.

At this point, your PS/2 workstation is ready to attach to the Ethernet LAN.

2.9.4 Verification

To verify TCP/IP connectivity between OS/2 and MVS we use PING, TELNET and FTP.

Ping from OS/2

```
OS2 C:\>ping 9.67.32.21
PING 9.67.32.21: 56 data bytes
64 bytes from 9.67.32.21: icmp_seq=0. time=32. ms
64 bytes from 9.67.32.21: icmp_seq=1. time=0. ms

----9.67.32.21 PING Statistics----
2 packets transmitted, 2 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/16/32

The external process was cancelled by a Ctrl+Break or another process.
^C
```

Ping from TSO

```
------------------------  TSO COMMAND PROCESSOR  ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.32.23

TCPPNG015I Ping V2R2.1: Pinging host 9.67.32.23.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.059 seconds. Successes so far 1
***
```

FTP from OS/2

```
OS2 C:\>ftp 9.67.32.21
Connected to 9.67.32.21.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 16:24:30 on 01/08/94
220 Connection will close if idle for more than 10 minutes.
Name (9.67.32.23): soutsos
331 Send password please.
Password:
230 SOUTSOS is logged on.
ftp> pwd
257 "'SOUTSOS.'" is working directory
ftp> quit
221 Quit command received. Goodbye.

OS2 C:\>
```

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR  ----------
 ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

 ===> ftp 9.67.32.23

 FTPALL001I MVS TCP/IP FTP V2R2.1
 FTPALL105I Connecting to 9.67.32.23, port 21
 220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
 FTPALL010I USER (identify yourself to the host):
soutsos
 FTPALL252I >>>USER soutsos
 331 Password required for soutsos.
 FTPALL228I Password:

 FTPALL252I >>>PASS ********
 230 User soutsos logged in.
 FTPALL011I Command:
pwd
 FTPALL252I >>>PWD
 257 "C::" is current directory.
 FTPALL011I Command:
quit
 FTPALL252I >>>QUIT
 221 Goodbye.
 ***
```

TELNET (PMANT) from OS/2

PMANT is a OS/2 TCP/IP implementation of the TELNET TN3270 protocol that uses Presentation Manager to display the 3270 screens. To invoke PMANT, enter:

```
OS2 C:\>pmant 9.67.32.21
```

In our scenario the TELNET default application in MVS TCP/IP is NetView Access Services:

```
                                        Hot Line: 17-6666
                                        Date . .: 01/08/94
                                        Time . .: 16:29:55
                                        Terminal: RAIAE001
      N E T V I E W
      *******   *******   *******   *********   *******   *******
     **    **  **    **  **    **   **         **    **  **    **
    **    **  **       **          **         **       **
    ********* **          **       *********  *******  ******
   **    **  **          **       **              **       *
  **    **  **    **  **    **  **    **       **    **  **    **
 **    **  ******   ******   *********  *******   *******
                                        S E R V I C E S
  NetView Access Services, Release 3.1 - Program Number 5665-365
     (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

           Enter Logon information:
              User . . . . . .         (User ID/LOGOFF)
              Password . . . .         New Password . .

              Application  . .
              Group  . . . . .
              Location . . . .
 PF 1=Help 2=Language
```

TELNET from TSO

```
 ------------------------ TSO COMMAND PROCESSOR  ------------------
 ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

 ===> telnet 9.67.32.23

 TCPTEL001I MVS TCP/IP Telnet V2R2.1
 TCPUTM110I Connecting to 9.67.32.23, port TELNET (23)
 ***
```

```
 TCPUTM118I
 TCPUTM119I Using Line Mode...
 TCPUTM120I
 TCPUTM121I Notes on using Telnet when in Line Mode:
 TCPUTM122I - To hide Password, Hit PF3 or PF15
 TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
 ***
```

```
 OS/2 Version 2.1 (Soutsos)

 Enter your password: ....

 <Soutsos>-C:\

 Telnet command: quit
```

Note: The **Telnet command** prompt is invoked by pressing PF4.

2.10 Scenario 3: TCP/IP over Fiber Distributed Data Interface

The purpose of this connectivity scenario is to describe how a FDDI
LAN-attached workstation can use the TCP/IP protocol to communicate with MVS
host applications through an IBM 3172 Interconnect Controller running ICP
Version 3 Release 2 as shown in Figure 58.
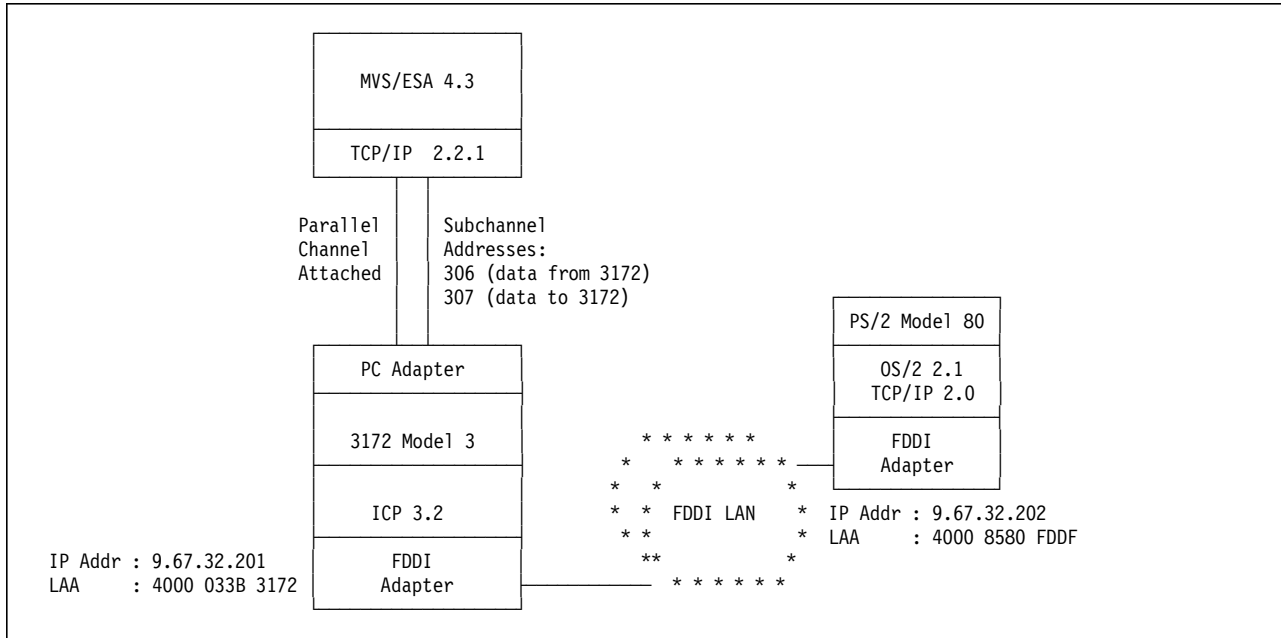
*Figure 58. TCP/IP over FDDI LAN. An FDDI LAN-attached PS/2 workstation accessing TCP/IP applications on the
MVS host via an IBM 3172 Interconnect Controller gateway.*

2.10.1 Host Definitions

IOCP Definitions

Refer to "IOCP Definitions" on page 80 for these definitions.

Operating System Definitions

Refer to "MVS/ESA Definitions" on page 81 for these definitions.

TCP/IP Definitions

TCP/IP on the host requires the following definitions for the FDDI LAN.

```
DEVICE ICPFD306 LCS 306 NETMAN                    1

LINK FD306 FDDI 0 ICPFD306                        2

TRANSLATE 9.67.32.202 FDDI 40008580FDDF FD306  3

HOME                                              4
  9.67.32.201    FD306

GATEWAY                                           5
  9.67.32.202 = FD306   DEFAULTSIZE   HOST

START CH1FD306                                    6
```

1 The DEVICE statement specifies the pair of devices (subchannels) the host uses to communicate with the 3172. In our case, inbound data to the host uses subchannel 306 and outbound data uses subchannel 307. The second subchannel is not specified explicitly on this statement.

2 The LINK statement identifies the interface as an FDDI LAN adapter attached to the host using the devices specified in the DEVICE statement.

3 The TRANSLATE statement maps the remote adapter of the LAN device (PS/2 workstation) to its physical (MAC) address to enable ARP request processing. Apparently the PS/2 FDDI adapter does not handle ARP requests.

4 The HOME section specifies the IP address assigned to the token-ring LAN adapter on the 3172.

5 The GATEWAY section specifies a direct route to our LAN-attached PS/2 client workstation using its IP address.

6 The START statement causes the 3172 token-ring adapter to insert on the LAN and activates host-to-3172 communication.

2.10.2 3172 Definitions

2.10.2.1 Defining the FDDI LAN Adapter to Your 3172

To attach the 3172 to the FDDI LAN you must install an FDDI LAN adapter in a valid 3172 slot according to the plugging chart for parallel channel adapters shown in Table 8 on page 40.

We installed the FDDI LAN adapter in slots 6 and 7 and used the Operator Facility/2 operator station to define it to ICP in the following manner:

Important

Please note that the 3172 can be attached to the FDDI LAN in **single attached station mode** or **dual attached station mode**. We installed both adapters (Base in slot 6 and Extender in slot 7) but attached to the FDDI LAN in single attached station (SAS) mode. Since we attached the 3172 in SAS mode, we did not have to install the Extender adapter in slot 7.

Step   1. Double-click on the **OF/2** icon to open it.

Step   2. Click on **3172ICP**.

Step   3. Select **Configure** from the action bar.

Step   4. Click on **Profiles** from the pull-down menu.

Step   5. Select **Profiles** from the action bar.

Step   6. Click on **Open** from the pull-down menu.

Step   7. Click on **OK** on the Open Profile menu.

The panel shown in Figure 59 on page 106 appears.
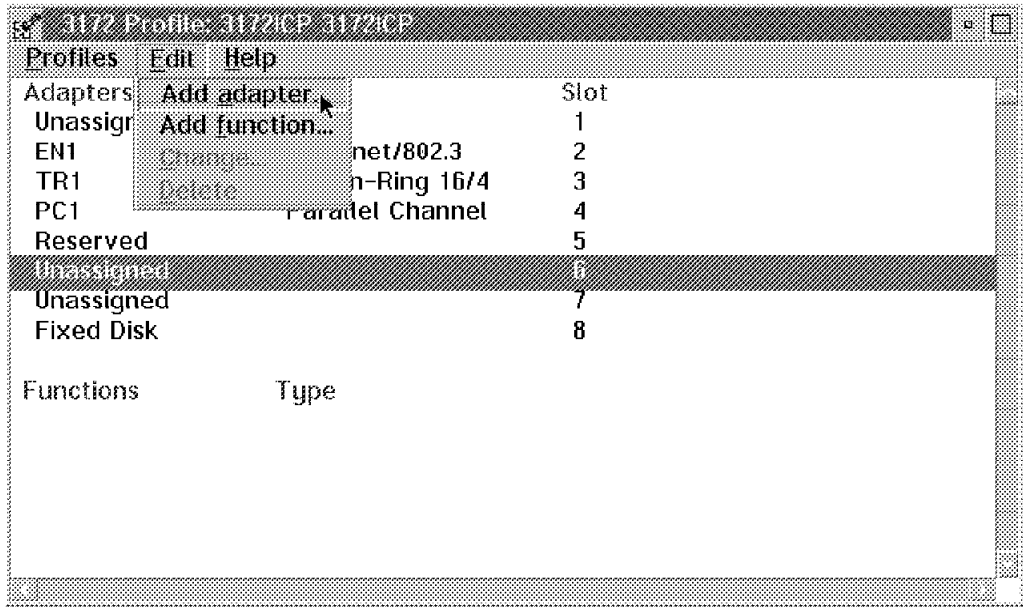
Figure 59. Adding FDDI LAN Adapter to 3172

Step 8. Select the appropriate slot for FDDI.

We installed the FDDI adapter in slots 6 and 7.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Add adapter** from the pull-down menu.

The panel shown in Figure 60 appears.
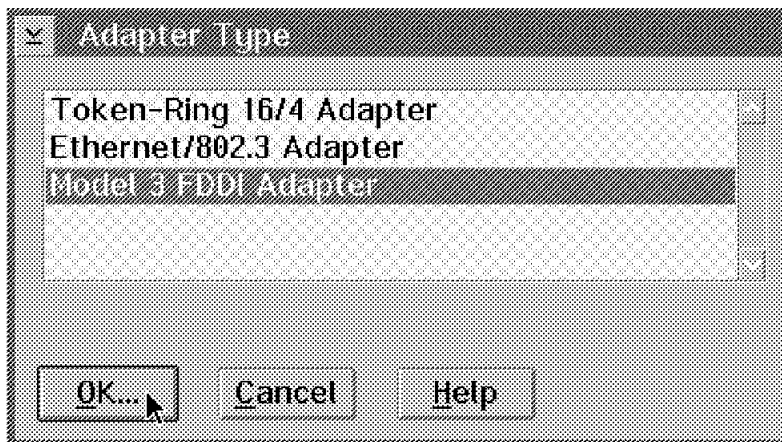
Figure 60. Selecting FDDI LAN Adapter

Step 11. Select **Model 3 FDDI Adapter** on this panel and click **OK** to indicate that we are defining an FDDI LAN adapter.

The panel shown in Figure 61 on page 107 appears.
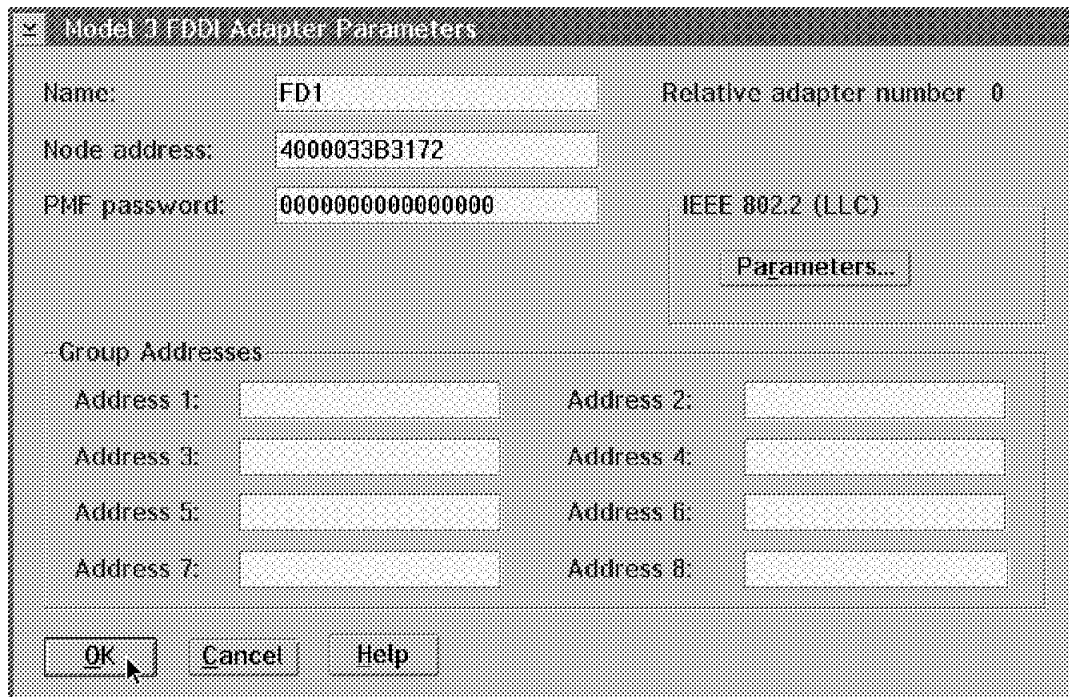
Figure 61. Model 3 FDDI Adapter Parameters

Step 12. Type in a symbolic name for your FDDI LAN adapter.

We specified **FD1** here.

Step 13. Type in the locally administered address (LAA) of your FDDI LAN adapter in the Node address field.

The LAA of our FDDI LAN adapter was 4000033B3172.

Step 14. Click on **OK** to save your FDDI LAN adapter definitions and exit.

Note: We recommend that you accept the default 802.2 link control (LLC) parameters and PMF password of 000000000000.

2.10.2.2 Adding the TCP/IP Function to the 3172 FDDI LAN Adapter

Step 1. Double-click on the **OF/2** icon.

Step 2. Click on **3172ICP**.

Step 3. Select **Configure** from the action bar.

Step 4. Click on **Profiles** from the pull-down menu.

Step 5. Select **Profiles** from the action bar.

Step 6. Click on **Open** from the pull-down menu.

Step 7. Click on **OK** on the Open Profile menu.

Step 8. Select the LANGATE function near the bottom of this panel.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Change** from the pull-down menu.

The Parallel Channel LAN Gateway Definitions panel appears.

Step 11. Click on **Add**.

The panel shown in Figure 62 on page 108 appears.
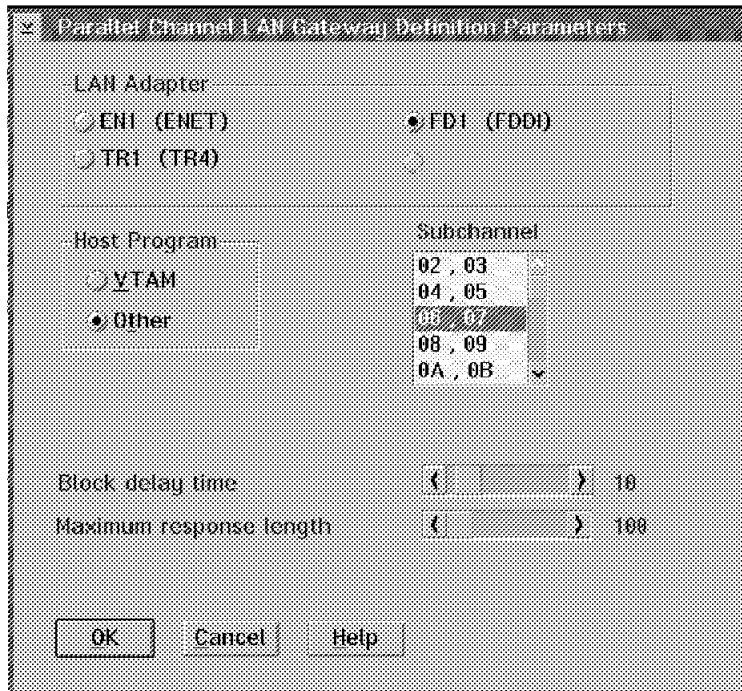
Figure 62. Adding TCP/IP Function to FDDI LAN Adapter

Step 12. Select LAN Adapter **FD1**.

Step 13. Select Host Program **Other**.

Other indicates a protocol other than VTAM.

Step 14. Select the subchannel pair to be used for TCP/IP traffic to and from the host. One subchannel is used to send and one to receive data.

We used subchannels 06 and 07.

Step 15. Click on **OK** to save your changes and exit.

The FDDI LAN adapter in your 3172 is now enabled for TCP/IP.

Notes:

1. You can add either or both host programs to your adapter.

2. You can add either host program to your adapter first.

3. You can not select both **VTAM** and **Other** at the same time.

2.10.3 Workstation Definitions

To prepare your PS/2 workstation for attachment to the FDDI LAN using the TCP/IP protocol, you must perform the following tasks:

- Configure your FDDI LAN adapter for TCP/IP protocol using the LAPS application.

- Assign your FDDI LAN adapter an IP address and a subnet mask using TCP/IP configuration.

- Select the TCP/IP applications to be autostarted for the connectivity verification step.

2.10.3.1 Configuring Your FDDI LAN Adapter for TCP/IP

The FDDI adapter installed in your PS/2 workstation can support a variety of communications protocols, such as TCP/IP, NetBIOS and IEEE 802.2. To enable the necessary protocols for your adapter, in this case TCP/IP, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step   1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step   2. Type laps to start LAPS.

Wait for a few seconds until startup has completed. You are then presented with two panels in succession.

Step   3. Click on **Configure** on the first panel.

Step   4. Click on **Continue** on the second panel.

The **Configure LAN Transports** option is selected on this panel.

Step   5. The panel shown in Figure 63 appears.
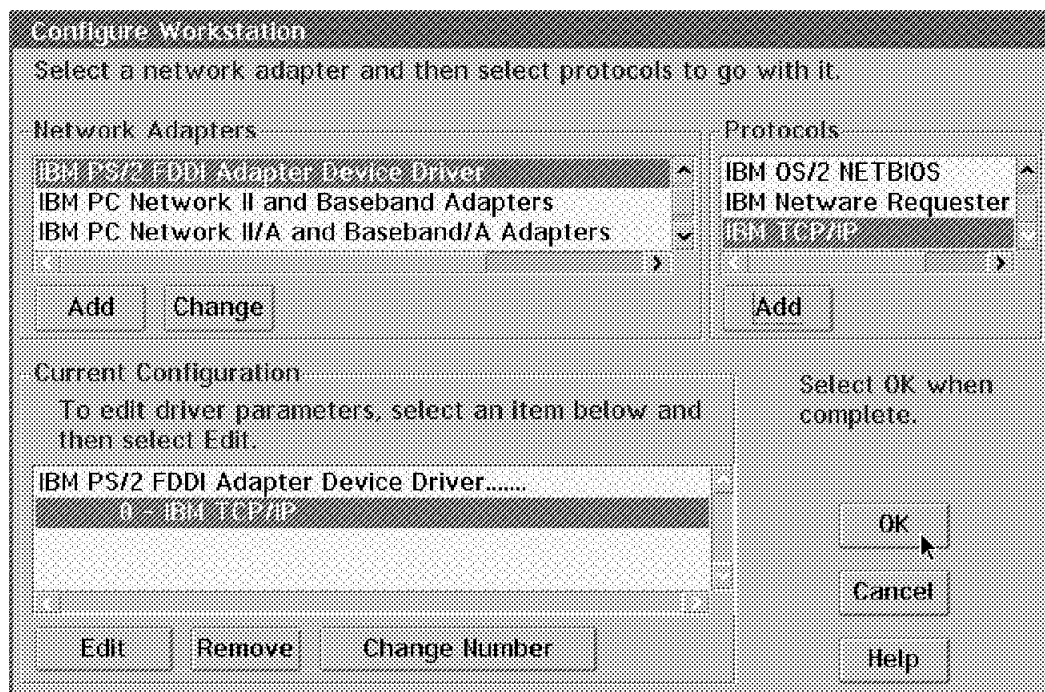
Figure 63. Configuring your FDDI LAN Adapter for TCP/IP

Step   6. Select **IBM PS/2 FDDI Adapter Device Driver** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step   7. Select **IBM TCP/IP** from the Protocols window and click on **Add**.

Your adapter is now enabled for the TCP/IP protocol.

> ┌─ **Important** ───┐
>
> The protocol enabled for your FDDI adapter is now shown in the
> Current Configuration window preceded by the number **0** to indicate
> its **relative adapter number**. Take note of this number because you
> need it during TCP/IP configuration.
>
> └───┘

Step 8. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 9. Click on **Exit** on each of these panels to exit from LAPS.

2.10.3.2 Assigning an IP Address to Your FDDI Adapter

To enable your workstation to communicate with other stations over the FDDI
LAN using the TCP/IP protocol, you must assign an IP address to the FDDI LAN
adapter. Use the following procedure to perform this task:

Step 1. If TCP/IP has not been started on your workstation already, go to an
OS/2 prompt, type `tcpstart` and press Enter to start it now.

Wait until TCPIP/IP startup has completed.

Step 2. At an OS/2 prompt, access the drive on which IBM TCP/IP Version 2.0
for OS/2 is installed and type `tcpipcfg` to start the TCP/IP configuration
process.

Wait until the panel shown in Figure 64 appears.
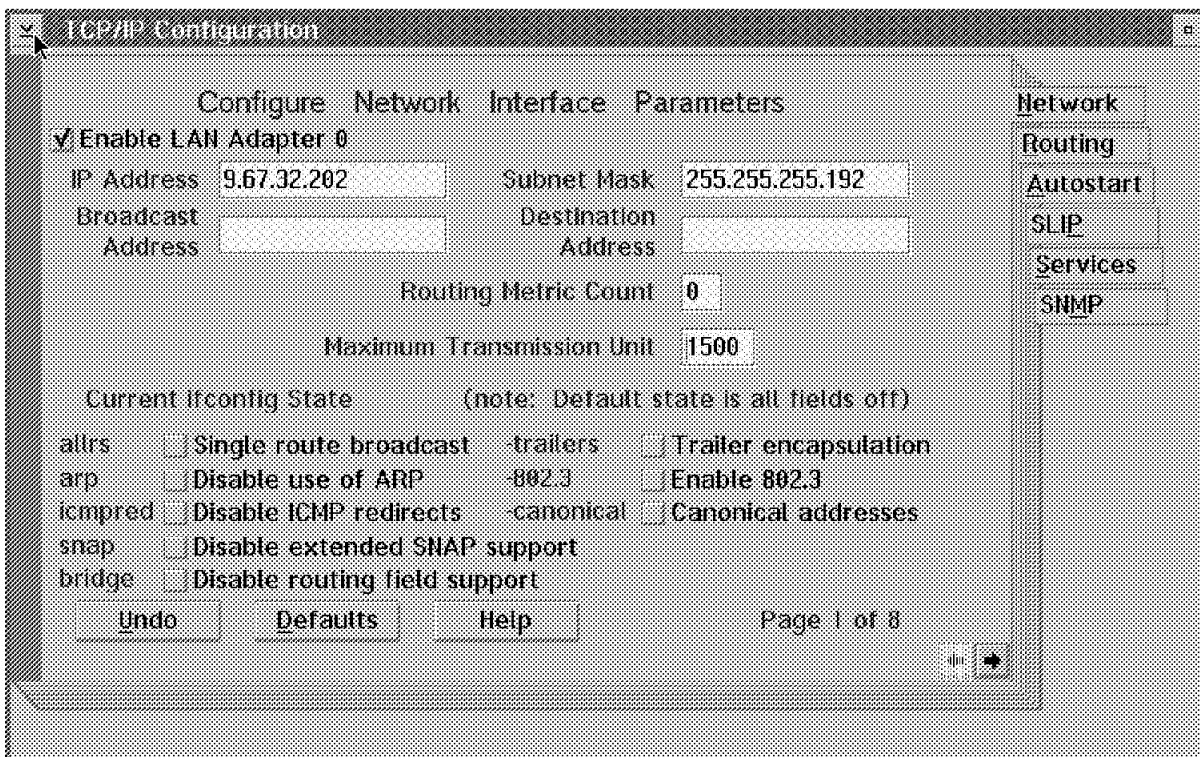
*Figure 64. Assigning an IP Address to Your FDDI Adapter. Enable your FDDI LAN adapter, and assign it an IP
address and subnet mask.*

Step 3. Click on **Enable LAN Adapter 0**.

You must use the relative adapter number referred to in 2.10.3.1, "Configuring Your FDDI LAN Adapter for TCP/IP" on page 109 to select and enable the correct FDDI LAN adapter. In this case, it happens to be relative adapter number 0.

> ┌─── **Important** ───────────────────────────────────┐
>
> If you have multiple LAN adapters installed in your workstation use the right-pointing arrow at the bottom right-hand corner of this panel to advance to the next available (unused) LAN adapter and select it.

Step   4. Type 9.67.32.202 in the IP Address field.

The IP Address of our FDDI LAN adapter is 9.67.32.202.

Step   5. Type 255.255.255.192 in the Subnet Mask field.

The mask of our FDDI subnet is 255.255.255.192.

Note: Now your workstation is known in the TCP/IP network by this IP address with the given subnet mask. Consult with your network administrator to obtain your IP address and subnet mask.

2.10.3.3 Autostarting TCP/IP Applications

We intend to use the TCP/IP applications FTP and TELNET to verify our workstation-to-host connectivity. Therefore, we want to "autostart" these applications whenever TCP/IP is started. We proceed as follows:

Step   1. At the TCP/IP Configuration panel, click on **Autostart**

The panel shown in Figure 50 on page 89 appears.

Step   2. Click on **Enable this machine to start the inetd super server**.

Step   3. Click on **Enable other users to login to this machine.**

Step   4. Click on **Enable others to access your files by using FTP.**

Step   5. Double-click on the title bar icon.

Another panel appears and prompts you to Save or Discard your changes.

Step   6. Click on **Save** to save your TCP/IP changes and exit from TCP/IP configuration.

At this point, your PS/2 workstation is ready to attach to the FDDI LAN.

2.10.4 Verification

To verify TCP/IP connectivity between OS/2 and MVS we use PING, TELNET and FTP.

Ping from OS/2

```
OS2 C:\>ping 9.67.32.201
PING 9.67.32.201: 56 data bytes
64 bytes from 9.67.32.201: icmp_seq=0. time=32. ms
64 bytes from 9.67.32.201: icmp_seq=1. time=0. ms

----9.67.32.201 PING Statistics----
2 packets transmitted, 2 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/16/32

The external process was cancelled by a Ctrl+Break or another process.
^C
```

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.32.202

TCPPNG015I Ping V2R2.1: Pinging host 9.67.32.202.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.059 seconds. Successes so far 1
***
```

FTP from OS/2

```
OS2 C:\>ftp 9.67.32.201
Connected to 9.67.32.201.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 16:24:30 on 01/08/94
220 Connection will close if idle for more than 10 minutes.
Name (9.67.32.202): soutsos
331 Send password please.
Password:
230 SOUTSOS is logged on.
ftp> pwd
257 "'SOUTSOS.'" is working directory
ftp> quit
221 Quit command received. Goodbye.

OS2 C:\>
```

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR  --------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.32.202

FTPALL001I MVS TCP/IP FTP V2R2.1
FTPALL105I Connecting to 9.67.32.202, port 21
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
FTPALL010I USER (identify yourself to the host):
soutsos
FTPALL252I >>>USER soutsos
331 Password required for soutsos.
FTPALL228I Password:

FTPALL252I >>>PASS ********
230 User soutsos logged in.
FTPALL011I Command:
pwd
FTPALL252I >>>PWD
257 "C::" is current directory.
FTPALL011I Command:
quit
FTPALL252I >>>QUIT
221 Goodbye.
***
```

TELNET (PMANT) from OS/2

PMANT is a OS/2 TCP/IP implementation of the TELNET TN3270 protocol that
uses Presentation Manager to display the 3270 screens. To invoke PMANT,
enter:

```
OS2 C:\>pmant 9.67.32.201
```

In our scenario the TELNET default application in MVS TCP/IP is NetView Access Services:

```
                                              Hot Line: 17-6666
                                              Date . .: 01/08/94
                                              Time . .: 16:29:55
                                              Terminal: RAIAE001
      N E T V I E W
      *******    *******    *******   *********   *******    *******
    **      **  **    **   **    **         **    **     **  **     **
   **      **  **           **        **         **        **
   *********  **           **        *********   *******    ******
  **      **  **           **        **                **         *
 **      **  **    **  **    **   **        **     **  **     **
**      **  ******    ******   *********   *******    *******
                                              S E R V I C E S
  NetView Access Services, Release 3.1 - Program Number 5665-365
     (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

          Enter Logon information:
            User . . . . . .          (User ID/LOGOFF)
            Password . . . .          New Password . .

            Application  . .
            Group  . . . . .
            Location . . . .
PF 1=Help 2=Language
```

TELNET from TSO

```
  ------------------------ TSO COMMAND PROCESSOR  ------------------
  ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

  ===> telnet 9.67.32.202

  TCPTEL001I MVS TCP/IP Telnet V2R2.1
  TCPUTM110I Connecting to 9.67.32.202, port TELNET (23)
  ***
```

```
  TCPUTM118I
  TCPUTM119I Using Line Mode...
  TCPUTM120I
  TCPUTM121I Notes on using Telnet when in Line Mode:
  TCPUTM122I - To hide Password, Hit PF3 or PF15
  TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
  ***
```

```
  OS/2 Version 2.1 (Soutsos)

  Enter your password: ....

  <Soutsos>-C:\

  Telnet command: quit
```

Note: The **Telnet command** prompt is invoked by pressing PF4.

2.10.5 Hints and Tips

When configuring this scenario we encountered a problem pinging the MVS host from the PS/2 workstation and vice versa. When we pinged from the workstation the response was **100% packet loss**. When we pinged from the MVS host, the response was a **time out**.

We discovered that the problem was caused by the inability of the 3172 FDDI LAN adapter to handle ARP requests from the PS/2 workstation (TCP/IP client). To address this problem, code the **TRANSLATE** statement in the TCP/IP profile on the host in the same section as and immediately following the DEVICE and LINK statements for the 3172 FDDI LAN interface.

The TRANSLATE statement correlates the IP and physical address of the LAN device (PS/2 workstation) to TCP/IP on the host to enable it to reply to TCP/IP client ARP requests. Refer to Chapter 4 of the *IBM 3172 Interconnect Controller Interconnect Controller Program Version 3.2 User's Guide* for the format of this statement.

2.11 Scenario 4: SNA over Token-Ring

The purpose of this connectivity scenario is to describe how a token-ring LAN-attached workstation can use the SNA LU2 protocol to establish a TSO session with an MVS host through an IBM 3172 Interconnect Controller running ICP Version 3 Release 2 as shown in Figure 65.
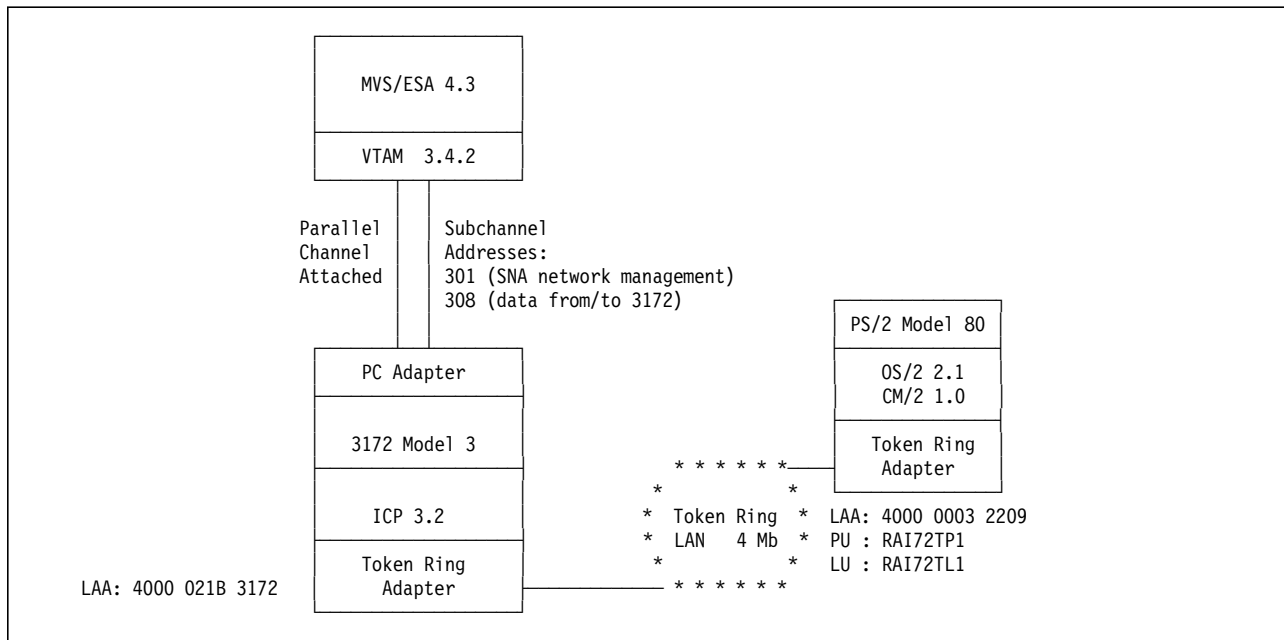
Figure 65. SNA over Token-Ring LAN. A token-ring LAN-attached PS/2 workstation establishing a TSO session with the MVS host via an IBM 3172 Interconnect Controller gateway.

2.11.1 Host Definitions

IOCP Definitions

Refer to "IOCP Definitions" on page 80 for these definitions.

Operating System Definitions

Refer to "MVS/ESA Definitions" on page 81 for these definitions.

VTAM Definitions

An XCA major node must be coded for 3172 SNA Management Services and for the token-ring LAN adapter. Additionally, a switched major node must be coded for the 3172 DSPU and for the token-ring LAN and its DSPUs.

The XCA major node definitions for 3172 SNA Management Services are shown below.

```
    ************************************************************************
    **   3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR 3172 NETWORK MANAGEMENT **
    ************************************************************************
    **
    RAI72    VBUILD TYPE=XCA         XCA FOR 3172 NETWORK MANAGEMENT
    **
    RAI72P   PORT  CUADDR=301,                                             X
                   MEDIUM=BOXMGR
    **
    RAI72G   GROUP
    **
    RAI72L   LINE
    **
    RAI72P   PU
```

The XCA major node definitions for the 3172 token-ring LAN adapter are shown below.

```
    ************************************************************************
    **   3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR TOKEN RING            **
    ************************************************************************
    **
    RAITR    VBUILD TYPE=XCA         XCA FOR 3172 TOKEN RING LAN
    **
    RAITRP   PORT  ADAPNO=0,                                              X
                   CUADDR=308,                                            X
                   MEDIUM=RING,                                           X
                   SAPADDR=4,                                             X
                   TIMER=60
    **
    RAITRG   GROUP DIAL=YES,                                              X
                   ANSWER=ON,                                             X
                   AUTOGEN=(245,L,P),            1                        X
                   CALL=INOUT,                                            X
                   ISTATUS=ACTIVE
```

1   The AUTOGEN parameter is supported by VTAM 3.4.1 or later releases. A 3172 token-ring LAN can support a maximum of 255 PUs, but it is reduced to 245 PUs when an operator station is attached to the same LAN.

The switched major node definitions for the 3172 PU are shown below.

```
***********************************************************************
**  3172 MODEL 3 (ICP) - 3172 SWITCHED MAJOR NODE FOR SSCP-PU SESSION*
***********************************************************************
**
RAI72S    VBUILD MAXGRP=1,                                           X
                 MAXNO=1,                                            X
                 TYPE=SWNET
**
RAI72PU   PU     ADDR=01,                 3172 PU                    X
                 IDBLK=074,               1                          X
                 IDNUM=00020,             2                          X
                 MAXDATA=265,             3                          X
                 MAXOUT=2,                4                          X
                 MAXPATH=1                5
**
RAI72P1   PATH   CALL=INOUT,                                         X
                 DIALNO=9904000000000000, 6                          X
                 GID=1,                                              X
                 GRPNM=RAI72G,                                       X
                 PID=1
```

1　　The IDBLK must be specified as **074** for the 3172.

2　　The IDNUM value **must match** the **VTAM IDNUM** value specified in the parallel channel adapter configuration as shown in Figure 13 on page 47.

3　　The MAXDATA parameter has no meaning for the 3172. VTAM calculates the MAXDATA send size based on information received from the 3172 and then readjusts this value based on different criteria, such as LAN type, routing considerations, and so on.

4　　MAXOUT on PU macro has no meaning for a 3172.

5　　If the switched PU is to be dialed from the host, you need a PATH macro. MAXPATH is used by VTAM to determine how much storage to reserve for path control blocks. If you do not code a path, then this parameter is not required.

6　　If the switched PU is to be dialed from the host, then you must code the DIALNO parameter.

Note: One thing to remember is that the PU macro in the switched major node defines the characteristics of the PU and the PATH statement defines how it is connected to the host. You may code multiple path statements for the PU. So the actual physical path to the PU may change depending on the path that is chosen. Along with that, some of the parameters that are coded on the PU macro may become useful. For example, MAXOUT and MAXDATA, when the connection is SDLC switched over an NCP.

The switched major node definitions for the single token-ring LAN-attached PS/2 workstation are shown below.

```
 ************************************************************************
 ** 3172 MODEL 3 (ICP) - TKR LAN SWITCHED MAJOR NODE              **
 ************************************************************************
 **
 RAI72TS  VBUILD MAXGRP=1,                                               X
                 MAXNO=1,                                                X
                 TYPE=SWNET
 **
 RAI72TP1 PU    ADDR=01,                                                 X
                DLOGMOD=M2SDLCNQ,                                        X
                IDBLK=05D,                                               X
                IDNUM=32209,                                             X
                ISTATUS=ACTIVE,                                          X
                LOGAPPL=RAIAT,                                           X
                MAXDATA=2057,                                            X
                MAXOUT=2,                                                X
                MAXPATH=1,                                               X
                MODETAB=AMODETAB,                                        X
                PUTYPE=2,                                                X
                USSTAB=US327X
 **
 RAI72TH1 PATH  CALL=INOUT,                                              X
                DIALNO=1104400000032209,                                 X
                GID=1,                                                   X
                GRPNM=RAI72G,                                            X
                PID=1
 **
 RAI72TL1 LU    LOCADDR=2            DEPENDENT LU FOR LU2 SESSION
 **
 RAI72TL2 LU    LOCADDR=0,        1  INDEPENDENT LU FOR LU6.2 SESSION  X
                DLOGMOD=DSIL6MOD
```

1 This LU definition is not necessary but we included it as a sample definition if an LU 6.2 session is to be established through the 3172.

2.11.2 3172 Definitions

2.11.2.1 Defining the Token-Ring LAN Adapter to Your 3172
The task of defining the token-ring LAN adapter to the 3172 has been described in 2.8.2.1, "Defining the token-ring LAN Adapter to Your 3172" on page 82

2.11.2.2 Adding VTAM Function to Your 3172 Token-Ring LAN Adapter
Currently the 3172 token-ring LAN adapter supports only TCP/IP. Now we must enable it for VTAM traffic also. This task is known as **adding function** to the adapter and it is performed at the operator station using the following procedure:

Step   1. Double-click on the **OF/2** icon.

Step   2. Click on **3172ICP**.

Step   3. Click on **Configure** from the action bar.

Step   4. Select **Profiles** from the pull-down menu.

Step   5. Select **Profiles** from the action bar.

Step   6. Select **Open** from the pull-down menu.

Step   7. Click on **OK** on the Open Profile menu.

The panel shown in Figure 66 on page 119 appears.
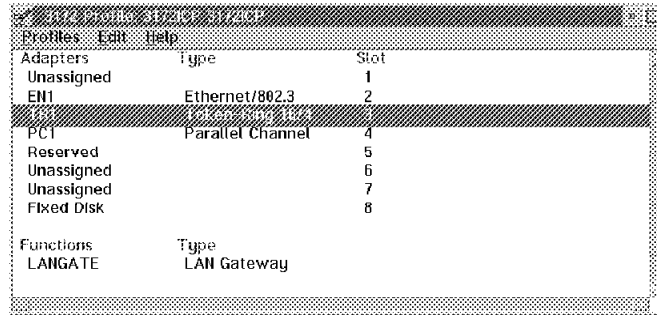
Figure 66. Adding VTAM function to a Token-Ring LAN Adapter

Step 8. Select **LANGATE** from the Functions section.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Change** from the pull-down menu.

> The Parallel Channel LAN Gateway Definitions panel appears.

Step 11. Click on **Add**.

> The Parallel Channel LAN Gateway Definition Parameters panel appears.

Step 12. Select **TR1** from the LAN Adapter box.

Step 13. Select **VTAM** from the Host Program box.

Step 14. Select the subchannel from the Subchannel window that the 3172 will use to send/receive VTAM traffic to/from the host.

> We specified subchannel **08**.

Step 15. Click on **OK** to save these changes and return to the Parallel Channel LAN Gateway Definitions panel again.

Step 16. Click on **OK** to save these changes and return to 3172 Profile panel.

Step 17. Select **Profiles** from the action bar and click on Exit.

> You are prompted if you want to save your changes.

Note: It does not matter whether you add the TCP/IP or VTAM function to your token-ring LAN adapter first. You can always add the other one later.

2.11.3 Workstation Definitions

To prepare your PS/2 workstation for attachment to the token-ring LAN using the SNA LU2 protocol, you must perform the following tasks:

• Configure your token-ring LAN adapter for SNA (802.2) protocol using the LAPS application.

• Define your PS/2 workstation to CM/2 by specifying a CPNAME, IDBLK and IDNUM.

• Define your LAN gateway (3172 Model 3) to CM/2 by specifying its physical (MAC) address.

2.11.3.1 Configuring Your Token-Ring LAN Adapter for SNA

To enable the SNA LU2 protocol for your token-ring adapter, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step 1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step 2. Type `laps` to start LAPS.

Wait for a few seconds until startup has completed. You will be presented with two panels in succession.

Step 3. Click on **Configure** on the first panel.

Step 4. Click on **Continue** on the second panel.

The **Configure LAN Transports** option is selected on this panel.

Step 5. The panel shown in Figure 67 on page 121 appears.

Step 6. Select **IBM Token-Ring Network Adapters** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step 7. Select **IBM IEEE 802.2** from the Protocols window and click on **Add**.

Your adapter is now enabled for the IEEE 802.2 protocol which includes all SNA protocols.

Step 8. Select **IBM OS/2 NETBIOS** from the Protocols window and click on **Add**.

Your adapter is now enabled for the NetBIOS protocol. This protocol is *not* required but you might want to select it in case you decide later on to operate the 3172 from this workstation using OF/2. It is optional.

> **Important**
>
> The two protocols enabled for your token-ring adapter are now shown in the Current Configuration window preceded by the number **0** to indicate the **relative adapter number**. Take note of this number because you need it during TCP/IP configuration.

Step 9. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 10. Click on **Exit** on each of these panels to exit from LAPS.
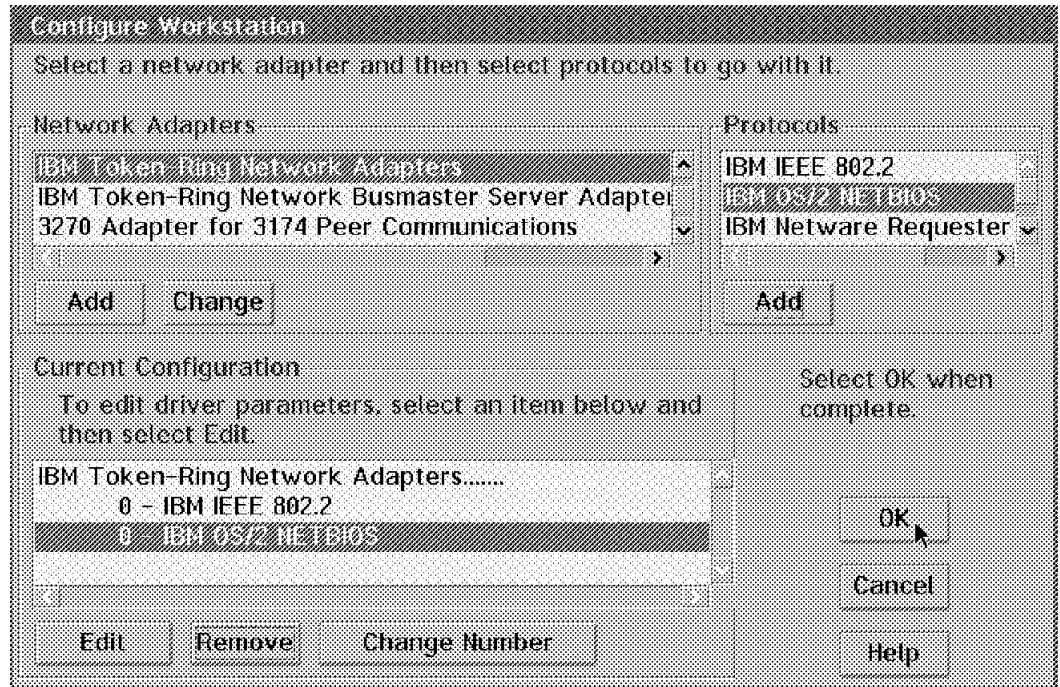
Figure 67. Configuring Your Token-Ring LAN Adapter for SNA

2.11.3.2 Defining Your PS/2 Workstation and LAN Gateway to CM/2

Use this procedure to define your PS/2 workstation and LAN gateway to Communications Manager/2:

Step 1. At an OS/2 prompt, type cmsetup and press Enter.

Step 2. Click on **OK** on the CMSETUP panel.

Step 3. Click on **Setup** on the Communications Manager Setup panel.

Step 4. Select the proper configuration on the Open Configuration panel and click on **OK**.

The panel shown in Figure 68 on page 122 appears.
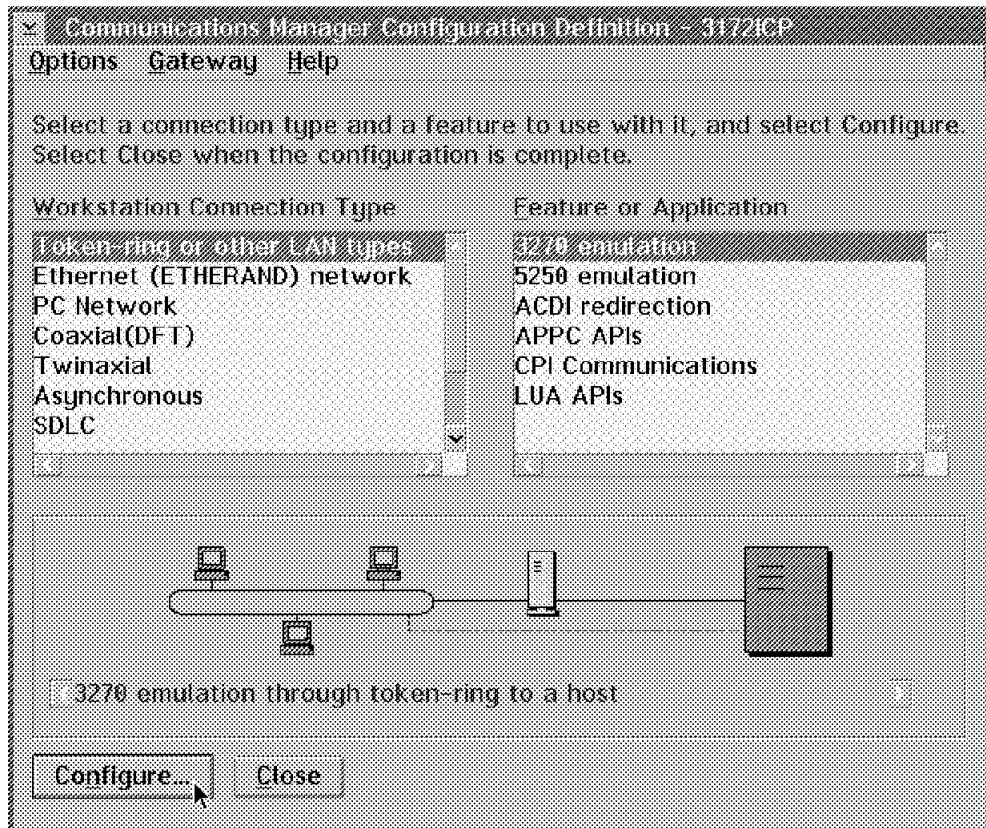
Figure 68. Selecting Token-Ring LAN and 3270 Emulation. In Communications Manager/2 define a token-ring LAN connection using 3270 emulation.

Step 5. Select **Token-Ring or other LAN types** and **3270 emulation** and click on **Configure**.

The panel shown in Figure 69 on page 123 appears.

Step 6. Type the network ID of your workstation in the **Network ID** field.

We specified USIBMRA.

Step 7. Type the CPNAME of your workstation in the **Local node name** field.

We specified WRT32209.

Step 8. Type the IDBLK and IDNUM of your workstation in the **Local node ID** field.

We specified 05D and 32209.

Step 9. Type the physical (MAC) address of the 3172 token-ring LAN adapter in the **LAN destination address** field.

We specified 4000021B3172.
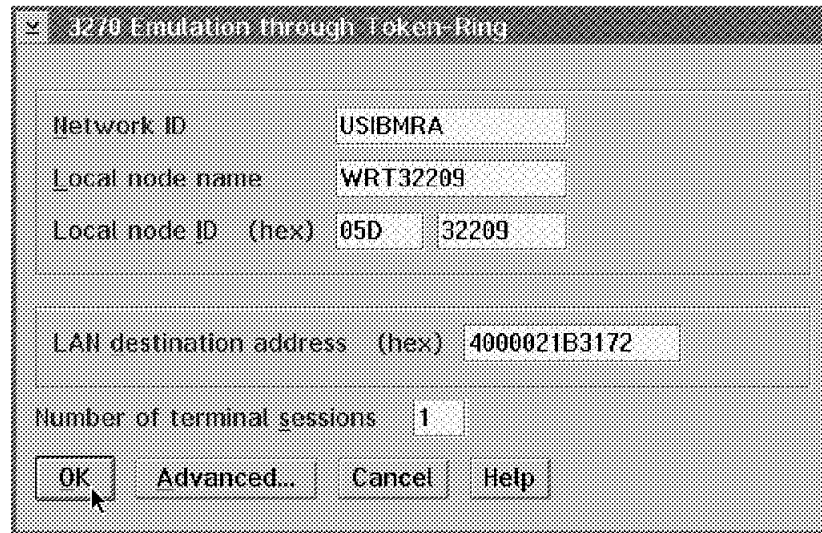
Figure 69. Defining Your PS/2 Workstation and LAN Gateway in CM/2. In Communications Manager/2 define your PS/2 workstation and LAN gateway.

2.11.4 Verification

To verify VTAM connectivity using 3270 emulation (SNA LU2) we establish a TSO session from the PS/2 workstation to the MVS host. To establish this session, the following tasks must be completed:

- Activate VTAM major nodes on MVS host
- Initiate TSO session using Communications Manager/2

Activate VTAM Major Nodes on the MVS Host

At the MVS system console, enter the following commands in the sequence shown to activate the necessary VTAM major nodes. Below each command you see the VTAM response.

```
/V NET,ID=RAI72X,ACT        1
IST097I VARY ACCEPTED
IST093I RAI72X ACTIVE

/V NET,ID=RAI72S,ACT        2
IST097I VARY ACCEPTED
IST093I RAI72PU ACTIVE
IST093I RAI72S ACTIVE

/V NET,ID=RAI72TRX,ACT      3
IST097I VARY ACCEPTED
IST093I RAI72TRX ACTIVE

/V NET,ID=RAI72TRS,ACT      4
IST097I VARY ACCEPTED
IST093I RAI72TP1 ACTIVE
IST093I RAI72TRS ACTIVE
IST663I AM RESUME REQUEST FAILED, SENSE=08010000 993
IST664I REAL  OLU=USIBMRA.RAI72TL2    REAL  DLU=USIBMRA.RAIAT
IST889I SID = F86FE1648B5A4E26
IST890I AUTOLOGON SESSION SETUP FAILED
IST314I END
```

1 This command activates the 3172 parallel channel adapter.

2 This command activates the 3172 SNA management services.

3 This command activates the 3172 token-ring LAN adapter.

4 This command activates the 3172 token-ring LAN devices (PUs). VTAM tries to dial out to the PU and establish a session with its LU because we specified **CALL=INOUT** on the PATH macro. You can specify **CALL=IN** if you want to restrict session establishment to the workstation.

Initiate TSO Session using Communications Manager/2

Go to the OS/2 Desktop and use the following procedure to initiate the TSO session:

Step 1. Double-click on **Communications Manager/2** icon.

Step 2. Double-click on **Manage 3270/5250 Sessions** icon.

Step 3. Double-click on **3270/5250 Session Management** icon.

Step 4. Select the session on this panel and click on **Session** from the action bar.

Step 5. Select **Start** option from the pull-down menu as shown in Figure 70.
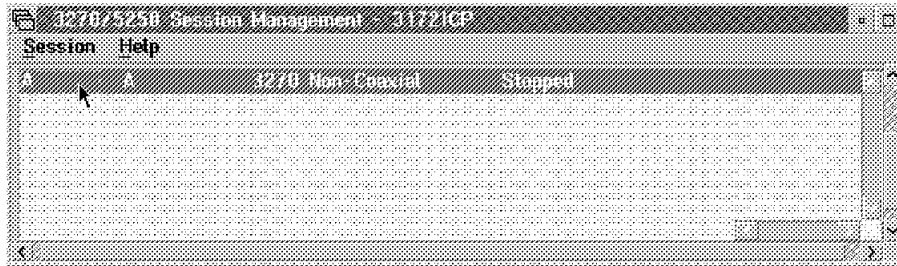
Figure 70. Scenario 4 Verification. Using Communications Manager/2 to establish a 3270 emulation (TSO) session on the MVS host.

A 3270 emulation session is established and the TSO logon panel appears on your screen.

2.12 Scenario 5: SNA over Ethernet

The purpose of this connectivity scenario is to describe how an Ethernet LAN-attached workstation can use the SNA LU2 protocol to establish a TSO session with an MVS host through an IBM 3172 Interconnect Controller running ICP Version 3 Release 2 as shown in Figure 71 on page 125.

```
            ┌─────────────────┐
            │   MVS/ESA 4.3   │
            ├─────────────────┤
            │   VTAM  3.4.2   │
            └─────────────────┘

   Parallel  │  │ Subchannel
   Channel   │  │ Addresses:
   Attached  │  │ 301 (SNA network management)
             │  │ 309 (data from/to 3172)
                                                    ┌─────────────────┐
                                                    │  PS/2 Model 65  │
                             Ethernet LAN           ├─────────────────┤
            ┌─────────────────┐                     │    OS/2 2.1     │
            │   PC Adapter    │                     │    CM/2 1.0     │
            ├─────────────────┤                     ├─────────────────┤
            │   3172 Model 3  │                     │    Ethernet     │
            ├─────────────────┤─────────────────────│    Adapter      │
            │     ICP 3.2     │                     └─────────────────┘
            ├─────────────────┤                  LAA: 4000 014A 8565
            │    Ethernet     │                  PU : RAI72EP1
 LAA : 4000 │    Adapter      │                  LU : RAI72EL1
 012B 3172  └─────────────────┘
```
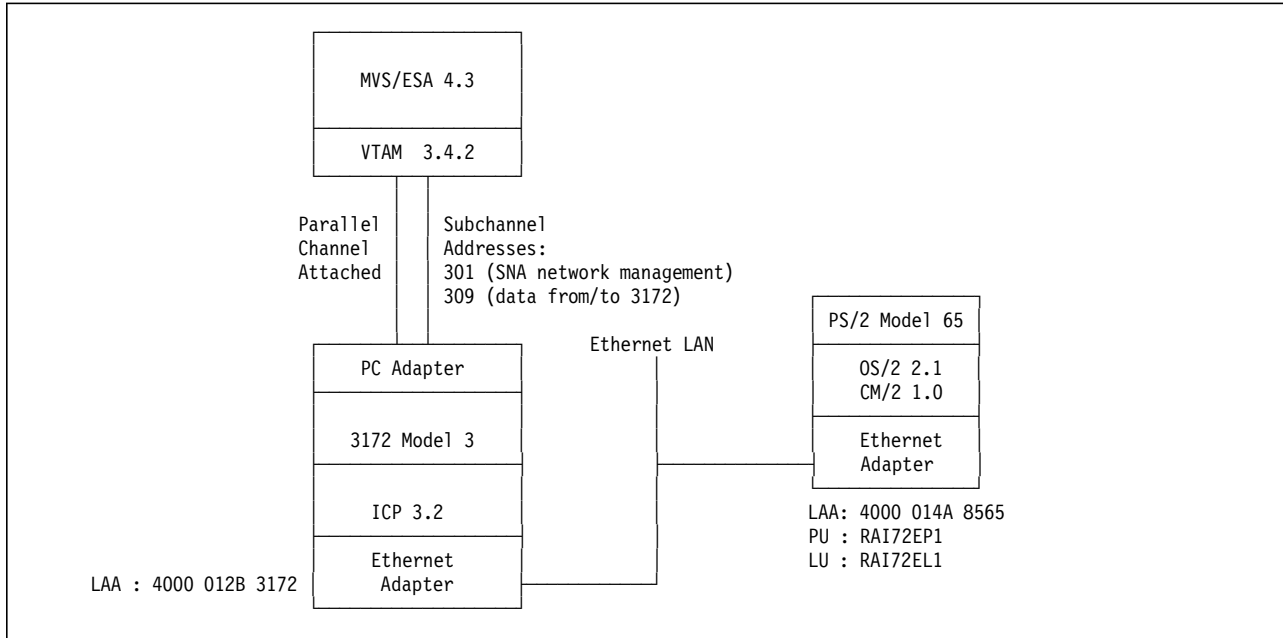
Figure 71. SNA over Ethernet LAN. An Ethernet LAN-attached PS/2 workstation establishing a TSO session with the MVS host via an IBM 3172 Interconnect Controller gateway.

2.12.1 Host Definitions

IOCP Definitions

Refer to "IOCP Definitions" on page 80 for these definitions.

Operating System Definitions

Refer to "MVS/ESA Definitions" on page 81 for these definitions.

VTAM Definitions

An XCA major node must be coded for 3172 SNA Management Services and for the Ethernet LAN adapter. Additionally, a switched major node must be coded for the 3172 DSPU and for the Ethernet LAN and its DSPUs.

The XCA major node definitions for 3172 SNA Management Services are shown below.

```
    ***********************************************************************
    ** 3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR 3172 NETWORK MANAGEMENT **
    ***********************************************************************
    **
    RAI72    VBUILD TYPE=XCA        XCA FOR 3172 NETWORK MANAGEMENT
    **
    RAI72P   PORT  CUADDR=301,                                          X
                   MEDIUM=BOXMGR
    **
    RAI72G   GROUP
    **
    RAI72L   LINE
    **
    RAI72P   PU
```

The XCA major node definitions for the 3172 Ethernet LAN adapter are shown below.

```
**************************************************************************
**   3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR ETHERNET LAN          **
**************************************************************************
**
RAIEN     VBUILD TYPE=XCA          XCA FOR 3172 ETHERNET LAN
**
RAIENP    PORT ADAPNO=0,                                              X
                 CUADDR=309,                                          X
                 MEDIUM=CSMACD,                                       X
                 SAPADDR=4,                                           X
                 TIMER=60
**
RAIENG    GROUP DIAL=YES,                                             X
                 ANSWER=ON,                                           X
                 AUTOGEN=(255,L,P),          ■1                       X
                 CALL=INOUT,                                          X
                 ISTATUS=ACTIVE
```

■1   The AUTOGEN parameter is supported by VTAM 3.4.1 or later releases. A
     3172 Ethernet LAN can support a maximum of 255 PUs.

The switched major node definitions for the 3172 PU are shown below.

```
**************************************************************************
**   3172 MODEL 3 (ICP) - 3172 SWITCHED MAJOR NODE               **
**************************************************************************
**
RAI72S    VBUILD MAXGRP=1,                                            X
                 MAXNO=1,                                             X
                 TYPE=SWNET
**
RAI72PU   PU   ADDR=01,          3172 DSPU                            X
                 IDBLK=074,                                           X
                 IDNUM=00020,              ■1                         X
                 MAXDATA=265,              ■2                         X
                 MAXOUT=2,                 ■3                         X
                 MAXPATH=1                 ■4
**
RAI72P1   PATH CALL=INOUT,                                            X
                 DIALNO=9904000000000000,  ■5                         X
                 GID=1,                                               X
                 GRPNM=RAI72G,                                        X
                 PID=1
```

■1   The IDNUM value **must match** the **VTAM IDNUM** value specified in the
     parallel channel adapter configuration as shown in Figure 13 on page 47.

■2   The MAXDATA parameter has no meaning for the 3172. VTAM calculates
     the MAXDATA send size based on information received from the 3172 and
     then readjusts this value based on different criteria, such as LAN type,
     routing considerations, and so on.

■3   MAXOUT on PU macro has no meaning for a 3172.

■4   If the switched PU is to be dialed from the host, you need a PATH macro.
     MAXPATH is used by VTAM to determine how much storage to reserve for
     path control blocks. If you do not code a path, then this parameter is not
     required.

5 If the switched PU is to be dialed from the host, then you must code the DIALNO parameter.

Note: One thing to remember is that the PU macro in the switched major node defines the characteristics of the PU and the PATH statement defines how it is connected to the host. You may code multiple path statements for the PU. So the actual physical path to the PU may change depending on the path that is chosen. Along with that, some of the parameters that are coded on the PU macro may become useful. For example, MAXOUT and MAXDATA, when the connection is SDLC switched over an NCP.

The switched major node definitions for the single Ethernet LAN-attached PS/2 workstation are shown below.

```
**********************************************************************
** 3172 MODEL 3 (ICP) - ETH LAN SWITCHED MAJOR NODE           **
**********************************************************************
**
RAI72ES  VBUILD MAXGRP=1,                                         X
                MAXNO=1,                                          X
                TYPE=SWNET
**
RAI72EP1 PU    ADDR=01,                                           X
               DLOGMOD=M2SDLCNQ,                                  X
               IDBLK=05D,                                         X
               IDNUM=A8565,                                       X
               LOGAPPL=RAIAT,                                     X
               MAXDATA=2057,                                      X
               MAXOUT=2,                                          X
               MAXPATH=1,                                         X
               MODETAB=AMODETAB,                                  X
               PUTYPE=2,                                          X
               USSTAB=US327X
**
RAI72EH1 PATH  CALL=INOUT,                                        X
               DIALNO=11044000014A8565,                           X
               GID=1,                                             X
               GRPNM=RAI72G,                                      X
               PID=1
**
RAI72EL1 LU    LOCADDR=2           DEPENDENT LU FOR LU2 SESSION
**
RAI72EL2 LU    LOCADDR=0,      1   INDEPENDENT LU FOR LU6.2 SESSION  X
               DLOGMOD=DSIL6MOD
```

1 This LU definition is not necessary but we included it as a sample definition if an LU6.2 session is to be established through the 3172.

2.12.2 3172 Definitions

2.12.2.1 Defining the Ethernet LAN Adapter to Your 3172
The task of defining the Ethernet LAN adapter to the 3172 has been described in 2.9.2.1, "Defining the Ethernet LAN Adapter to Your 3172" on page 94

2.12.2.2 Adding VTAM Function to Your 3172 Ethernet LAN Adapter
Currently the 3172 Ethernet LAN adapter supports only TCP/IP. Now we must enable it for VTAM traffic also. This task is known as **adding function** to the adapter and it is performed at the operator station using the following procedure:

Step 1. Double-click on the **OF/2** icon.

Step 2. Click on **3172ICP**.

Step 3. Click on **Configure** from the action bar.

Step 4. Select **Profiles** from the pull-down menu.

Step 5. Select **Profiles** from the action bar.

Step 6. Select **Open** from the pull-down menu.

Step 7. Click on **OK** on the Open Profile menu.

> The panel shown in Figure 66 on page 119 appears.

Step 8. Select **LANGATE** from the Functions section.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Change** from the pull-down menu.

> The Parallel Channel LAN Gateway Definitions panel appears.

Step 11. Click on **Add**.

> The Parallel Channel LAN Gateway Definition Parameters panel appears.

Step 12. Select **EN1** from the LAN Adapter box.

Step 13. Select **VTAM** from the Host Program box.

Step 14. Select the subchannel from the Subchannel window that the 3172 will use to send/receive VTAM traffic to/from the host.

> We specified subchannel **09**.

Step 15. Click on **OK** to save these changes and return to the Parallel Channel LAN Gateway Definitions panel again.

Step 16. Click on **OK** to save these changes and return to 3172 Profile panel.

Step 17. Select **Profiles** from the action bar and click on Exit.

> You are prompted if you want to save your changes.

Note: It does not matter whether you add the TCP/IP or VTAM function to the Ethernet LAN adapter first. You can always add the other one later.

2.12.3 Workstation Definitions

To prepare your PS/2 workstation for Ethernet LAN access using the SNA LU2 protocol, you must perform the following tasks:

• Configure your Ethernet LAN adapter for SNA (802.2) protocol using LAPS.

• Define your PS/2 workstation to CM/2 by specifying a CPNAME, IDBLK and IDNUM.

• Define your LAN gateway (3172 Model 3) to CM/2 by specifying its physical (MAC) address.

2.12.3.1 Configuring Your Ethernet LAN Adapter for SNA

To enable the SNA LU2 protocol for your token-ring adapter, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step 1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step 2. Type laps to start LAPS.

> Wait for a few seconds until startup has completed. You will be presented with two panels in succession.

Step 3. Select **Configure** on the first of the two panels.

Step 4. Select **Configure LAN Transports** on the second panel and press the **Continue** button.

Step 5. You will be presented with the panel shown in Figure 21 on page 58.

Step 6. Select the adapter type installed in your workstation and press the **Add** button.

Step 7. Select each protocol that you want to enable for your adapter and press the **Add** button once for each one.

Step 8. Exit from LAPS.

2.12.3.2 Defining Your PS/2 workstation and LAN Gateway to CM/2

Use this procedure to define your PS/2 workstation and LAN gateway to Communications Manager/2:

Step 1. At an OS/2 prompt, type cmsetup and press Enter.

Step 2. Click on **OK** on the CMSETUP panel.

Step 3. Click on **Setup** on the Communications Manager Setup panel.

Step 4. Select the proper configuration on the Open Configuration panel and click on **OK**.

> The panel shown in Figure 72 appears.
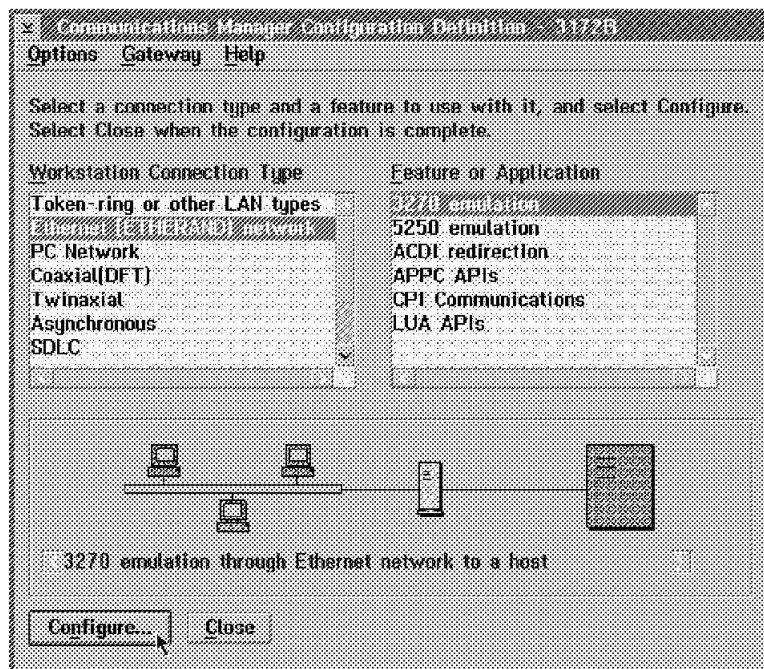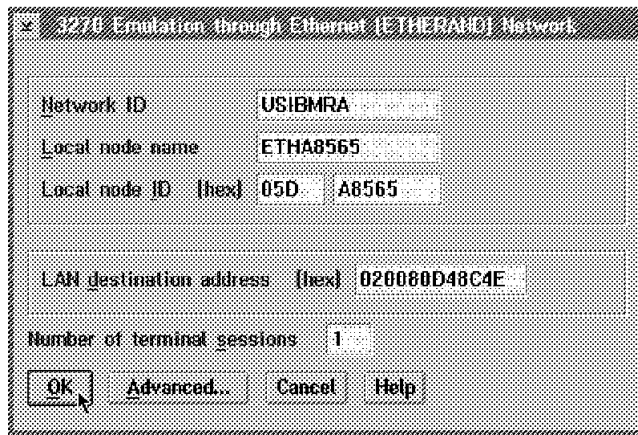
Figure 72. Selecting Ethernet LAN and 3270 Emulation. In Communications Manager/2 define an Ethernet LAN connection using 3270 emulation.

Step 5. Select **Ethernet (ETHERAND) network** and **3270 emulation** as shown in Figure 72 and press the **Configure** button.

Step   6. Type your **Network ID**, **Local node name**, **Local node ID** and **LAN destination address** and press the **OK** button as shown in Figure 73 on page 130.

```
┌─────────────────────────────────────────────────────────────┐
│ ⊻  3270 Emulation through Ethernet (ETHERAUI) Network         │
├─────────────────────────────────────────────────────────────┤
│                                                               │
│   Network ID          USIBMRA                                 │
│                                                               │
│   Local node name     ETHA8565                                │
│                                                               │
│   Local node ID  (hex) 05D    A8565                           │
│                                                               │
│                                                               │
│   LAN destination address   (hex)  020080D48C4E               │
│                                                               │
│                                                               │
│   Number of terminal sessions    1                            │
│                                                               │
│   ┌────┐                                                      │
│   │ OK │   Advanced...    Cancel    Help                      │
│   └────┘                                                      │
└─────────────────────────────────────────────────────────────┘
```

Figure 73. Defining Your PS/2 Workstation and LAN Gateway.   In Communications Manager/2 define your PS/2 workstation and LAN gateway.

Note: The **LAN destination address** specified above is the physical (MAC) address of your 3172 Controller in **canonical form**.

2.12.4 Verification

To verify VTAM connectivity using 3270 emulation (SNA LU2) we establish a TSO session from the PS/2 workstation to the MVS host. To establish this session, the following tasks must be completed:

   • Activate VTAM major nodes on MVS host

   • Initiate TSO session using Communications Manager/2

Activate VTAM Major Nodes on the MVS Host

At the MVS system console, enter the following commands in the sequence shown to activate the necessary VTAM major nodes. Below each command you see the VTAM response.

```
/V NET,ID=RAI72X,ACT        1
IST097I VARY ACCEPTED
IST093I RAI72X ACTIVE

/V NET,ID=RAI72S,ACT        2
IST097I VARY ACCEPTED
IST093I RAI72PU ACTIVE
IST093I RAI72S ACTIVE

/V NET,ID=RAI72ENX,ACT      3
IST097I VARY ACCEPTED
IST093I RAI72ENX ACTIVE

/V NET,ID=RAI72ENS,ACT      4
IST097I VARY ACCEPTED
IST093I RAI72EP1 ACTIVE
IST093I RAI72ENS ACTIVE
IST663I AM RESUME REQUEST FAILED, SENSE=08010000 993
IST664I REAL  OLU=USIBMRA.RAI72EL2    REAL  DLU=USIBMRA.RAIAT
IST889I SID = F86FE1648B5A4E28
IST890I AUTOLOGON SESSION SETUP FAILED
IST314I END
```

1   This command activates the 3172 parallel channel adapter.

2   This command activates the 3172 SNA management services.

3   This command activates the 3172 Ethernet LAN adapter.

4   This command activates the 3172 Ethernet LAN devices (PUs). VTAM tries to dial out to the PU and establish a session with its LU because we specified **CALL=INOUT** on the PATH macro. You can specify **CALL=IN** if you want to restrict session establishment to the workstation.

Initiate TSO Session using Communications Manager/2

Go to OS/2 Desktop and use the following procedure to initiate the TSO session:

Step   1. Double-click on **Communications Manager/2** icon.

Step   2. Double-click on **Manage 3270/5250 Sessions** icon.

Step   3. Double-click on **3270/5250 Session Management** icon.

Step   4. Select the session on this panel and click on **Session** from the action bar.

Step   5. Select **Start** option from the pull-down menu as shown in Figure 70 on page 124.

A 3270 emulation session is established and the TSO logon panel appears on your screen.

2.12.5 Hints and Tips

The physical (MAC) address of the Ethernet adapter in the PS/2 workstation is 4000014A8565. When you convert it to its canonical form this address becomes 020080D48C4E. If you query it using the TCP/IP ″netstat -n″ command, the non-canonical form of the address is displayed.

However, when you define the LAN Destination Address in Communications Manager/2 3270 Emulation over Ethernet **make sure you specify it using the canonical form**. You can use the table in Appendix B of the *IBM 3172*

Interconnect Controller User's Guide to convert from non-canonical (4000xxxxxxxx) to canonical form (0200zzzzzzzz).

Note: If you do not specify the LAN Destination Address in canonical form, then when you start your TSO session, it will fail with a confusing COMM695 error at the bottom of your screen.

2.13 Scenario 6: SNA over Fiber Distributed Data Interface

The purpose of this connectivity scenario is to describe how a FDDI LAN-attached workstation can use the SNA LU2 protocol to establish a TSO session with an MVS host through an IBM 3172 Interconnect Controller running ICP Version 3 Release 2 as shown in Figure 74.

```
┌─────────────────────────────────────────────────────────────────────────────────┐
│                                                                                   │
│                  ┌─────────────────────┐                                          │
│                  │                     │                                          │
│                  │     MVS/ESA 4.3      │                                          │
│                  │                     │                                          │
│                  ├─────────────────────┤                                          │
│                  │     VTAM  3.4.2      │                                          │
│                  │                     │                                          │
│                  └─────────────────────┘                                          │
│                  Parallel │ Subchannel                                            │
│                  Channel  │ Addresses:                                            │
│                  Attached │ 301 (SNA network management)                          │
│                           │ 30A (data from/to 3172)         ┌──────────────────┐  │
│                           │                                 │  PS/2 Model 80   │  │
│                  ┌─────────────────────┐                    ├──────────────────┤  │
│                  │     PC Adapter      │                    │    OS/2 2.1      │  │
│                  │                     │                    │    CM/2 1.0      │  │
│                  ├─────────────────────┤                    ├──────────────────┤  │
│                  │    3172 Model 3     │    * * * * *        │     FDDI         │  │
│                  │                     │  *   * * * * * *────│    Adapter       │  │
│                  ├─────────────────────┤  *  *          *   └──────────────────┘  │
│                  │      ICP 3.2        │  * *  FDDI LAN  *  LAA: 4000 8580 FDDF    │
│                  │                     │  * *            *  PU : RAI72FP1          │
│                  ├─────────────────────┤   **            *  LU : RAI72FL1          │
│  LAA : 4000 033B 3172 │     FDDI       │    * * * * * *                            │
│                  │     Adapter         │───                                        │
│                  └─────────────────────┘                                          │
│                                                                                   │
└─────────────────────────────────────────────────────────────────────────────────┘
```
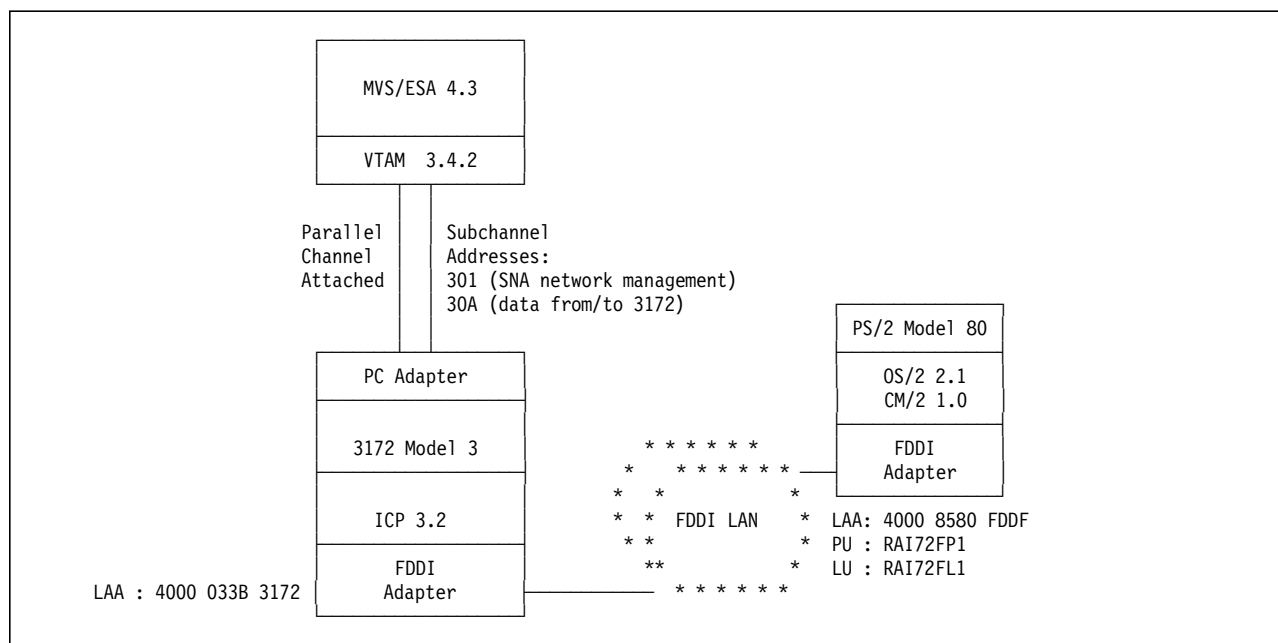
Figure 74. SNA over FDDI LAN.   A FDDI LAN-attached PS/2 workstation establishing a TSO session with the MVS host via an IBM 3172 Interconnect Controller gateway.

2.13.1 Host Definitions

IOCP Definitions

Refer to "IOCP Definitions" on page 80 for these definitions.

Operating System Definitions

Refer to "MVS/ESA Definitions" on page 81 for these definitions.

VTAM Definitions

An XCA major node must be coded for 3172 SNA Management Services and for the FDDI LAN adapter. Additionally, a switched major node must be coded for the 3172 DSPU and for the FDDI LAN and its DSPUs.

The XCA major node definitions for 3172 SNA Management Services are shown below.

```
****************************************************************
**  3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR 3172 NETWORK MANAGEMENT **
****************************************************************
**
RAI72     VBUILD TYPE=XCA        XCA FOR 3172 NETWORK MANAGEMENT
**
RAI72P    PORT  CUADDR=301,                                        X
                MEDIUM=BOXMGR
**
RAI72G    GROUP
**
RAI72L    LINE
**
RAI72P    PU
```

The XCA major node definitions for the 3172 FDDI LAN adapter are shown below.

```
****************************************************************
**  3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR FDDI LAN              **
****************************************************************
**
RAIFD     VBUILD TYPE=XCA        XCA FOR 3172 FDDI LAN
**
RAIFDP    PORT  ADAPNO=0,                                          X
                CUADDR=30A,                                        X
                MEDIUM=FDDI,                                       X
                SAPADDR=4,                                         X
                TIMER=60
**
RAIFDG    GROUP DIAL=YES,                                          X
                ANSWER=ON,                                         X
                AUTOGEN=(255,L,P),          1                      X
                CALL=INOUT,                                        X
                ISTATUS=ACTIVE
```

1   The AUTOGEN parameter is supported by VTAM 3.4.1 or later releases. A
    3172 FDDI LAN can support a maximum of 255 PUs.

The switched major node definitions for the 3172 PU are shown below.

```
    ***********************************************************************
    **  3172 MODEL 3 (ICP) - 3172 SWITCHED MAJOR NODE               **
    ***********************************************************************
    **
    RAI72S    VBUILD MAXGRP=1,                                          X
                     MAXNO=1,                                           X
                     TYPE=SWNET
    **
    RAI72PU  PU     ADDR=01,          3172 DSPU                         X
                    IDBLK=074,                                          X
                    IDNUM=00020,                    1                   X
                    MAXDATA=265,                    2                   X
                    MAXOUT=2,                       3                   X
                    MAXPATH=1                       4
    **
    RAI72P1  PATH   CALL=INOUT,                                         X
                    DIALNO=9904000000000000,        5                  X
                    GID=1,                                              X
                    GRPNM=RAI72G,                                       X
                    PID=1
```

1   The IDNUM value **must match** the **VTAM IDNUM** value specified in the parallel channel adapter configuration as shown in Figure 13 on page 47.

2   The MAXDATA parameter has no meaning for the 3172. VTAM calculates the MAXDATA send size based on information received from the 3172 and then readjusts this value based on different criteria, such as LAN type, routing considerations, and so on.

3   MAXOUT on PU macro has no meaning for a 3172.

4   If the switched PU is to be dialed from the host, you need a PATH macro. MAXPATH is used by VTAM to determine how much storage to reserve for path control blocks. If you do not code a path, then this parameter is not required.

5   If the switched PU is to be dialed from the host, then you must code the DIALNO parameter.

Note: One thing to remember is that the PU macro in the switched major node defines the characteristics of the PU and the PATH statement defines how it is connected to the host. You may code multiple path statements for the PU. So the actual physical path to the PU may change depending on the path that is chosen. Along with that, some of the parameters that are coded on the PU macro may become useful. For example, MAXOUT and MAXDATA, when the connection is SDLC switched over an NCP.

The switched major node definitions for the single FDDI LAN-attached PS/2 workstation are shown below.

```
    ************************************************************************
    **  3172 MODEL 3 (ICP) - FDDI LAN SWITCHED MAJOR NODE           **
    ************************************************************************
    **
    RAI72FS  VBUILD MAXGRP=1,                                              X
                    MAXNO=1,                                               X
                    TYPE=SWNET
    **
    RAI72FP1 PU     ADDR=01,                                               X
                    DLOGMOD=M2SDLCNQ,                                      X
                    IDBLK=05D,                                             X
                    IDNUM=32205,                                           X
                    ISTATUS=ACTIVE,                                        X
                    LOGAPPL=RAIAT,                                         X
                    MAXDATA=2057,                                          X
                    MAXOUT=2,                                              X
                    MAXPATH=1,                                             X
                    MODETAB=AMODETAB,                                      X
                    PUTYPE=2,                                              X
                    USSTAB=US327X
    **
    RAI72FH1 PATH   CALL=INOUT,                                            X
                    DIALNO=110440008580FDDF,                               X
                    GID=1,                                                 X
                    GRPNM=RAI72G,                                          X
                    PID=1
    **
    RAI72FL1 LU     LOCADDR=2            DEPENDENT LU FOR LU2 SESSION
    **
    RAI72FL2 LU     LOCADDR=0,        1   INDEPENDENT LU FOR LU6.2 SESSION  X
                    DLOGMOD=DSIL6MOD
```

1   This LU definition is not necessary but we included it as a sample definition
    if an LU6.2 session is to be established through the 3172.

2.13.2 3172 Definitions

2.13.2.1 Defining the FDDI LAN Adapter to Your 3172
The task of defining the FDDI LAN adapter to the 3172 has been described in
2.10.2.1, "Defining the FDDI LAN Adapter to Your 3172" on page 105.

2.13.2.2 Adding VTAM Function to Your 3172 FDDI LAN Adapter
Currently the 3172 FDDI LAN adapter supports only TCP/IP. Now we must
enable it for VTAM traffic also. This task is known as **adding function** to the
adapter and it is performed at the operator station using the following procedure:

Step   1. Double-click on the **OF/2** icon.

Step   2. Click on **3172ICP**.

Step   3. Click on **Configure** from the action bar.

Step   4. Select **Profiles** from the pull-down menu.

Step   5. Select **Profiles** from the action bar.

Step   6. Select **Open** from the pull-down menu.

Step   7. Click on **OK** on the Open Profile menu.

        The panel shown in Figure 66 on page 119 appears.

Step 8. Select **LANGATE** from the Functions section.

Step 9. Select **Edit** from the action bar.

Step 10. Select **Change** from the pull-down menu.

The Parallel Channel LAN Gateway Definitions panel appears.

Step 11. Click on **Add**.

The Parallel Channel LAN Gateway Definition Parameters panel appears.

Step 12. Select **FD1** from the LAN Adapter box.

Step 13. Select **VTAM** from the Host Program box.

Step 14. Select the subchannel from the Subchannel window that the 3172 will use to send/receive VTAM traffic to/from the host.

We specified subchannel **0A**.

Step 15. Click on **OK** to save these changes and return to the Parallel Channel LAN Gateway Definitions panel again.

Step 16. Click on **OK** to save these changes and return to 3172 Profile panel.

Step 17. Select **Profiles** from the action bar and click on Exit.

You are prompted if you want to save your changes.

Note: It does not matter whether you add the TCP/IP or VTAM function to the FDDI LAN adapter first. You can always add the other one later.

2.13.3 Workstation Definitions

To prepare your PS/2 workstation for FDDI LAN access using the SNA LU2 protocol, you must perform the following tasks:

- Configure your FDDI LAN adapter for SNA (802.2) protocol using the LAPS application.

- Define your PS/2 workstation to CM/2 by specifying a CPNAME, IDBLK and IDNUM.

- Define your LAN gateway (3172 Model 3) to CM/2 by specifying its physical (MAC) address.

2.13.3.1 Configuring Your FDDI LAN Adapter for SNA

To enable the SNA LU2 protocol for your FDDI adapter, use the LAN Adapter and Protocol Support (LAPS) application as described in the following procedure:

Step 1. At an OS/2 prompt, access the drive on which Network Transport Services/2 (NTS/2) is installed and change to the IBMCOM directory.

Step 2. Type laps to start LAPS.

Wait for a few seconds until startup has completed. You will be presented with two panels in succession.

Step 3. Click on **Configure** on the first panel.

Step 4. Click on **Continue** on the second panel.

The **Configure LAN Transports** option is selected on this panel.

Step 5. The panel shown in Figure 75 on page 137 appears.
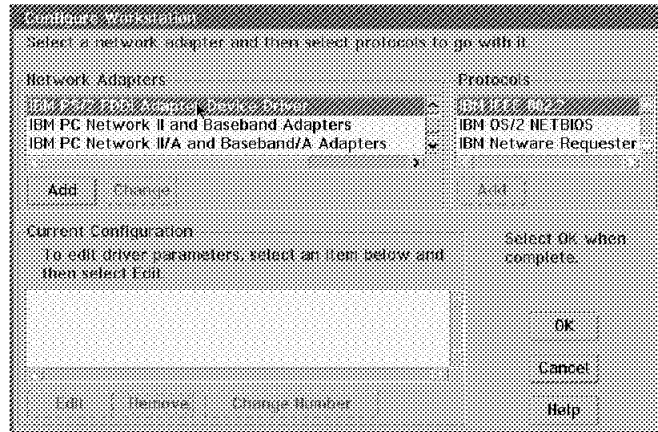
Figure 75. Configuring your FDDI Adapter for SNA

Step 6. Select **IBM PS/2 FDDI Adapter Device Driver** from the Network Adapters window and click on **Add**.

This adapter is added to your configuration and is displayed in the Current Configuration window.

Step 7. Select **IBM IEEE 802.2** from the Protocols window and click on **Add**.

Your adapter is now enabled for the 802.2 protocol and it is displayed in the Current Configuration window.

Step 8. Click on **OK** to save your workstation configuration.

You are then presented with two exit panels in succession.

Step 9. Click on **Exit** on each of these panels to exit from LAPS.

2.13.3.2 Defining Your PS/2 Workstation and LAN Gateway to CM/2

Use this procedure to define your PS/2 workstation and LAN gateway to Communications Manager/2:

Step 1. At an OS/2 prompt, type cmsetup and press Enter.

Step 2. Click on **OK** on the CMSETUP panel.

Step 3. Click on **Setup** on the Communications Manager Setup panel.

Step 4. Select the proper configuration on the Open Configuration panel and click on **OK**.

The panel shown in Figure 76 on page 138 appears.
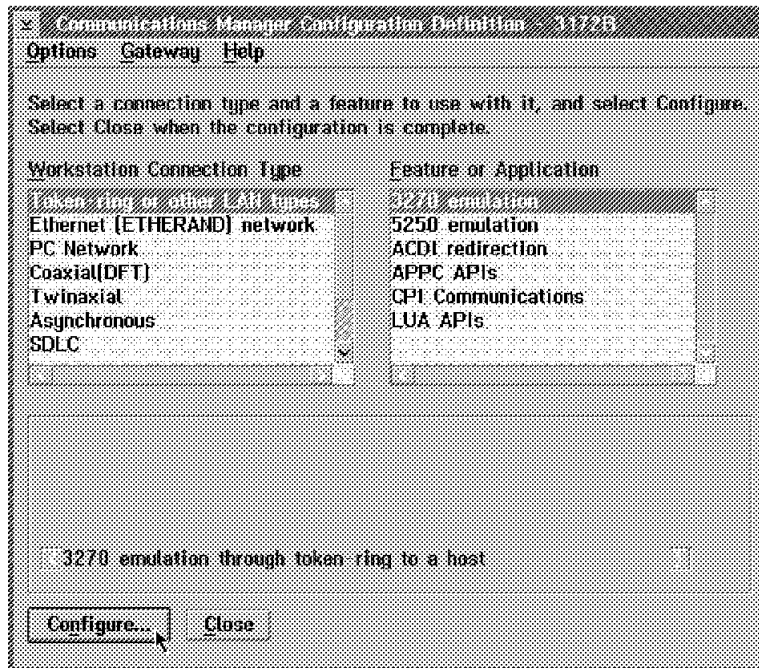
Figure 76. Selecting FDDI LAN and 3270 Emulation. In Communications Manager/2 define a FDDI LAN connection using 3270 emulation.

Step 5. Select **Token-Ring or other LAN types** and **3270 emulation** and click on **Configure**.

The panel shown in Figure 77 appears.
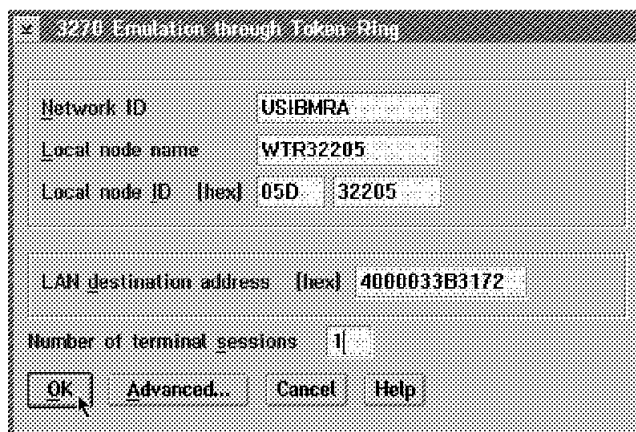
Figure 77. Defining Your PS/2 Workstation and LAN Gateway. In Communications Manager/2 define your PS/2 workstation and LAN gateway.

Step 6. Type the network ID of your workstation in the **Network ID** field.

We specified USIBMRA.

Step 7. Type the CPNAME of your workstation in the **Local node name** field.

We specified WTR32205.

Step 8. Type the IDBLK and IDNUM of your workstation in the **Local node ID** field.

We specified 05D and 32205.

Step   9. Type the physical (MAC) address of the 3172 FDDI LAN adapter in the **LAN destination address** field.

We specified 4000033B3172.

2.13.4 Verification

To verify VTAM connectivity using 3270 emulation (SNA LU2) we establish a TSO session from the PS/2 workstation to the MVS host. To establish this session, the following tasks must be completed:

• Activate VTAM major nodes on MVS host

• Initiate TSO session using Communications Manager/2

Activate VTAM Major Nodes on the MVS Host

At the MVS system console, enter the following commands in the sequence shown to activate the necessary VTAM major nodes. Below each command you see the VTAM response.

```
/V NET,ID=RAI72X,ACT        1
IST097I VARY ACCEPTED
IST093I RAI72X ACTIVE

/V NET,ID=RAI72S,ACT        2
IST097I VARY ACCEPTED
IST093I RAI72PU ACTIVE
IST093I RAI72S ACTIVE

/V NET,ID=RAI72FDX,ACT      3
IST097I VARY ACCEPTED
IST093I RAI72FDX ACTIVE

/V NET,ID=RAI72FDS,ACT      4
IST097I VARY ACCEPTED
IST093I RAI72FP1 ACTIVE
IST093I RAI72FDS ACTIVE
IST663I AM RESUME REQUEST FAILED, SENSE=08010000 993
IST664I REAL  OLU=USIBMRA.RAI72FL2    REAL  DLU=USIBMRA.RAIAT
IST889I SID = F86FE1648B5A4E28
IST890I AUTOLOGON SESSION SETUP FAILED
IST314I END
```

1   This command activates the 3172 parallel channel adapter.

2   This command activates the 3172 SNA management services.

3   This command activates the 3172 FDDI LAN adapter.

4   This command activates the 3172 FDDI LAN devices (PUs). VTAM tries to dial out to the PU and establish a session with its LU because we specified **CALL=INOUT** on the PATH macro. You can specify **CALL=IN** if you want to restrict session establishment to the workstation.

Initiate TSO Session using Communications Manager/2

Go to OS/2 Desktop and use the following procedure to initiate the TSO session:

Step   1. Double-click on **Communications Manager/2** icon.

Step   2. Double-click on **Manage 3270/5250 Sessions** icon.

Step 3. Double-click on **3270/5250 Session Management** icon.

Step 4. Select the session on this panel and click on **Session** from the action bar.

Step 5. Select **Start** option from the pull-down menu as shown in Figure 70 on page 124.

A 3270 emulation session is established and the TSO logon panel appears.

Chapter 3. 3172 for Offload of TCP/IP

This chapter describes how to install, configure, and use the Offload feature for IBM TCP/IP Version 2 Release 2.1 for MVS or IBM TCP/IP Version 2 Release 2 for VM on the IBM 3172 Interconnect Controller Model 3.

Offload of TCP/IP is designed to reduce the CPU utilization on the System/390 host by using the 3172 CPU cycles for header and checksum processing, fragmentation and reassembly of IP datagrams as well as IP routing. On the average, using Offload reduces TCP/IP host CPU utilization by 30%. Thus, if you are concerned about host CPU cycles, it is recommended that you use Offload in place of the 3172 Interconnect Controller Program. Another benefit gained from using Offload over ICP is that you can perform IP routing within the 3172 itself.

If however, you are concerned about performance, it is recommended that you use ICP which offers 2 to 3 times the throughput when compared with Offload. ICP also supports multiple protocols (SNA and OSI aside from TCP/IP) as well as multiple channel connections. For more details about ICP, see Chapter 1, "3172 Perspectives" on page 1.

When running Offload, the 3172 uses the Operating System/2 Version 2.1 as its operating system and uses IBM TCP/IP Version 2.0 for OS/2 and the Offload server to do the processes listed above. For more information about the Offload system, see Chapter 1, "Introducing the Offload System," of the *IBM TCP/IP Version 2 Release 2.1 for MVS: Offload of TCP/IP Processing* or *IBM TCP/IP Version 2 Release 2 for VM: Offload of TCP/IP Processing*.

An Offload 3172 can connect to an S/390 host either through a parallel channel using the IBM 3172 Parallel Channel Adapter or through an ESCON channel using the IBM 3172 ESCON Adapter. It can attach to a token-ring network through the IBM Token-Ring 16/4 Busmaster Adapter or the IBM Token-Ring Auto LANStreamer MC32 Adapter an Ethernet network through an IBM 3172 Ethernet/802.3 Busmaster Adapter or the IBM Ethernet EtherStreamer MC32 Adapter, to a Fiber Distributed Data Interface network through an IBM 3172 FDDI Adapter, or multiple networks through a combination of adapters.

Take note that the Offload feature can *only* handle TCP/IP and not SNA.

3.1 Hardware and Software Requirements and Options

This section lists the hardware and software requirements of the 3172 Offload system. It also lists optional hardware and software that are supported when running the Offload feature.

3.1.1 Hardware Requirements

The Offload system requires the following hardware:

3172 Model 3 with the Offload hardware feature (FC 2700) which includes:

- 25 MHz 80486SX processor card
- 8MB RAM
- 80MB fixed disk

- 9524-001 or 9524-004 color monitor and power cord
- IBM keyboard
- XGA display adapter
- 8MB non-ECC memory expansion (for a total of 16MB RAM)

One or a combination of the following LAN adapters:

- IBM 3172 Token-Ring 16/4 Busmaster Adapter (FC 2215)
- IBM 3172 Ethernet/802.3 Busmaster Adapter (FC 2225)
- IBM 3172 FDDI Adapter (FC 2300)

One of the following channel adapters:

- IBM 3172 System/390 Parallel Channel Adapter (FC 2501)
- IBM 3172 ESCON Adapter (FC 2800)

Notes:

1. Both the 25 and 50 MHz processor cards are supported.
2. A maximum of one (1) FDDI adapter is supported.
3. If an FDDI adapter is installed, only two other adapters are supported.

3.1.2 Optional Hardware Features

- Mouse accessory kit (FC 8770 or P/N 32G5430)
- 16MB ECC memory upgrade (FC 2810)
- 50 MHz 80486DX processor card (FC 2830)

3.1.3 Software Requirements

The Offload system requires the following software:

- IBM TCP/IP Version 2 Release 2.1 for MVS (5735-HAL) or IBM TCP/IP Version 2 Release 2 for VM (5735-FAL) with the Offload Feature Diskette (5775-AQP for MVS or 5775-BDW for VM)
- IBM Operating System/2 Version 2.1 (5604-467)
- IBM TCP/IP Version 2.0 for OS/2 Base Kit (5622-086)

Important

- IBM TCP/IP Version 2 Release 2 for VM requires the application of PTF for APAR PN35887 on the host to enable the Offload feature.
- If you are running TCP/IP on a guest system under VM, this guest system must be defined to the first level system as follows depending on the level of VM that you have:
  - V=R if you are running VM/ESA 1.0 or 1.1
  - V = *X* if you are running VM/ESA 1.2 or later, where *X* can be V, F, or R
- Make sure you have the latest version of the Offload Feature diskette for your environment. The latest version provides you with the latest ESCON and parallel channel adapter device drivers.

3.1.4 Optional Software Feature

- Fix for OS/2 2.1 Workplace Shell Component APARs PJ08808, PJ08727, and PJ08606

> ┌─ **Note** ──┐
>
> Install the fix for OS/2 2.1 WPS component if the following occur:
>
> - The final Shutdown has completed... message is displayed underneath the Please wait ... Shutdown still in progress. message.
>
> - Mass duplication of template objects after creating a shadow.
>
> └──┘

3.2 Supported Adapter Combinations on the 3172 Offload System

This section explains the combination of adapters that are supported on the 3172 Offload system.

Tables 12 and 13 show the adapter combinations that are supported by the 3172 Offload system. The slot numbers appearing in the tables are the numbers as you would see them from the rear of the box (slot 8 is the leftmost; slot 1 is the rightmost). Abbreviations used in the tables are:

ESCON   ESCON adapter

Ether   Ethernet/802.3 busmaster adapter

FDDI   FDDI adapter

NU   Not used

PCA   Parallel channel adapter

T-R   Token-ring 16/4 busmaster adapter

XGA   XGA adapter

Table 12. IBM 3172 Model 3 Offload Adapter Plugging Chart for Parallel Channel

Gateway Card Slots								
8	7	6	5	4	3	2	1	Combinations
Fixed Disk Adapter	FDDI+ T-R Ether	FDDI+ NU	XGA	PCA	NU	NU	NU	One LAN Adapter
Fixed Disk Adapter	T-R Ether	T-R Ether	XGA	PCA	NU	NU	NU	Two LAN Adapters
Fixed Disk Adapter	FDDI+	FDDI+	XGA	PCA	T-R Ether	NU	NU	
Fixed Disk Adapter	T-R Ether	T-R Ether	XGA	PCA	T-R Ether	NU	NU	Three LAN Adapters
Fixed Disk Adapter	FDDI+	FDDI+	XGA	PCA	T-R Ether	T-R Ether	NU	
Fixed Disk Adapter	T-R Ether	T-R Ether	XGA	PCA	T-R Ether	T-R Ether	NU	Four LAN Adapters

Note:

+ The FDDI adapter can occupy only slots 6 and 7.

Table 13. IBM 3172 Model 3 Offload Adapter Plugging Chart for ESCON Channel

			Gateway Card Slots					
8	7	6	5	4	3	2	1	Combinations
Fixed Disk Adapter	FDDI• T-R Ether	FDDI• NU	XGA	NU	NU	ESCON•	ESCON•	One LAN Adapter
Fixed Disk Adapter	FDDI• T-R Ether	FDDI• T-R Ether	XGA	NU	NU	ESCON•	ESCON•	Two LAN Adapters
Fixed Disk Adapter	FDDI•	FDDI•	XGA	T-R Ether	NU	ESCON•	ESCON•	
Fixed Disk Adapter	FDDI•	FDDI•	XGA	T-R Ether	T-R Ether	ESCON•	ESCON•	Three LAN Adapters
Fixed Disk Adapter	T-R Ether	T-R Ether	XGA	T-R Ether	NU	ESCON•	ESCON•	
Fixed Disk Adapter	T-R Ether	T-R Ether	XGA	T-R Ether	T-R Ether	ESCON•	ESCON•	Four LAN Adapters

Note:

• The FDDI adapter can occupy only slots 6 and 7.

• The ESCON adapter can occupy only slots 1 and 2.

> **Reminders**
>
> • The FDDI adapter occupies two slots.
>
> • The ESCON adapter occupies two slots.
>
> • The ESCON and parallel channel adapter are mutually exclusive.

3.3 The ITSO Offload Environment

The purpose of this section is to show the 3172 hardware and software environment where the Offload scenarios were performed.

3.3.1 The ITSO Offload Hardware Environment

The following diagram shows the hardware environment that was used for the Offload scenarios.

```
                    ┌──────────────────┐        9121-320
                    │                  │        CPU
                    │     ┌──────────┐ │
                    │     │ 18 │ChPID│ │
                    │     └──────────┘ │
                    └──────────────────┘
                        device address = 340

                    ┌──────────────────┐        9032-002
                    │     ┌──────────┐ │        ESCON
                    │     │ E1 │ port│ │        Director
                    │     └──────────┘ │
                    │     ┌──────────┐ │
                    │     │ E8 │ port│ │
                    │     └──────────┘ │
                    └──────────────────┘

Adapter             ┌──────────────────┐        3172-003
Slot No.            │      ESCON       │        Interconnect
                    │      1 & 2       │        Controller
Slot No.            │  3      4   6 & 7│
Adapter             │ T-R    Eth   FDDI│
                    └──────────────────┘
                       │      │      │
```
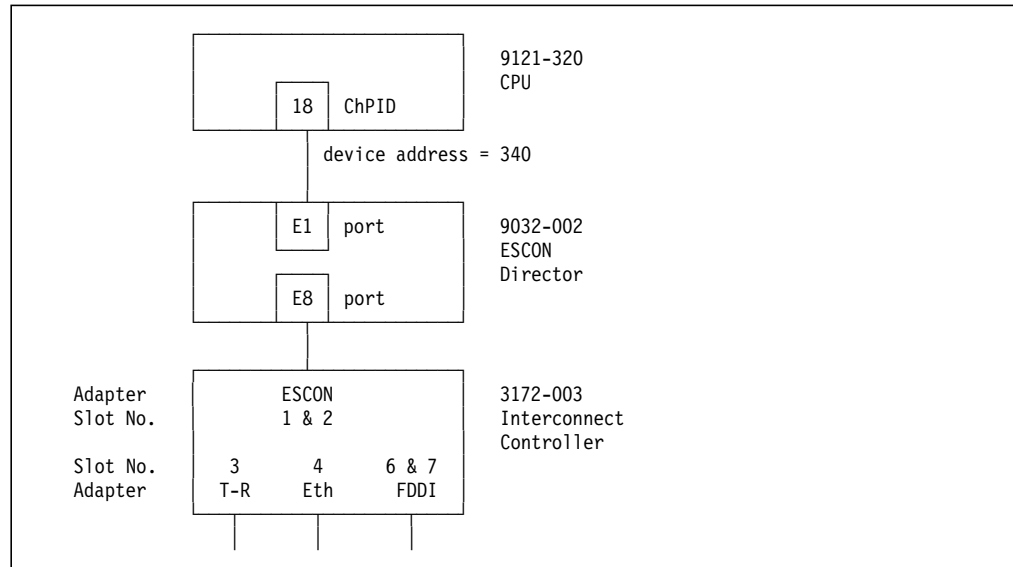
Figure 78. ITSO Offload Hardware Environment

The ITSO Offload hardware environment included the following:

- System/390
  - 9121-320 CPU
  - 9032-002 ESCON Director
- 3172 Model 3
  - Offload hardware feature (for a total of 16MB RAM)
  - IBM 3172 Token-Ring 16/4 Busmaster Adapter
  - IBM 3172 Ethernet/802.3 Busmaster Adapter
  - IBM 3172 FDDI Adapter
  - IBM 3172 ESCON Adapter
  - Mouse accessory kit
  - 50 MHz 80486DX processor card
- Workstations
  - IBM PS/2 Model 80 with a Token-Ring Network 16/4 Adapter/A
  - IBM PS/2 Model 65 with an Ethernet Adapter/A
  - IBM PS/2 Model 80 with an FDDI Adapter/A
- Local Area Networks
  - Token-Ring LAN operating at a 4 Mbps data rate
  - Ethernet LAN operating at a 10 Mbps data rate
  - Fiber Distributed Data Interface LAN operating at a 100 Mbps data rate

3.3.2 The ITSO Offload Software Environment

The following diagram shows the software environment that was used for the offload scenarios.

```
+----------------------------------------------------------------+
|                                                                |
|              +----------------------+                          |
|              | MVS/ESA              |  9121-320                |
|              | VM/ESA               |                          |
|              | TCP/IP               |                          |
|              +----------------------+                          |
|                         |                                      |
|              +----------------------+                          |
|              | OS/2 2.1             |  3172-003                |
|              | TCP/IP 2.0 for OS/2  |                          |
|              | Offload Server       |                          |
|              +----------------------+                          |
|                         |                                      |
|              +----------------------+                          |
|              | OS/2 2.1             |  Workstations            |
|              | TCP/IP 2.0 for OS/2  |                          |
|              +----------------------+                          |
|                                                                |
+----------------------------------------------------------------+
```
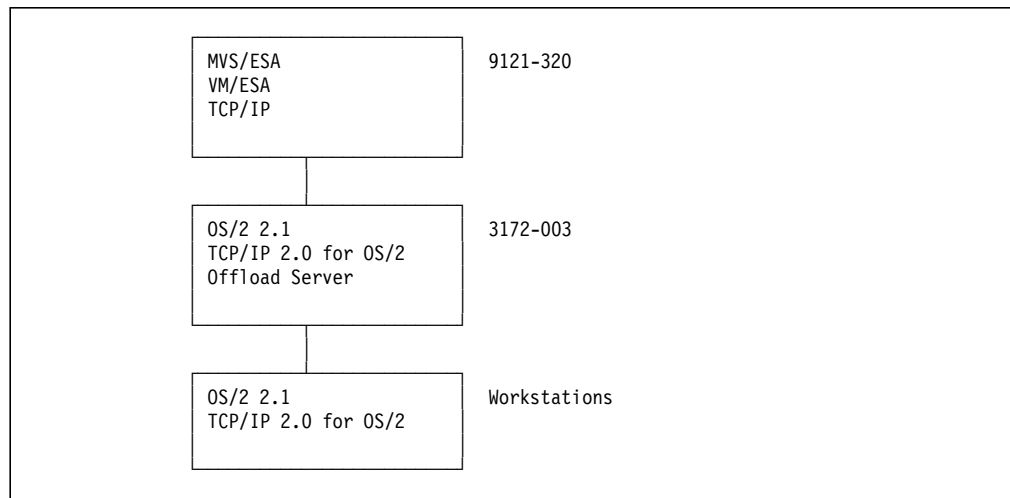
Figure 79. ITSO Offload Software Environment

The ITSO Offload software environment included the following:

- System/390

  - IBM MVS/Enterprise System Architecture and IBM VM/Enterprise System Architecture

  - IBM TCP/IP Version 2 Release 2.1 for MVS and IBM TCP/IP Version 2 Release 2 for VM

- 3172 Model 3

  - IBM Operating System/2 Version 2.1

  - IBM TCP/IP Version 2.0 for OS/2 Base Kit :i2refid=offl.Feature Diskette

  - Offload Feature diskette for MVS and VM

  - Fix for OS/2 2.1 WPS component

- Workstations

  - IBM Operating System/2 Version 2.1

  - IBM TCP/IP Version 2.0 for OS/2 Base Kit

  - Fix for OS/2 2.1 WPS component

Note:

> You can only configure a 3172 to support either MVS Offload or VM Offload. In the ITSO scenarios, the Offload 3172 was initially set up for MVS Offload then was converted to support VM Offload.
>
> The Offload Feature diskettes for MVS are different from VM. Thus, you have to reinstall the Offload feature when changing the operating system the 3172 will connect to. See 3.5.8, "Installing and Configuring the Offload Feature" on page 161 for more information on installing the Offload feature.

3.3.3 Completed Worksheets for the ITSO Offload Environment

The following tables show the completed worksheets that were used to set up the ITSO Offload environment.

```
                          3172 OFFLOAD ADAPTERS
                          ====================

Slot        Adapter              IP              Subnet        Logical LAN  Locally-admin.
No           Type              Address            Mask         Adapter No.  (MAC) Address
----  ----------------------  ---------------  -------------------  -----------  --------------

 1         ESCON Adapter

 2         ESCON Adapter                                             LAN 3

 3      Token-ring Adapter     9.67.38.22      255.255.255.192       LAN 0      4000 011C 3172

 4       Ethernet Adapter      9.67.32.22      255.255.255.192       LAN 1      4000 012C 3172

 5         XGA Adapter

 6         FDDI Adapter        9.67.38.200     255.255.255.192       LAN 2      4000 013C 3172

 7         FDDI Adapter

 8      Fixed Disk Adapter
```

Figure 80. Completed ITSO Offload Adapters Worksheet

> **Adapter type** can be:
>
> - ESCON adapter
> - Ethernet/802.3 busmaster adapter
> - FDDI adapter
> - Token-ring 16/4 busmaster adapter
> - Not used
>
> **IP Address** must be in the dotted decimal notation (XXX.XXX.XXX.XXX).
>
> **Subnet Mask** must be in the dotted decimal notation (XXX.XXX.XXX.XXX).
>
> **Logical LAN Adapter Number** will range from 0 to 4.
>
> - Logical LAN adapter numbers should be filled up in the same order they are inserted into the slots except for the channel attachment card which should always be the last Logical LAN adapter. For example, the LAN card inserted in the lowest slot number is Logical LAN Adapter 0.
>
> **Local-admin address** (or MAC address) must be a 12-digit hexadecimal address (if you use a locally-administered address). Make sure that a unique address is used for each adapter on the network.
>
> - For token-ring adapters, it is recommended that the locally administered address fall within the range of 4000 0000 0000 to 4000 7FFF FFFF, but you can specify an address up to 4000 FFFF FFFF.

- For Ethernet adapters, it is recommended that, to comply with the 802.3 standard for node addresses, the first byte of the node address must be even.

- For FDDI adapters, the recommended range is 4000 0000 0000 to 4FFF FFFF FFFF.

```
                       HOST ATTACHMENT DATA
                       ====================

   Adapter        Base Subchannel      Parallel Channel         ESCON
    Type             Address          Data Transfer Speed    Director Path
   -------        ---------------     -------------------    -------------

    PCA                                                          N/A

    ESCON             40                     N/A                  E1
```

Figure 81. Completed ITSO Host Attachment Data Worksheet

Base Subchannel Address is a 2-digit hexadecimal number in the range of 00 to FE. This address (plus the succeeding one which will form an address pair) will be used to transfer data between the host attachment card and the host computer.

Parallel Channel Data Transfer Speed can be:

- DC Interlock

- 2 MBps data streaming

- 3 MBps data streaming

- 4.5 MBps data streaming

ESCON Director Path is a 2-digit hexadecimal number in the range of 00 to FF.

3.3.4 The ITSO Offload Environment, Logical Appearance

To the network users and TCP/IP, the environment in Figure 78 on page 145 looks like the network depicted below:
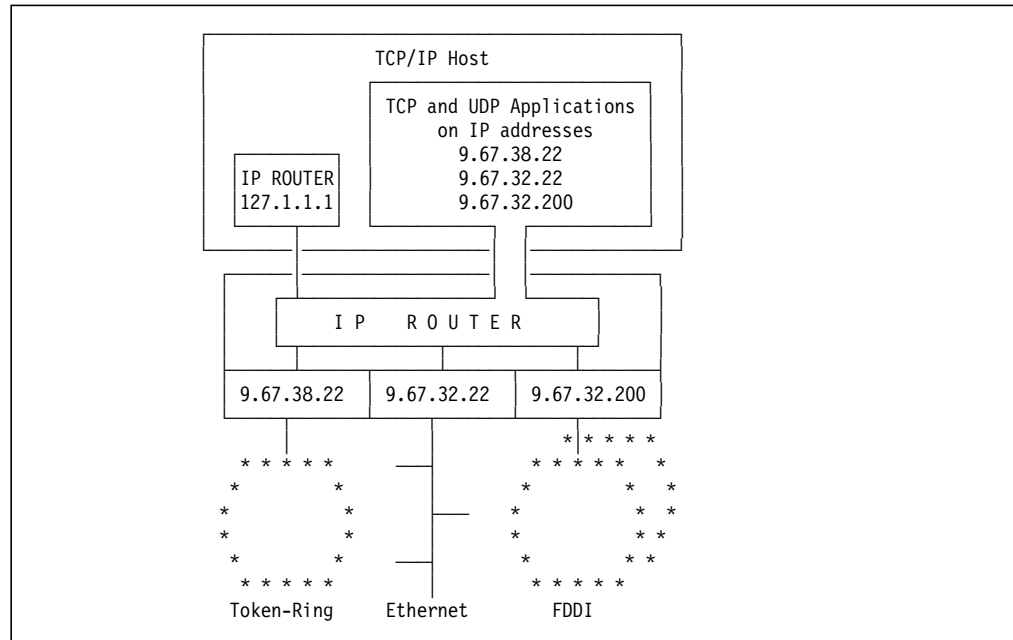
Figure 82. The Logical Network Appearance of the ITSO Offload Environment

3.4 Preparing the Host for Offload

The following section describes the IOCP, operating system, and host TCP/IP profile definitions that were used in the ITSO Offload environment.

Preparing the host for Offload includes the following tasks:

- Defining the 3172 to the IOCP

- Defining the 3172 to the operating system (MVS or VM)

- Defining the 3172 to the host TCP/IP

3.4.1 IOCP Definition

Channel path definition:

```
CHPID    PATH=((18)),TYPE=CNC,SWITCH=E1                        1
```

1 The CHPID macro specifies that channel path 18 is a native ESCON channel, and that all control units and I/O devices that attach to this channel path support the ESCON Architecture protocol. The SWITCH parameter indicates that cable attached to channel 18 is connected to port E1 of the ESCON device.

Control unit and device definitions with logical addressing = 1 for the Offload 3172:

```
         CNTLUNIT  CUNUMBR=340,UNIT=3172,PATH=(18),         X
                   CUADD=1,LINK=(E8),UNITADD=((40,32))   2
DEV340   IODEVICE  UNIT=SCTC,ADDRESS=(340,32),              X
                   CUNUMBR=(340)                         3
```

2 The CNTLUNIT macro describes the 3172 as control unit number 340 and attached to channel path 18 with addresses 340 to 35F reserved for it. It also describes the 3172 with logical address 1 and is attached to port E8 of the ESCON director.

3 The IODEVICE macro describes the 3172 as a device with ESCON CTC support.

Note: See Chapter 2, ″IOCP Macroinstructions and Functions″ in the *Input/Output Configuration Program User′s Guide and ESCON Channel-to-Channel Reference* for more information about IOCP definitions.

3.4.2 VM/ESA Definition

VM/ESA HCPRIO definition:

```
RDEVICE ADDRESS=(340,32),DEVTYPE=CTCA
```

3.4.3 MVS/ESA Definition

MVS/ESA IODEVICE macro for ESCON channel:

```
IODEVICE UNIT=SCTC,ADDRESS=(340,32)
```

3.4.4 TCP/IP Definition

Buffer definitions:

```
DATABUFFERPOOLSIZE            150   28672          1
SMALLDATABUFFERPOOLSIZE       1200                 2
TINYDATABUFFERPOOLSIZE        500                  3
```

1 If you have both Offload and ICP 3172s defined in one TCP/IP instance, use a DATABUFFERPOOLSIZE of 28672 (this is the only value supported by Offload). Adjust the number of data buffers according to your requirements and the amount of virtual storage available.

2 Small data buffers hold 2048 bytes of data. They are used when exchanging medium amounts of data between the TCP/IP address space and the Offload host. If you are using both Offload and ICP 3172s, define an average of 2 buffers per ICP telnet user.

3 These are data buffers of 256 bytes plus control information which are used to send miscellaneous commands to the Offload host. On the average, define 1 or more buffers per Offload telnet user but make sure that there is an ample supply; otherwise, communication with the Offload host ceases.

Device and link definitions:

```
DEVICE OFFDEV    CLAW 340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
LINK   OFFTR1    OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
LINK   OFFEN1    OFFLOADAPIBROAD 9.67.32.22  OFFDEV  OFFIPLINK
LINK   OFFFD1    OFFLOADAPIBROAD 9.67.32.200 OFFDEV  OFFIPLINK
```

Device startup definition:

```
START OFFDEV
```

The PRIMARYINTERFACE and HOME statements are optional when running the Offload feature.

The PRIMARYINTERFACE statement specifies which link is to be the primary TCP/IP interface for the MVS host. The primary interface always appears first in the list of host addresses displayed by NETSTAT HOME. If the PRIMARYINTERFACE statement is not specified, then the first address in the home list is the default local address.

The links for an Offload host cannot be specified in the HOME statement. Other links such as links for a 3172 running ICP should still be specified in the HOME statement.

For more information about the PRIMARYINTERFACE and HOME statements, see Chapter 5, "Configuring TCP/IP on the MVS Host," of the *IBM TCP/IP Version 2 Release 2.1 for MVS: Offload of TCP/IP Processing* or Chapter 6, "Configuring TCP/IP on the VM Host," of the *IBM TCP/IP Version 2 Release 2 for VM: Offload of TCP/IP Processing*.

3.5 Preparing the 3172 for Offload

The following section describes the installation and customization steps that must be done to make the 3172 into an Offload host.

Preparing the 3172 for Offload includes the following tasks:

1. Creating the 3172 system partition

2. Installing IBM Operating System/2 Version 2.1

3. Customizing IBM Operating System/2 Version 2.1

4. Installing IBM TCP/IP Version 2.0 for OS/2 Base Kit

5. Configuring IBM TCP/IP Version 2.0 for OS/2 Base Kit

6. Installing the parallel channel adapter or ESCON adapter device driver

7. Configuring LAPS for OS/2

8. Installing and configuring the Offload feature

3.5.1 Creating the 3172 System Partition

The first step in setting up an Offload host is to create the 3172 system partition from the 3172 reference diskette and store it on the fixed disk.

Follow the instructions in the *IBM 3172 Interconnect Controller Model 3 Maintenance Information* for restoring the system partition.

The 3172 will automatically reboot when this process completes. When the reference diskette main menu appears on the screen, remove the reference diskette and turn off the 3172. You are now ready to install IBM Operating System/2 Version 2.1.

3.5.2 Installing IBM Operating System/2 Version 2.1

The following steps describe the installation procedures for IBM Operating System/2 Version 2.1.

Step 1. Insert the OS/2 Version 2.1 Installation Diskette in the disk drive and switch on the 3172. If the 3172 is already on, press and hold Ctrl+Alt and press Del to restart the 3172. Follow the on-screen instructions until you get to the Preparing the Hard Disk screen.

Step 2. When the Preparing the Hard Disk screen is displayed, select **Accept predefined installation partition** then press Enter.

Step 3. At the Installation Drive Selection screen, select **Accept the drive** and press Enter.

Step 4. At the Select the File System screen, select **FAT File System** as the file system to be used.

Note: The FAT file system is recommended for the 80MB fixed disk installed in the 3172 and is the only supported file system for Offload. The 80MB fixed disk is the only supported fixed disk for Offload.

Step 5. At this point, some of the OS/2 system files have been added to the 3172 fixed disk. When you restart the system, you will see the OS/2 Setup and Installation window. Select **Select Features and Install**.

> **── Tip ──**
>
> If you have a mouse attached to the 3172, you can now use it to make selections.
>
> Otherwise, use the following keystrokes:
>
> • Use the Tab key to move the cursor to the next field (or use Shift+Tab for the previous field).
>
> • Use the Up Arrow (↑) or Down Arrow (↓) keys to move the cursor among choices.
>
> • Press the spacebar then Enter to select an item in a multiple selection field (the spacebar toggles between select and deselect).
>
> • Press Enter to select an item in a single selection field.

Step 6. At the System Configuration window, the Mouse field should display No Pointing Device Support if no mouse is attached to the 3172, or PS/2 (tm) Style Pointing Device if you have a mouse attached. Otherwise, select the Mouse checkbox and press Enter. Select the proper pointing device, then press Enter.

Note: Older 3172 Model 3s may not have a mouse port at the back. Only 3172 Model 3s with serial numbers greater than 23-60291 have the accessible mouse port at the rear of the machine.

Step 7. At the Select Printers window, select **Do Not Install Default Printer** and press Enter.

Step 8. At the System Configuration window, select the Primary Display checkbox and press Enter.

Step 9. Select **Video Graphics Array (VGA)** and press Enter.

Step 10. Press Enter to leave the System Configuration window.

Step 11. At the OS/2 Setup and Installation window, deselect (remove the checkmark next to each feature -- use the Tab key and spacebar when using the keyboard or use the mouse) all of the features *except*:

• Optional System Utilities

• REXX

Step 12. Select the **More...** pushbutton next to Optional System Utilities. Deselect the following:

• Manage Partitions

• Link Object Modules

• Picture Viewer

Step 13. At the OS/2 Setup and Installation window, select **Software Configuration** from the menu bar (press Alt+S). Tab to the `SWAPPATH` field. Replace the default location of the swap file with the root directory of drive C by typing `C:`, then press Enter.

For OS/2 performance reasons, it is generally recommended that the swap file be placed in the root directory of the most used partition of the least used physical fixed disk drive. In the 3172, where we only have one partition (the C: drive) and one physical fixed disk drive (the 80MB fixed disk drive), we choose the root directory of C: as the location of our swap file.

Step 14. Select **Install** and press Enter to continue with the installation.

Step 15. In the Advanced Options window, deselect `Migrate Applications` and press Enter.

Step 16. Follow the screen instructions to continue with the installation.

Step 17. When prompted, remove the diskette and press Enter to restart the system.

OS/2 2.1 is now resident on the 3172 fixed disk.

3.5.3 Customizing IBM Operating System/2 Version 2.1

The following items describe optional customization steps for IBM Operating System/2 Version 2.1. These steps can help reduce the space OS/2 2.1 occupies, help improve the performance of the Offload system a little bit, and, in general, help you recover from simple OS/2 desktop corruption.

- You can erase the following files and directories which are not used or needed:
  - Files
    - C:\OS2\OS2_13.RC
    - C:\OS2\WIN_30.RC
    - C:\OS2\INSTALL\OS2*.INI
    - C:\OS2\INSTALL\CONFIG.SYS
  - Directories (and everything contained)
    - C:\OS2\MDOS\WINOS2
    - C:\OS2\MDOS
    - C:\OS2\APPS
- Copy the CONFIG.SYS file to the C:\OS2\INSTALL subdirectory (type `COPY \CONFIG.SYS \OS2\INSTALL` at the command prompt).

> ┌─ **Tip** ──┐
>
> From now on until the installation and configuration of the 3172 Offload
> system is completed, back up the CONFIG.SYS file to the C:\OS2\INSTALL
> subdirectory each time you complete an installation section and name
> the files serially. For example, after installing OS/2 2.1, name the backup
> file CONFIG.001; after installing TCP/IP for OS/2, name the backup file
> CONFIG.002, and so on. This way, if something goes wrong which causes
> the 3172 not to boot completely, you can copy a working CONFIG.SYS
> backup file to the root directory after booting the 3172 using the OS/2 2.1
> Installation Diskette and Diskette 1.
>
> └──┘

- Edit the CONFIG.SYS file with the following revisions (start the OS/2 System
  Editor which is in the OS/2 System - Productivity folder):

  − Insert this line after the SET AUTOSTART= line:

    ```
    SET RESTARTOBJECTS=STARTUPFOLDERSONLY,REBOOTONLY
    ```

  − Erase all non-existent subdirectories from the following lines:

    - LIBPATH= (C:\OS2\APPS\DLL, C:\OS2\MDOS)

    - SET PATH= (C:\OS2\APPS, C:\OS2\MDOS\WINOS2)

    - SET DPATH= (C:\OS2\APPS, C:\OS2\MDOS\WINOS2, C:\OS2\MDOS)

    - SET HELP= (C:\OS2\HELP\TUTORIAL)

    Directories in these lists are searched sequentially for specific files.
    OS/2 will have to search and go through each subdirectory whether or
    not it exists and whether or not it contains files. It will help performance
    to remove non-existent or empty directories and to order the list such
    that the location of the most used files are placed at the start of the list.

  − Insert the following lines at the end of the file:

    ```
    CALL=C:\OS2\XCOPY.EXE C:\OS2\INSTALL\OS2*.INI C:\OS2\INSTALL\OS2*.IN2
    CALL=C:\OS2\XCOPY.EXE C:\OS2\OS2*.INI C:\OS2\INSTALL\OS2*.INI
    ```

    > ┌─ **Note** ──┐
    >
    > These two lines will automatically back up the INI files each time you
    > start the 3172. A backup copy of the current INI files and a backup
    > copy of the INI files as they existed at the previous startup will be
    > made.
    >
    > In case the INI files become corrupted (usually indicated by the
    > desktop failing to come up), copy the older set of INI files into the
    > C:\OS2 subdirectory using this command after booting the 3172 using
    > the OS/2 2.1 Installation Diskette and Diskette 1:
    >
    >   COPY C:\OS2\INSTALL\OS2*.IN2 C:\OS2\OS2*.INI
    >
    > └──┘

  − Insert this line before the SHELL= statement:

    ```
    PROTECTONLY=YES
    ```

    When PROTECTONLY is set to YES, OS/2 does not load the necessary code to
    support DOS sessions. This results in a more reliable system because
    there is better memory management of the system. This also saves
    memory which can otherwise be used for OS/2-specific code.

  Save the file (select **File**, select **Save**, and specify **Plain text** if it prompts you
  for a file type).

• Install the fix for OS/2 2.1 WPS component.

   Follow the instructions which come with the fix package.

OS/2 Version 2.1 is now installed and configured on the 3172. Shut down OS/2 and reboot your 3172 at this time to activate the changes you have made.

```
┌─ Shutdown ──────────────────────────────────────────────────────────┐
│                                                                       │
│  To shut down OS/2 using a keyboard, follow these steps:              │
│  Step   1. Press Ctrl+Esc to bring up the Window List.                │
│  Step   2. Use the arrow keys to highlight Desktop - Icon View and press Enter │
│             to select the Desktop window.                             │
│  Step   3. Press Ctrl+\ (backslash) to deselect all objects from the Desktop │
│             then press Ctrl+F10 to bring up the Desktop pop-up menu.   │
│             Highlight Shutdown... then press Enter.                   │
│  Step   4. Continue to follow the dialog box instructions to complete the │
│             shutdown.                                                  │
│                                                                       │
│  To shut down OS/2 using the mouse, follow these steps:               │
│  Step   1. Place the mouse pointer on an empty portion of the Desktop. │
│  Step   2. Click the right mouse button to bring up the Desktop pop-up menu. │
│  Step   3. Click on Shutdown...                                       │
│  Step   4. Continue to follow the dialog box instructions to complete the │
│             shutdown.                                                  │
│                                                                       │
└───────────────────────────────────────────────────────────────────────┘
```

3.5.4 Installing IBM TCP/IP Version 2.0 for OS/2 Base Kit

The following steps describe the installation procedures for IBM TCP/IP Version 2.0 for OS/2 Base Kit with LAN Adapter and Protocol Support (LAPS).

Step   1. Turn on the 3172 and when the OS/2 Desktop has started, open an OS/2 Window.

Step   2. Insert the IBM TCP/IP Version 2.0 for OS/2 Base Kit Diskette 1 in the disk drive.

Step   3. At the OS/2 prompt, type A:\TCPINST then press Enter to start the installation process. The Installation Tool window is displayed after a few seconds.

Step   4. Select Base TCP/IP for OS/2 in the Install section.

Step   5. Verify that the directory name for installation is C:\TCPIP.

Step   6. Select the Install/run LAN Adapter and Protocol Support (LAPS) entry and make sure the box beside it contains a checkmark.

Step   7. Deselect the Configure network connections entry and make sure the box beside it does *not* contain a checkmark.

Step   8. Select **Install** then press Enter.

Step   9. Press Enter to confirm the target directory for installation.

Step 10. When the installation has finished, select **OK** and press Enter.

Step 11. *DO NOT* configure LAPS at this time. Select **Exit** and press Enter.

Step 12. Select **Continue** to update CONFIG.SYS.

Step 13. Select **OK** to confirm changes to CONFIG.SYS.

Step 14. Select **Exit** to exit LAPS.

IBM TCP/IP Version 2.0 for OS/2 is now installed on the 3172. Shut down OS/2 and reboot your 3172 at this time to activate the changes you have made.

3.5.5 Configuring IBM TCP/IP Version 2.0 for OS/2 Base Kit

The following steps describe the steps to configure IBM TCP/IP Version 2.0 for OS/2 Base Kit with LAN Adapter and Protocol Support (LAPS) for an Offload system.

┌─── **Note** ───┐

Do not follow the installation instructions found in the IBM TCP/IP Version 2 Release 2.1 for MVS: Offload of TCP/IP Processing or IBM TCP/IP Version 2 Release 2 for VM: Offload of TCP/IP Processing manuals -- this is for TCP/IP Version 1.2.1 for OS/2. You can follow the instructions found in the OFFLOAD.DOC file on the Offload Feature diskette 1.

└──┘

Step   1. Turn on the 3172 and when the OS/2 Desktop has started, open an OS/2 Window.

These messages might appear when you start the 3172 after installing IBM TCP/IP Version 2.0 for OS/2 Base Kit:

```
MSGP102E No message for nnscamsg 9 (ibmnsca) args= 8504 8496
MSGP102E No message for nnscamsg 2 (ibmnsca) args= 1
SYS102I: The device driver "C:\IBMCOM\MACS\IBMNSCA.OS2"
                specified in the DEVICE command on line 55 of the
                CONFIG.SYS file was not installed, line 55 is ignored.
```

These appear because we have not yet configured LAPS. There is nothing wrong with the installation. Just proceed and the problem will be corrected by the succeeding steps.

Step   2. At the OS/2 prompt, type TCPIPCFG then press Enter.

The TCP/IP Configuration notebook is displayed after a few moments.

Step   3. For each adapter installed in your machine, define and enable a LAN adapter. Press Tab to get to the Enable LAN Adapter line and press the spacebar to enable, wherein a checkmark should appear beside the line.

┌─── **Tip** ──┐

Use the Offload Adapters Worksheet when enabling your LAN adapters. See A.2, "Worksheets for 3172 Offload of TCP/IP" on page 359, ″Worksheets for 3172 Offload of TCP/IP″ for a copy of a blank worksheet.

└──┘

Step   4. Press Tab to get to the IP Address field and fill in the appropriate address for your adapter.

Step   5. Press Tab again and fill in the Subnet Mask for the adapter.

┌─ **Important** ─────────────────────────────────┐
│   │
│ • If you are running the Ethernet adapter on an Ethernet 802.3 │
│   network, select Enable 802.3 for that adapter.   │
│   │
│   You should select Enable 802.3 *only* if you are running with an │
│   Ethernet 802.3-type network. Most Ethernet networks are │
│   Ethernet V2-type networks, which do not require this parameter. │
│   Ensure that you are running with Ethernet 802.3 and not │
│   Ethernet V2 before selecting this parameter.   │
│   │
│ • If you are using Fiber Distributed Data Interface (FDDI) adapters, │
│   select Disable routing field support and Canonical addresses. │
│   │
└───┘

Do this step for each token-ring, Ethernet, and FDDI adapter.
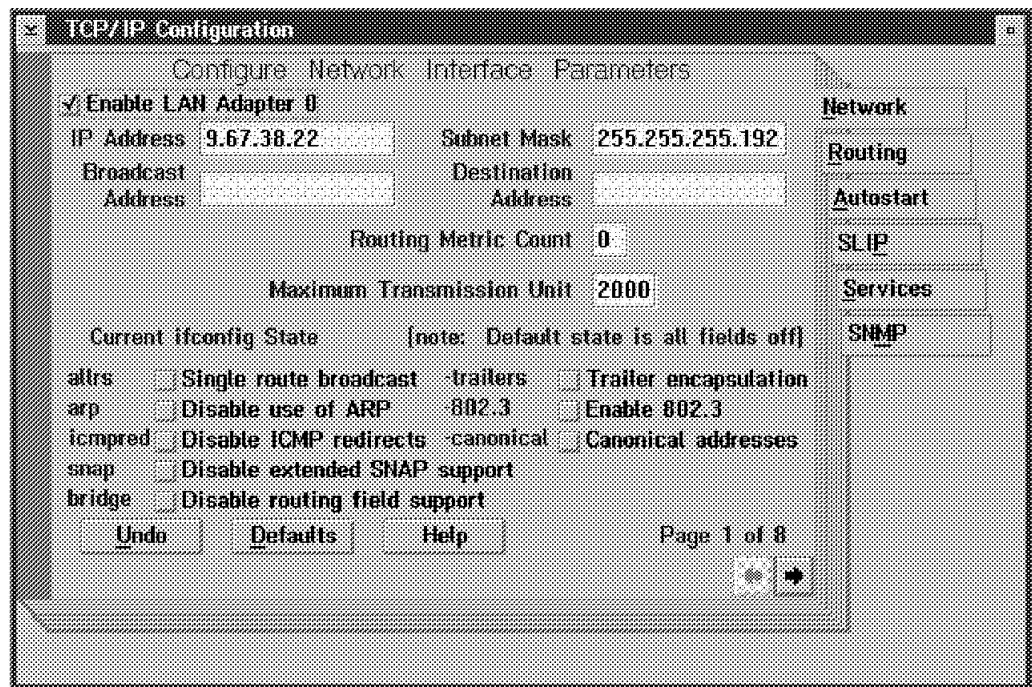
Figure 83. TCP/IP Configuration Network Page for LAN Adapter 0 (Token-Ring)

To configure another LAN adapter, press Alt+PgDn to go to the next adapter page (or Alt+PgUp to go to the previous adapter page).

Step   6. Go to the next adapter page after the last LAN adapter page and enable a LAN adapter for the PCA or ESCON adapter in your 3172. Enter 127.1.1.2 as the IP Address and 127.1.1.1 as the Destination Address for the adapter. Leave the Subnet Mask and Broadcast Address fields blank.

> **Important**
>
> When you reconfigure IBM TCP/IP Version 2.0 for OS/2 and remove (disable) LAN adapters, make sure that all enabled adapters are contiguous. For example, if you previously had LAN Adapter 0 to LAN Adapter 3 enabled and disable what was previously LAN Adapter 2, move the definitions of LAN Adapter 3 to the LAN Adapter 2 page and remove all the definitions in the LAN Adapter 3 page. Otherwise, what was defined in LAN Adapter 3 will not be recognized.

Step 7. If you want to configure Services, press Alt+↑ (Up Arrow) to highlight the current tab in the notebook. Otherwise, exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

Step 8. Press **S** to go to the first page of the Services section.

> **Warning!**
>
> • You should not configure IBM TCP/IP Version 2.0 for OS/2 to start any clients or servers in the Autostart section unless you start them on different ports than those defined on the host.
>
> • Do not change the routing table in IBM TCP/IP Version 2.0 for OS/2 whether RouteD is running or not. The host downloads a copy of its routing table to the Offload host.
>
> • Do not run the IBM TCP/IP Version 2.0 for OS/2 SNMP daemon. Use the SNMP program that is installed from the Offload Feature diskette.

Notes:

a. The information in the Services section is local to IBM TCP/IP Version 2.0 for OS/2 on the 3172 and is not used by the MVS or VM host.

b. You do not need to configure the routing tables. The MVS or VM host automatically downloads routing tables to the 3172 when Offload starts.

Step 9. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.5.6 Installing the PCA or ESCON Adapter Device Driver

The following steps describe the steps to install the parallel channel adapter or ESCON adapter device drivers.

Step 1. Insert the Offload Feature diskette 1 in the disk drive.

Step 2. At an OS/2 command prompt, enter A**:**\INSTALLD and press Enter. Wait for the files to be copied.

The parallel channel adapter or ESCON adapter drivers are now installed.

3.5.7 Configuring LAPS for OS/2

The following steps describe how to configure the LAN Adapter and Protocol Support (LAPS) for OS/2.

Step 1. At an OS/2 command prompt, enter C:\IBMCOM\LAPS and press Enter.

Step 2. At the main menu for the LAPS utility, select **Configure**. The Configure Workstation window allows you to tell the system which adapters you have installed and how you previously defined them in the TCP/IP Configuration notebook.

Step 3. At the Configuration dialog box, select **Configure LAN Transports** then press Enter or **Continue...**.

Step 4. At the Configure Workstation window, select a network adapter by moving the cursor to the Network Adapters field. Use the Up (↑) and Down (↓) Arrow keys to scroll through the various network adapters. Once you have found the correct adapter, highlight it and press Enter. The adapter name appears in the Current Configuration box.

```
┌─ Important ──────────────────────────────────────────────────┐
│                                                               │
│  Use the proper adapter name for the adapter type you have.   │
│                                                               │
│  Adapter Type        Adapter Name                             │
│                                                               │
│  ESCON (NSCA)        IBM NSCA (ESCON) 370 Channel Attach      │
│                                                               │
│  Ethernet            IBM Busmaster Ethernet Adapter           │
│                                                               │
│  FDDI                IBM PS/2 FDDI Adapter Device Driver       │
│                                                               │
│  PCA                 IBM PCA 370 Channel Attach               │
│                                                               │
│  Token-Ring          IBM Token-Ring Network Busmaster Server  │
│                      Adapter                                   │
│                                                               │
│  You must define either a PCA or an ESCON adapter to run Offload.│
│                                                               │
└───────────────────────────────────────────────────────────────┘
```

Step 5. Press Tab to highlight the Add box under the Protocols field and press Enter. A number and IBM TCP/IP appear under your defined adapter in the Current Configuration box. *This number should correspond to the LAN Adapter number of that adapter's definition in the TCP/IP Configuration notebook.* For example, the first adapter you configured in the notebook (LAN Adapter 0) should be designated 0 here.

```
┌─ For Ethernet adapters ──────────────────────────────────────┐
│                                                               │
│  If you installed an Ethernet adapter on the 3172, you must   │
│  take the following additional steps to ensure proper operation:│
│                                                               │
│  Step  1. Press Tab to go to the Current Configuration box,   │
│           and use the Up (↑) and Down (↓) Arrow keys to select│
│           the IBM Busmaster Ethernet Adapter.                 │
│                                                               │
│  Step  2. Press Tab to select the Edit button and press Enter.│
│                                                               │
│  Step  3. When the Edit window is displayed, press Tab to go  │
│           to the Micro Channel Slot Number line and enter the │
│           slot number in which the Ethernet adapter is        │
│           installed in the machine. Use the Offload Adapters  │
│           Worksheet to confirm the slot number in which the   │
│           adapter is located.                                 │
│                                                               │
│  Step  4. Press OK to close the window.                       │
│                                                               │
└───────────────────────────────────────────────────────────────┘
```
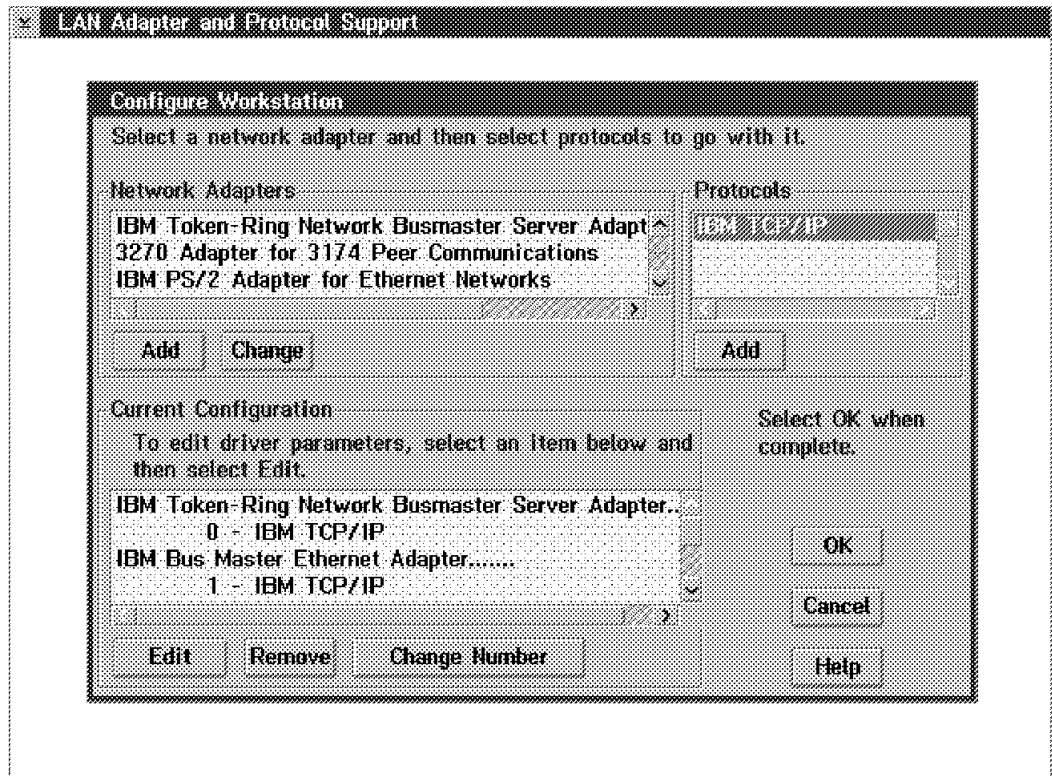
Figure 84. LAPS Configure Workstation Window Showing LAN Adapters 0 and 1

For locally-administered address users

If you are using locally-administered addresses on your network, you must take the following steps to ensure proper operation:

Step 1. Press Tab to go to the Current Configuration box, and use the Up (↑) and Down (↓) Arrow keys to select each network adapter.

Step 2. Press Tab to select the Edit button and press Enter.

Step 3. When the Edit window is displayed, press Tab to go to the Network adapter address line and enter the locally-administered address of that particular network adapter. Use the Offload Adapters Worksheet to confirm the address for the adapter.

Step 4. Press **OK** to close the window.

Note: Leave all other parameters at their default values.

```
┌─────────────────────────────────────────────────────────────┐
│░Parameters░for░IBM░Token-Ring░Network░Busmaster░Server░Adapter░│
│░Edit░the░parameters░as░needed.░                                │
│                                                               │
│                                                               │
│   Network adapter address              ┌─────────────────┐    │
│                                        │ 4000011C3172    │    │
│                                        └─────────────────┘    │
│   Adapter card buffer size             ┌─────────────────┐    │
│                                        │ 1032            │    │
│                                        └─────────────────┘    │
│   Minimum adapter card transmit buffers ┌────────────────┐    │
│                                        │ 4               │    │
│                                        └─────────────────┘    │
│   Maximum adapter card transmit buffers ┌────────────────┐    │
│                                        │ 48              │    │
│                                        └─────────────────┘    │
│   Maximum number of queued transmits   ┌─────────────────┐    │
│                                        │ 31              │    │
│                                        └─────────────────┘    │
│   Minimum number of adapter driver receive buffers ┌────────┐ │
│                                        │ 20              │    │
│                                        └─────────────────┘    │
│   Size of adapter driver receive buffer ┌────────────────┐    │
│                                        │ 2048            │    │
│                                        └─────────────────┘    │
│                                                               │
│  ┌────────┐  ┌────────┐  ┌────────┐  ┌────────┐               │
│  │   OK   │  │ Cancel │  │ Range  │  │  Help  │               │
│  └────────┘  └────────┘  └────────┘  └────────┘               │
└─────────────────────────────────────────────────────────────┘
```

Figure 85. Edit Adapter Parameters Window for a Token-Ring Busmaster Adapter

Step 6. Repeat the previous steps for all your adapters, including your PCA or ESCON adapter.

Step 7. Select **OK** when you are done.

Step 8. Select **Exit** at the main LAPS window to exit.

Step 9. Select **Continue** to update your CONFIG.SYS file.

Step 10. Select **OK** to confirm changes to CONFIG.SYS.

Step 11. Select **Exit** to exit LAPS.

LAPS for OS/2 is now configured.

3.5.8 Installing and Configuring the Offload Feature

This section describes the steps to install and configure the Offload feature on your 3172 Offload machine from the Offload Feature diskettes.

Step 1. Insert the Offload Feature diskette 1 in the disk drive. At an OS/2 command prompt, enter A:\INSTALL to automatically load the Offload feature onto your machine. Press Enter after reading the information that comes up on the screen.

Step 2. The utility installs the files on your fixed disk and configures the system according to your specifications.

Note: You can change the system configuration without reinstalling the program by running the OFFSETUP program. The OFFSETUP program can change the channel settings for your PCA or ESCON adapter, or can be used to switch your system configuration between PCA and ESCON channel adapter types. You should not need to run the installation program more than once per machine since it installs all of the files needed for both PCA and ESCON.

Step 3. After the Offload files are installed on the 3172 fixed disk, you will be prompted to say whether you have a PCA or ESCON adapter installed.

Enter the appropriate choice for the adapter you have installed in your machine and press Enter.

Step   4. A window is then displayed prompting you for your base subchannel address. Enter the base subchannel address for your machine and press Enter. The base subchannel address is a two-digit hexadecimal number from 00 to FE.

For our ITSO setup, we entered 40.

Step   5. If you are configuring a PCA adapter, you will be given a list of the available Data Transfer Speeds. Select the channel data transfer speed, or press Enter to accept the default.

Step   6. If you are configuring an ESCON adapter, you will be prompted to enter the path through your ESCON director (ESCD). The path is entered as a three-digit hexadecimal number composed of two parts. The first two digits are the ESCD port address where the ESCON channel is plugged in (in our case, E1). The final digit is the logical address specified in the CUADD parameter in the IOCP definition (in our case, 1). Enter the hexadecimal value that determines the path through the ESCON director for your particular machine. For more details about the IOCP definitions, see 3.4.1, "IOCP Definition" on page 149.

Note: If two directors are used, the first two hex digits should reflect the port on the dynamic ESCD. If the CUADD parameter of the CNTLUNIT macro is not set, then 0 should be used. If there is no ESCD between the 3172 and the S/390, then the default of 010 should be used.

For our ITSO setup, we entered E11. SNMP

Step   7. You will be asked whether you want to start the SNMP subagent. If you want to monitor the Offload host with the MVS or VM SNMP agent, you must start the Offload SNMP subagent. To start the subagent, enter Y (Yes) to Do you want to start the Offload SNMP Subagent?

For the ITSO setup, enter Y.

Step   8. If you entered Y (Yes) to start the Offload SNMP subagent, you must enter your SNMP community name that was defined in the PW.SRC file or data set when the SNMP server was set up in TCP/IP for VM or MVS and press Enter.

For our ITSO setup, we entered public.

Step   9. Remove the Offload Feature diskette then shut down OS/2.

Offload feature is now installed and configured on the 3172.

3.6 Using the 3172 Offload Host

The following section describes the operation of the 3172 Offload host. See Chapter 6, "Using the Offload System" in the *IBM TCP/IP Version 2 Release 2.1 for MVS: Offload of TCP/IP Processing* or Chapter 7, "Using the Offload System" in the *IBM TCP/IP Version 2 Release 2 for VM: Offload of TCP/IP Processing* for more information about monitoring the Offload system.

Using the 3172 Offload host involves the following tasks:

  • Starting the 3172 Offload host

  • Shutting down the 3172 Offload host

- Reconfiguring the 3172 Offload host
- Reestablishing connection after a failure

3.6.1 Starting the 3172 Offload Host

Step   1. Switch on the 3172 and wait for OS/2 to complete its startup.

Step   2. When the startup is complete, check all the running subsystems by opening the OS/2 Window List (press Ctrl+Esc or click both mouse buttons simultaneously).

Aside from Desktop - Icon View, TCP/IP Offload Server should be on the list. If you configured to start the SNMP subagent, TCP/IP Offload SNMP Subagent should also be on the list as shown in Figure 86 .

Figure 86. Window List after Offload Startup

Step   3. Display the TCP/IP Offload Server window by selecting TCP/IP Offload Server and then pressing Enter. A window similar to Figure 87 appears. This is the TCP/IP Offload Server which is started automatically.
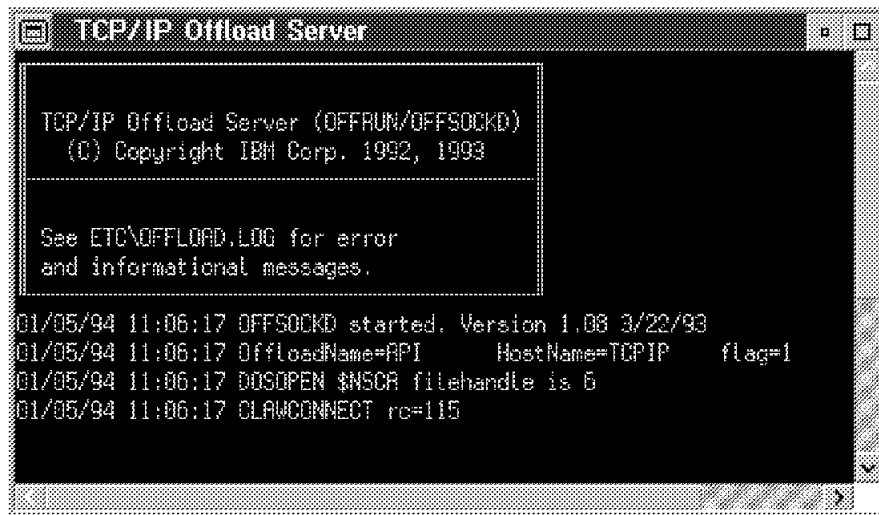
Figure 87. Offload Server Startup Window

If this does not occur, see Appendix B, ″Problem Determination,″ of the *IBM TCP/IP Version 2 Release 2.1 for MVS: Offload of TCP/IP Processing* or *IBM TCP/IP Version 2 Release 2 for VM: Offload of TCP/IP Processing* to determine the problem and appropriate solution.

Step   4. Start TCP/IP on your (MVS or VM) host system.

The following is sample output from a started TCP/IP address space.

```
TCPIPI008I    Initializing...
TCPIPI009I Real channel program support is being used
TCPIPI005I Trying to open TCPIP18.RAIANJE.TCPIP
TCPIPI006I Using profile file TCPIP.ITSC.RAIANJE.TCPIP
TCPCLW080I CLAW initializing:
TCPPRI385I  Device OFFDEV:
TCPPRI386I     Type: CLAW, Status: Not started
TCPPRI387I     Envelope queue size: 0
TCPPRI448I     Address: 0340 Host name: TCPIP Adapter name: OS2TCP Control Task
TCPSTM237I Telnet server: Using port 23
TCPSTM239I Telnet server: No inactivity timeout
TCPSTM240I Telnet server: Every 600 seconds a timing mark option packet will be sent
TCPSTM243I *****************************************
TCPSTM244I Log of IBM TCP/IP Telnet Server Users started on 12/20/93 at 14:56:45
TCPSTM245I
TCPSTM248I Telnet server: Using line-mode translate table TCPIP.ITSC.TELNETSE.TCPXLBIN
TCPIPI023I TCP-IP initialization complete.
TCPCLW112I Claw device OFFDEV: System validate completed.
TCPOFP102I Offload box OFFDEV: OffloadReady now true. Ready to establish sockets.
```

Figure 88. Started MVS TCP/IP Address Space Output

Once these steps have been completed, your Offload system should be up and
running. Enter netstat devlinks on the TSO command prompt to verify that
Offload is indeed up and running. The output should look like Figure 89. Take
note of the Status and OffloadReady fields.

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> netstat devlinks

MVS TCP/IP Netstat V2R2.1

1 Device OFFDEV      Type: CLAW        Status: Ready     OffloadReady: Y
  Queue size: 0          Address: 0340
2 Link OFFIPLINK    Type: Off-IP      Net number: 1
3 Link OFFTR1       Type: OffAPIbroad Net number: 0
4 Link OFFEN1       Type: OffAPIbroad Net number: 0
5 Link OFFFD1       Type: OffAPIbroad Net number: 0
***
```

Figure 89. Started MVS TCP/IP Netstat Devlinks Output

1   Device definition for the Offload 3172 OFFDEV.

2   IP link definition for OFFDEV's IP link OFFIPLINK.

3   API link definition for OFFDEV's API link OFFTR1. In this case, the API link is a
    token-ring adapter.

4   API link definition for OFFDEV's API link OFFEN1. In this case, the API link is
    an Ethernet adapter.

5   API link definition for OFFDEV's API link OFFFD1. In this case, the API link is
    an FDDI adapter.

3.6.2 Shutting Down the 3172 Offload Host

- Use the following steps to stop the Offload server and reconfigure the Offload host.

  Step 1. Press Ctrl+Esc to bring up the Window List.

  Step 2. Select **TCP/IP Offload Server** from the list. The TCP/IP Offload Server window becomes the active window.

  Step 3. Press Ctrl+C (Break). You will get the OS/2 command prompt [C:\].

  You can now run the OFFSETUP utility to reconfigure the Offload host, or run the installation utility to reinstall the Offload Feature diskette.

  You must shut down OS/2 and reboot the 3172 (press Ctrl+Alt+Del) to restart the Offload system.

- Use the following steps to stop the Offload server and completely shut down the 3172.

  − To shut down OS/2 using a keyboard, follow these steps:

    Step 1. Press Ctrl+Esc to bring up the Window List.

    Step 2. Use the arrow keys to highlight **Desktop - Icon View** and press Enter to select the Desktop window.

    Step 3. Press Ctrl+\ (backslash) to deselect all objects from the Desktop then press Ctrl+F10 to bring up the Desktop pop-up menu. Highlight **Shutdown...** then press Enter.

    Step 4. Continue to follow the dialog box instructions to complete the shutdown.

    Step 5. Turn off the 3172 when shutdown is complete.

  − To shut down OS/2 using the mouse, follow these steps:

    Step 1. Place the mouse pointer on an empty portion of the Desktop.

    Step 2. Click the right mouse button to bring up the Desktop pop-up menu.

    Step 3. Click on **Shutdown...**

    Step 4. Continue to follow the dialog box instructions to complete the shutdown.

    Step 5. Turn off the 3172 when shutdown is complete.

3.6.3 Reconfiguring the 3172 Offload Host

The OFFSETUP program allows you to change the Offload configuration of the 3172 without reinstalling the entire Offload product. It is placed in your C:\OFFLOAD subdirectory by the installation program. Follow the following steps to run the OFFSETUP program:

Step 1. At an OS/2 command prompt, type C:\OFFLOAD\OFFSETUP and press Enter.

Step 2. Enter the new configuration information when prompted. See 3.5.8, "Installing and Configuring the Offload Feature" on page 161 for more details about the configuration information.

Step 3. Bring down OS/2 using the shutdown procedures and restart the 3172 to implement the changes.

If you are running the OFFSETUP program and want to exit without making any changes, enter Ctrl+C (Break) when you are prompted for information and press Enter. This will bring you back to the OS/2 command prompt.

3.6.4 Reestablishing Connection after a Failure

There will be cases when you have to re-establish the communication link between the MVS or VM host and the Offload host. The first case involves a failure or shutdown in the MVS/VM host side of the TCP/IP address space/user IDs or the operating system itself. The second case involves a failure or shutdown of the Offload host. The third case involves a failure in any component between the two like channel cables, interface cards, or ESCON directors.

If any of the above occurs, you have to restart the TCP/IP address space or user ID using the following steps. This will restart all defined links and will reconnect the address space to the Offload host.

Note: When a Offload host adapter fails, you can use the OBEYFILE command to stop, repair and start the Offload host.

Step 1. Check if the Offload host is operational. To do this, open the OS/2 Window List (press Ctrl+Esc or click both mouse buttons simultaneously).

Aside from Desktop - Icon View, TCP/IP Offload Server should be on the list. If you configured to start the SNMP subagent, TCP/IP Offload SNMP Subagent should also be on the list as shown in Figure 86 on page 163 .

Step 2. Verify that *all* LAN interfaces on the Offload host are active by using the PING command.

Type the following at an OS/2 command prompt for each LAN adapter:

PING *IP address of LAN adapter*

In the ITSO Offload environment, the three commands are:

PING 9.67.38.22
PING 9.67.32.22
PING 9.67.38.200

and the screen in Figure 90 is a sample output of a successful PING.

```
[C:\]ping 9.67.38.22
PING 9.67.38.22: 56 data bytes
64 bytes from 9.67.38.22: icmp_seq=0. time=31. ms
64 bytes from 9.67.38.22: icmp_seq=1. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=2. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=3. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=4. time=0. ms

----9.67.38.22 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/6/31

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Figure 90. PING Command Issued for the Token-Ring Adapter from OS/2 TCP/IP

Note: Press Ctrl+C (Break) to stop the PING command.

Step 3. When you have verified that the Offload host is completely operational, you can now start the MVS or VM host TCP/IP address space or user ID. This will start all the defined links and you should get output similar to that shown in Figure 88 on page 164.

Step 4. To finally verify the connection, try the PING command on the MVS or VM host.

The screen in Figure 91 is a sample output of a successful PING to an Offload host adapter while the screen in Figure 92 is a sample output of a successful PING to another host on the network. (Host 9.67.38.29 was a PS/2 on the token-ring running IBM TCP/IP Version 2.0 for OS/2.)

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.38.22

TCPPNG015I Ping V2R2.1: Pinging host 9.67.38.22.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.018 seconds. Successes so far 1.
***
```

Figure 91. PING Command Issued for the Token-Ring Adapter from MVS TCP/IP

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.38.29

TCPPNG015I Ping V2R2.1: Pinging host 9.67.38.29.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.023 seconds. Successes so far 1.
***
```

Figure 92. PING Command Issued for Another Host from MVS TCP/IP

Note: For more information about the PING command on the MVS or VM systems, see *IBM TCP/IP Version 2 Release 2.1 for MVS: User's Guide* or *IBM TCP/IP Version 2 Release 2 for VM: User's Guide*.

Once these steps are completed, you can use the link provided by the Offload host.

3.7 Scenario 1 - TCP/IP over Token-Ring

The following section describes the conditions, requirements, and setup considerations that are applicable when using the 3172 Offload host as a LAN host gateway between an S/390 host running TCP/IP and a token-ring LAN-attached workstation. The section will also describe tests which will verify the connectivity between the S/390 host and the workstation.

```
┌──────────────────────────────────────────────────────────────────────────────────────────┐
│                                                                                            │
│                  ┌─────────────────────┐                                                   │
│                  │     MVS/ESA 4.3      │                                                   │
│                  │                     │                                                   │
│                  ├─────────────────────┤                                                   │
│                  │    TCP/IP  2.2.1     │                                                   │
│                  └─────────────────────┘                                                   │
│                                                                                            │
│              ESCON          Subchannel                   ┌─────────────────────┐           │
│              Attached       Addr : 340                   │    PS/2 Model 80     │           │
│                  ┌─────────────────────┐                 │                     │           │
│                  │    ESCON Adapter     │                 │      OS/2 2.1       │           │
│                  │                     │                 │     TCP/IP 2.0       │           │
│                  ├─────────────────────┤                 ├─────────────────────┤           │
│                  │    3172 Model 3      │  * * * * * *─── │     Token Ring       │           │
│                  │                     │   *         *   │      Adapter         │           │
│                  │      OS/2 2.1       │  * Token Ring * IP Addr : 9.67.38.29             │
│                  │     TCP/IP 2.0       │  * LAN   4 Mb * LAA     : 4000 0003 2257         │
│  IP Addr : 9.67.38.22  ├─────────────┤   *         *                                       │
│  LAA     : 4000 011C 3172 │ Token Ring │    * * * * * *                                     │
│                  │      Adapter        │──────                                             │
│                  └─────────────────────┘                                                   │
│                                                                                            │
└──────────────────────────────────────────────────────────────────────────────────────────┘
```
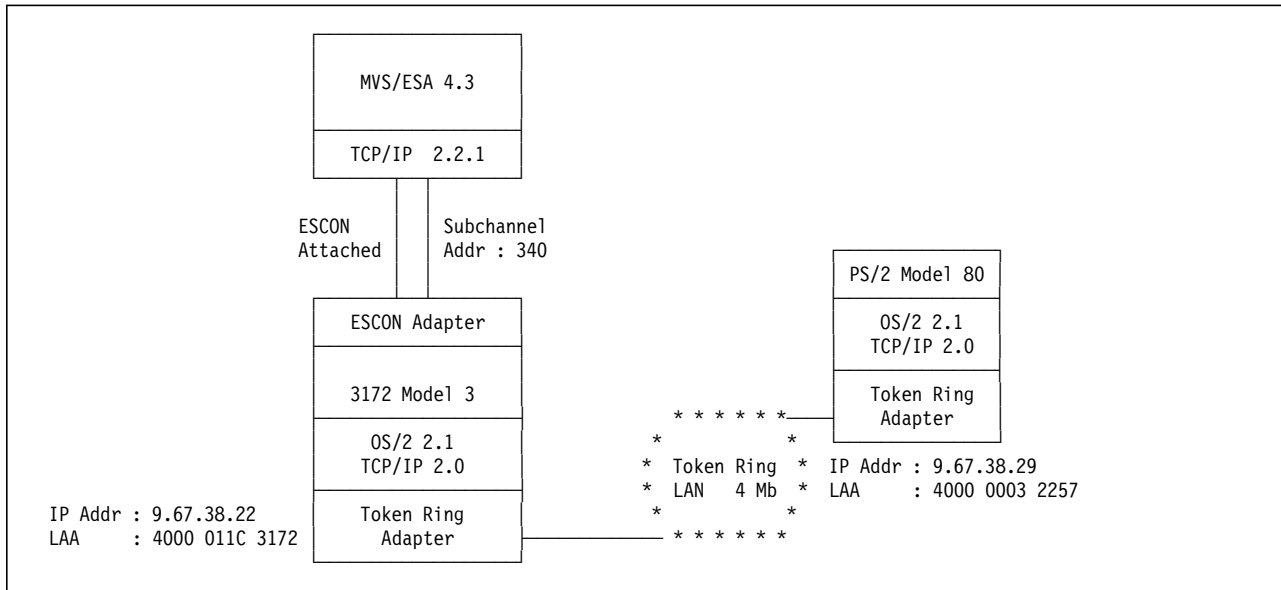
Figure 93. Scenario 1 -- TCP/IP over Token-Ring

> This scenario applies to setups wherein the 3172 Offload host is used as a
> TCP/IP LAN gateway between a token-ring LAN-attached workstation and an
> S/390 host. In this scenario, the S/390 host must be directly connected to the
> 3172 through either a parallel channel adapter or an ESCON adapter.
> Meanwhile, the token-ring LAN-attached workstation need not be in the same
> physical ring as the 3172 Offload host, but should be on the same logical ring.

3.7.1 Host Definitions

IOCP Definitions:

Channel path definition:

```
    CHPID   PATH=((18)),TYPE=CNC,SWITCH=E1
```

Control unit and device definitions with logical addressing = 1 for the Offload
3172:

```
            CNTLUNIT  CUNUMBR=340,UNIT=3172,PATH=(18),          X
                      CUADD=1,LINK=(E8),UNITADD=((40,32))
    DEV340  IODEVICE  UNIT=SCTC,ADDRESS=(340,32),               X
                      CUNUMBR=(340)
```

MVS/ESA IODEVICE Macro:

```
    IODEVICE UNIT=SCTC,ADDRESS=(340,32)
```

VM/ESA HCPRIO Definition:

```
    RDEVICE ADDRESS=(340,32),DEVTYPE=CTCA
```

TCP/IP Profile Definitions:

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set.
The selected parameters are the ones deemed to be significant for this scenario.

Buffer definitions:

```
DATABUFFERPOOLSIZE              150  28672
SMALLDATABUFFERPOOLSIZE         1200
TINYDATABUFFERPOOLSIZE          500
```

Device and link definitions:

```
DEVICE OFFDEV    CLAW 340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1 1  OFFDEV
LINK   OFFTR1    OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
```

┌─ **Important** ───┐
│   │
│ In your GATEWAY statements, make sure you use the proper packet size for │
│ each interface you use.   │
│   │
│ Use 1500 for Ethernet, 2000 for token-ring, and 4352 for FDDI.   │
│   │
└──┘

Device startup definition:

```
START OFFDEV
```

3.7.2 3172 Definitions

3172 LAPS for OS/2 Definition:

Step   1. At the Configure Workstation window, make sure that the Current
          Configuration field includes IBM Token-Ring Network Busmaster Server
          Adapter and under it has IBM TCP/IP as shown in Figure 84 on
          page 160.

Step   2. In the Edit Adapter Parameters window for Token-Ring 16/4 Busmaster
          Adapter, enter the network address of the token-ring adapter,
          4000011C3172 as shown in Figure 85 on page 161. Leave all other
          parameters at their default values.

Step   3. Press **OK** to close the window.

Step   4. Select **OK** when you are done.

Step   5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

3172 TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for LAN Adapter 0, enter the
          IP address and subnet mask for the token-ring adapter.

          We used 9.67.38.22 in the IP Address field and 255.255.255.192 in the
          Subnet Mask field.

          The window, when properly filled in, should look like Figure 83 on
          page 157.

Step   2. At the TCP/IP Configuration Network page for the ESCON adapter (LAN
          Adapter 3 for the ITSO environment), we entered 127.1.1.2 in the IP
          address field and 127.1.1.1 in the Destination Address field.

          The window, when properly filled in, should look like Figure 94.
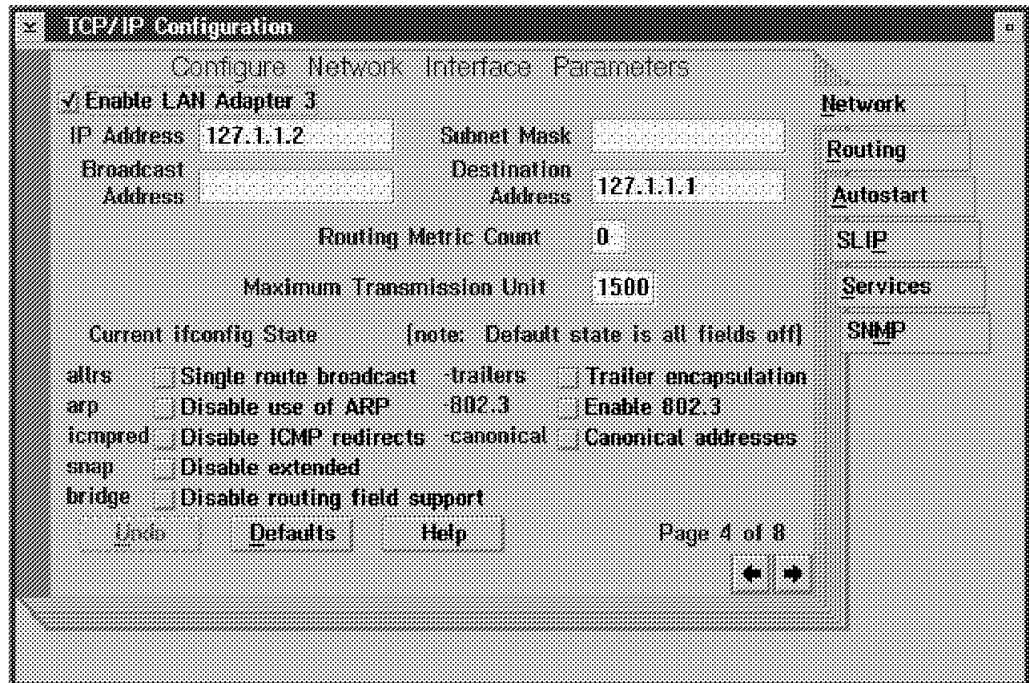
Figure 94. 3172 TCP/IP Configuration Network Page for LAN Adapter 3 (ESCON)

Step 3. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.7.3 Workstation Definitions

Workstation LAPS for OS/2 Definition:

Step 1. At the Configure Workstation window, make sure that the Current Configuration field includes the proper token-ring adapter name for the token-ring adapter type you have installed in your workstation. Use IBM Token-Ring Network Busmaster Server Adapter if you have an IBM Token-Ring 16/4 Busmaster Adapter installed or IBM Token-Ring Network Adapters if you have an IBM Token-Ring Network 16/4 Adapter/A installed. Ensure that IBM TCP/IP is included under the name for the token-ring adapter as shown in Figure 95.
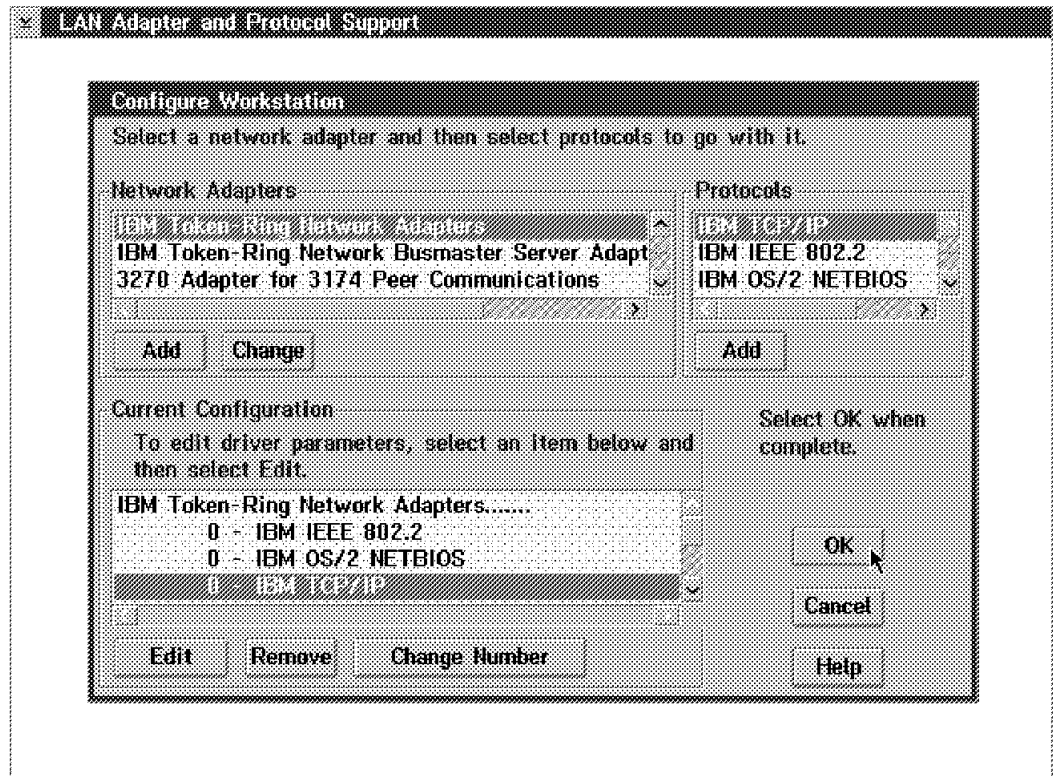
Figure 95. LAPS Configure Workstation Window for Workstation LAN Adapter (Token-Ring)

Step 2. If you are using locally-administered addresses, as in the ITSO setup, be sure to enter the network adapter address for the token-ring adapter in the Edit Adapter Parameters window as shown in Figure 96.

Note: Leave all other parameters at their default values.

```
Parameters for IBM Token-Ring Network Adapters
Edit the parameters as needed.


    Early release                              NO

    Adapter Mode                               PRIMARY

    Network adapter address                    400000032257

    Shared RAM address

    Maximum number of queued transmits         6

    Number of receive buffers                  2

    Receive buffer size                        256

    Number of adapter transmit buffers         1

    Transmit buffer size


       OK           Cancel         Range          Help
```
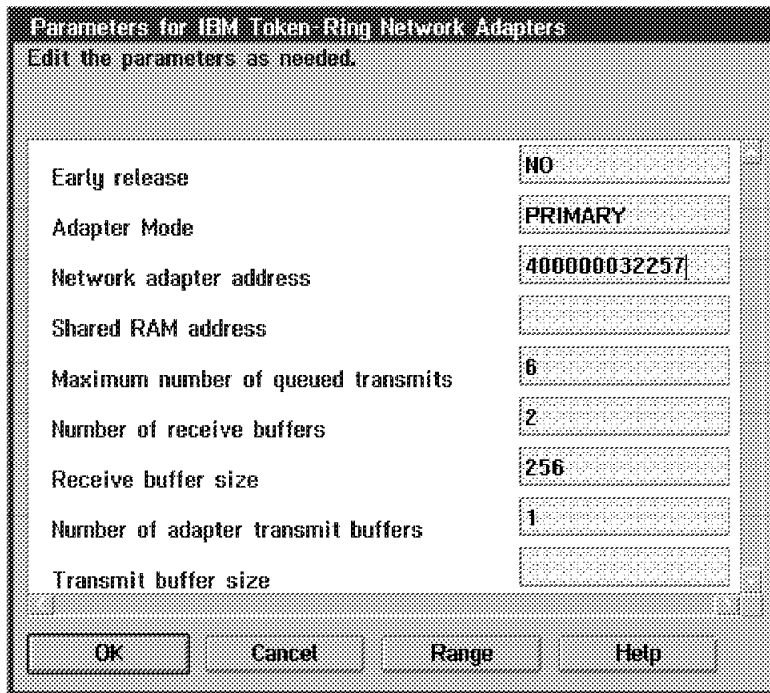
Figure 96. Edit Adapter Parameters for Workstation LAN Adapter (Token-Ring)

Step   3. Press **OK** to close the window.

Step   4. Select **OK** when you are done.

Step   5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

Workstation TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for the token-ring adapter,
           enter the IP address and subnet mask for the token-ring adapter.

           Enter 9.67.38.29 in the IP Address field and 255.255.255.192 in the
           Subnet Mask field.

Step   2. Change the Maximum Transmission Unit to 2000.

┌─ **Important** ──┐
│   │
│ For token-ring LAN-attached workstations, make sure that the MTU   │
│ size is set to *2000*. This applies to both 4 Mbps and 16 Mbps ring │
│ rates.   │
│   │
└───┘

The window, when properly filled in, should look like Figure 97.
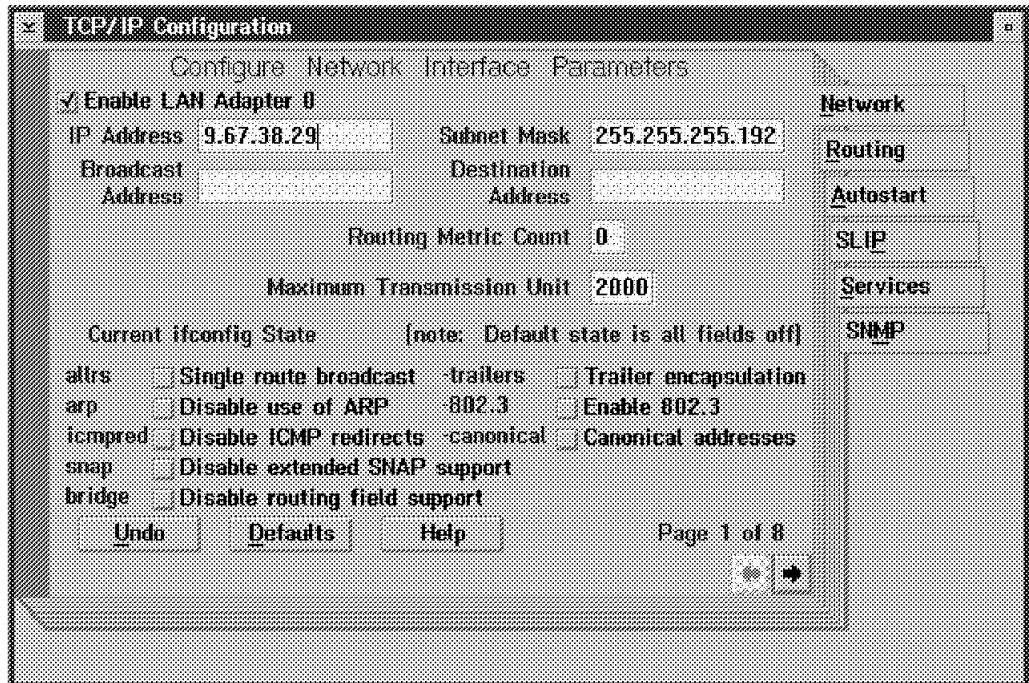
Figure 97. TCP/IP Configuration Network Page for Workstation Token-Ring Adapter

Step 3. Go to the Autostart page by pressing Alt+↑ (Up Arrow) then pressing **A** or by clicking on the Autostart tab.

Select Enable this machine to start the inetd super server, Enable other users to login to this machine, and Enable other users to access your files by using FTP. For the last two items, select the inetd radio button. (We enable these two items so that we can perform the verification tests. For your environment, enable only those you need.)

The window, when properly filled in, should look like Figure 98.
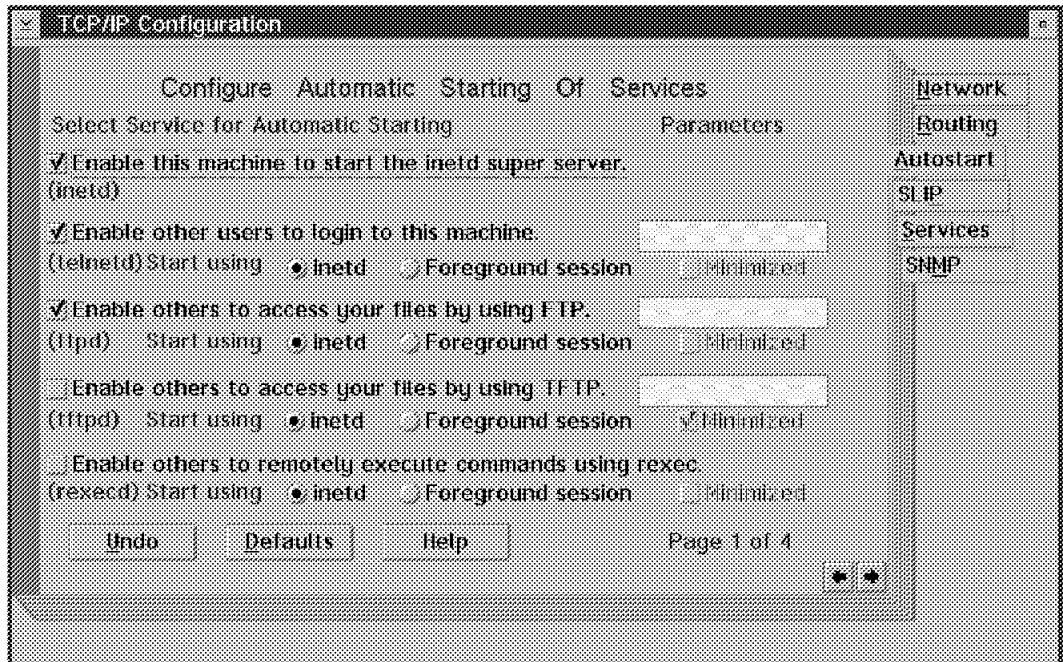
Figure 98. TCP/IP Configuration Autostart Page for Workstation

Step   4. Go to the Services page by pressing Alt+↑ (Up Arrow) then pressing **S** or by clicking on the Services tab.

Step   5. Click on the TRUSERS field, then press the **Edit** button.

Step   6. Enter, in their proper fields, the Username (lapitan in the ITSO setup), Password, and Directory access for read and write (both C:\ in the ITSO setup). Press the **Edit** button to save the settings.

┌─── **Important** ──┐

Entries in the Username field are *case-sensitive*. Make sure you remember this when you FTP into the workstation.

└──┘

Step   7. The window, when properly filled in, should look like Figure 99.
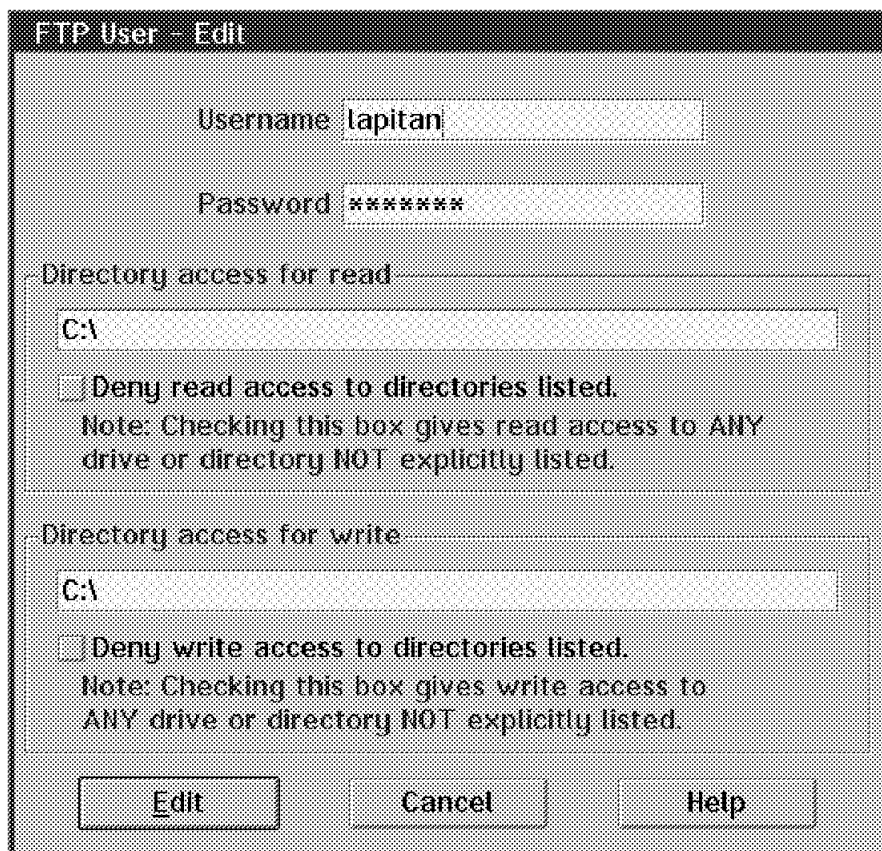
Figure 99. Edit FTP User Window for Workstation

Step   8. Press the Right arrow key ($\rightarrow$) twice to go to Page 3 of 3 of TCP/IP
Configuration Services.

Step   9. Enter the telnet password in the Telnet Password field.

Step 10. Exit and save your settings by closing the TCP/IP Configuration
notebook (press Alt+F4 or double-click on the Title Bar icon).

3.7.4 Verification Tests

Ping from OS/2

```
[C:\]ping 9.67.38.22
PING 9.67.38.22: 56 data bytes
64 bytes from 9.67.38.22: icmp_seq=0. time=31. ms
64 bytes from 9.67.38.22: icmp_seq=1. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=2. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=3. time=0. ms
64 bytes from 9.67.38.22: icmp_seq=4. time=0. ms

----9.67.38.22 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/6/31

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Figure 100. PING Command Issued for MVS TCP/IP from the Workstation

Notes:

 1. Press Ctrl+C (Break) to stop the PING command.

 2. Using this test verifies connectivity to the Offload host and *not* to the S/390 TCP/IP address space. Use the next test to fully verify connectivity between the workstation and the MVS TCP/IP address space.

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.38.29

TCPPNG015I Ping V2R2.1: Pinging host 9.67.38.29.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.023 seconds. Successes so far 1.
***
```

Figure 101. PING Command Issued for the Workstation from MVS TCP/IP

Telnet from OS/2

For this test, we use PMANT, which is an OS/2 Presentation Manager Telnet implementation. To use it, enter PMANT *IP address of remote host* on the OS/2 command prompt.

```
 [C:\]pmant 9.67.38.22
```

Figure 102. PMANT Command Issued for MVS TCP/IP from the Workstation

The screen or window, after entering the command, should look like Figure 103.

```
                                                      Hot Line: 17-6666
                                                      Date . .: 01/13/94
                                                      Time . .: 13:47:19
                                                      Terminal: RAIAE001
          N E T  V I E W
          *******   *******    *******   *********   *******    *******
       **       **  **     **  **     **  **          **    **  **     **
      **    **   **        **         **         **         **       **
      *********   **         **        *********   *******    *******
       **     **  **         **        **          **         **    **
      **       **  **    **   **     **  **          **    **  **     **
     **     **   ******    ******   *********  *******   *******
                                                     S E R V I C E S
        NetView Access Services, Release 3.1 - Program Number 5665-365
           (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

                 Enter Logon information:
                   User . . . . . .        (User ID/LOGOFF)
                   Password . . . .        New Password . .

                   Application  . .
                   Group  . . . . .
                   Location . . . .
PF 1=Help 2=Language
```

Figure 103. NetView Access Services Logon Screen from the Workstation

Note: In our scenarios, the MVS TCP/IP Telnet default application is NetView Access Services. **Telnet from TSO**

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> telnet 9.67.38.29

TCPTEL001I MVS TCP/IP Telnet V2R2.1
TCPUTM110I Connecting to 9.67.38.29, port TELNET (23)
***
```

Figure 104. Telnet Command Issued for the Workstation from MVS TCP/IP

```
TCPUTM118I
TCPUTM119I Using Line Mode...
TCPUTM120I
TCPUTM121I Notes on using Telnet when in Line Mode:
TCPUTM122I - To hide Password, Hit PF3 or PF15
TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
***
```

Figure 105. MVS TCP/IP Response after Telnet Command

```
OS/2 Version 2.1 (LAPITAN)

Enter your password: .......

<LAPITAN>-C:\dir/w

The volume label in drive C is C_DRIVE.
The Volume Serial Number is E639:D014
Directory of C:\

.             ..              AUTOEXEC.BAT   CONFIG.SYS    Desktop
Edwin         IBMCOM          IBMLAN         IBMLVL.INI    MUGLIB
Nowhere       OS2             PSFONTS        SPOOL         STARTUP.CMD
      15 file(s)      5962 bytes used
                    639488 bytes free


 <LAPITAN>-C:\

Telnet command: quit

Session ended. <ENTER> to return to TSO.

TCPUTM101I Telnet terminated
***
```

Figure 106. Telnet Session into Workstation from MVS TCP/IP

Note: The Telnet command: prompt is invoked by pressing PF4.

FTP from OS/2

```
[C:\]ftp 9.67.38.22
Connected to 9.67.38.22.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 14:16:03 on 01/13/94
220 Connection will close if idle for more than 10 minutes.
Name (9.67.38.22): lapitan
331 Send password please.
Password:
230 LAPITAN is logged on.
ftp> pwd
257 "'LAPITAN.'" is working directory
ftp> get esa4.ispprof(ispprof)
200 Port request OK.
125 Sending data set LAPITAN.ESA4.ISPPROF(ISPPROF) FIXrecfm 80
250 Transfer completed successfully.
local: esa4.ispprof(ispprof) remote: esa4.ispprof(ispprof)
1558 bytes received in 0 seconds (1 Kbytes/s)
ftp> quit
221 Quit command received. Goodbye.

[C:\]
```

Figure 107. FTP from the Workstation into MVS TCP/IP

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

 ===> ftp 9.67.38.29

 FTPALL001I MVS TCP/IP FTP V2R2.1
 FTPALL105I Connecting to 9.67.38.29, port 21
 220 LAPITAN FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
 FTPALL010I USER (identify yourself to the host):
lapitan
 FTPALL252I >>>USER lapitan
 331 Password required for lapitan.
 FTPALL228I Password:

 FTPALL252I >>>PASS ********
 230 User lapitan logged in.
 FTPALL011I Command:
pwd
 FTPALL252I >>>PWD
 257 "C:\" is current directory.
 FTPALL011I Command:
get autoexec.bat
 FTPALL252I >>>PORT 9,67,38,22,4,11
 200 PORT command successful.
 FTPALL252I >>>RETR autoexec.bat
 150 Opening ASCII mode data connection for autoexec.bat (311 bytes).
 226 Transfer complete.
 FTPALL168I 311 bytes transferred. Transfer rate 1.18 Kbytes/sec.
 FTPALL011I Command:
quit
 FTPALL252I >>>QUIT
 221 Goodbye.
 ***
```

Figure 108. FTP from MVS TCP/IP into the Workstation

3.8 Scenario 2 - TCP/IP over Ethernet

The following section describes the conditions, requirements, and setup considerations that are applicable when using the 3172 Offload host as a LAN host gateway between an S/390 host running TCP/IP and an Ethernet LAN-attached workstation. The section will also describe tests which will verify the connectivity between the S/390 host and the workstation.

```
                  ┌──────────────────────┐
                  │     MVS/ESA 4.3       │
                  │                       │
                  ├──────────────────────┤
                  │     TCP/IP  2.2.1     │
                  └───────┬──────┬────────┘
                          │      │
         ESCON            │      │ Subchannel
         Attached         │      │ Addr : 340
                          │      │                                      ┌──────────────────────┐
                  ┌───────┴──────┴────────┐          Ethernet LAN       │    PS/2 Model 65      │
                  │     ESCON Adapter      │                            │                       │
                  │                        │                            │      OS/2 2.1         │
                  ├────────────────────────┤                           │     TCP/IP 2.0        │
                  │     3172 Model 3       │                            ├──────────────────────┤
                  │                        │                            │      Ethernet         │
                  │      OS/2 2.1          │                            │      Adapter          │
                  │     TCP/IP 2.0         │          ┌─────────────────┤                       │
                  ├────────────────────────┤          │                 └──────────────────────┘
IP Addr : 9.67.32.22  │      Ethernet      │          │              IP Addr : 9.67.32.23
LAA     : 4000 012C 3172  │   Adapter       ├──────────┘              LAA     : 4000 014A 8565
                  └────────────────────────┘
```
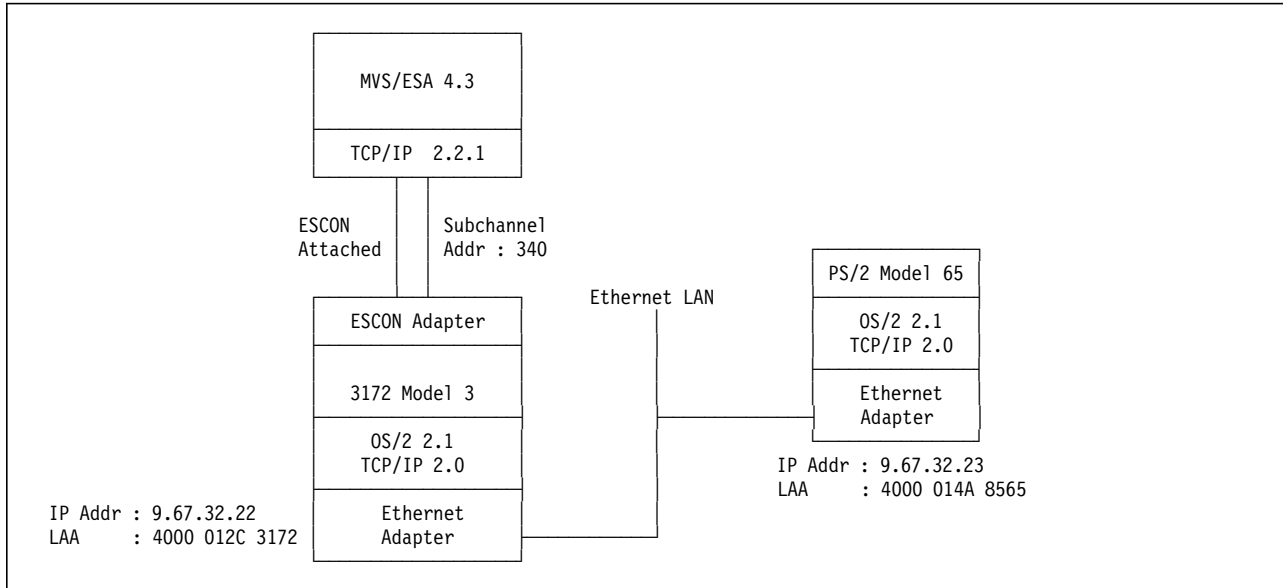
Figure 109. Scenario 2 -- TCP/IP over Ethernet

This scenario applies to setups wherein the 3172 Offload host is used as a TCP/IP LAN gateway between a Ethernet LAN-attached workstation and an S/390 host. In this scenario, the S/390 host must be directly connected to the 3172 through either a parallel channel adapter or an ESCON adapter. Meanwhile, the Ethernet LAN-attached workstation need not be in the same physical segment as the 3172 Offload host, but should be on the same logical segment.

3.8.1 Host Definitions

IOCP Definitions:

See Scenario 1 definitions in "IOCP Definitions" on page 168.

MVS/ESA IODEVICE Macro:

See Scenario 1 definitions in "MVS/ESA IODEVICE Macro:" on page 168.

VM/ESA HCPRIO Definition:

See Scenario 1 definitions in "VM/ESA HCPRIO Definition:" on page 168.

TCP/IP Profile Definitions:

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set. The selected parameters are the ones deemed to be significant for this scenario.

Buffer definitions:

```
DATABUFFERPOOLSIZE          150   28672
SMALLDATABUFFERPOOLSIZE     1200
TINYDATABUFFERPOOLSIZE      500
```

Device and link definitions:

```
DEVICE OFFDEV    CLAW  340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
LINK   OFFEN1    OFFLOADAPIBROAD 9.67.32.22  OFFDEV  OFFIPLINK
```

Device startup definition:

```
START OFFDEV
```

3.8.2 3172 Definitions

3172 LAPS for OS/2 Definition:

Step   1. At the Configure Workstation window, make sure that the Current
          Configuration field includes IBM Bus Master Ethernet Adapter and under
          it has IBM TCP/IP as shown in Figure 84 on page 160.

Step   2. In the Edit Adapter Parameters Window for Ethernet/802.3 Busmaster
          Adapter, enter the Microchannel slot number and the network address
          of the Ethernet adapter, 4000012C3172 as shown in Figure 110. Leave
          all other parameters at their default values.
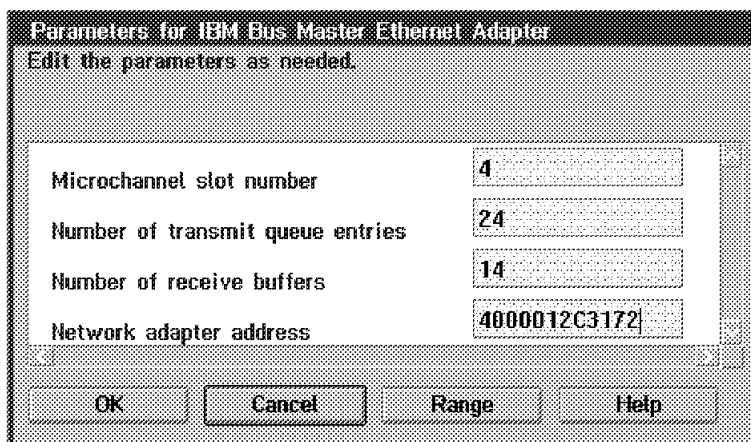
Figure 110. 3172 Edit Adapter Parameters Window for Ethernet/802.3 Busmaster Adapter

Step   3. Press **OK** to close the window.

Step   4. Select **OK** when you are done.

Step   5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

3172 TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for LAN Adapter 1, enter the
          IP address and subnet mask for the Ethernet adapter.

          Enter 9.67.32.22 in the IP Address field and 255.255.255.192 in the
          Subnet Mask field.

The window, when properly filled in, should look like Figure 111.
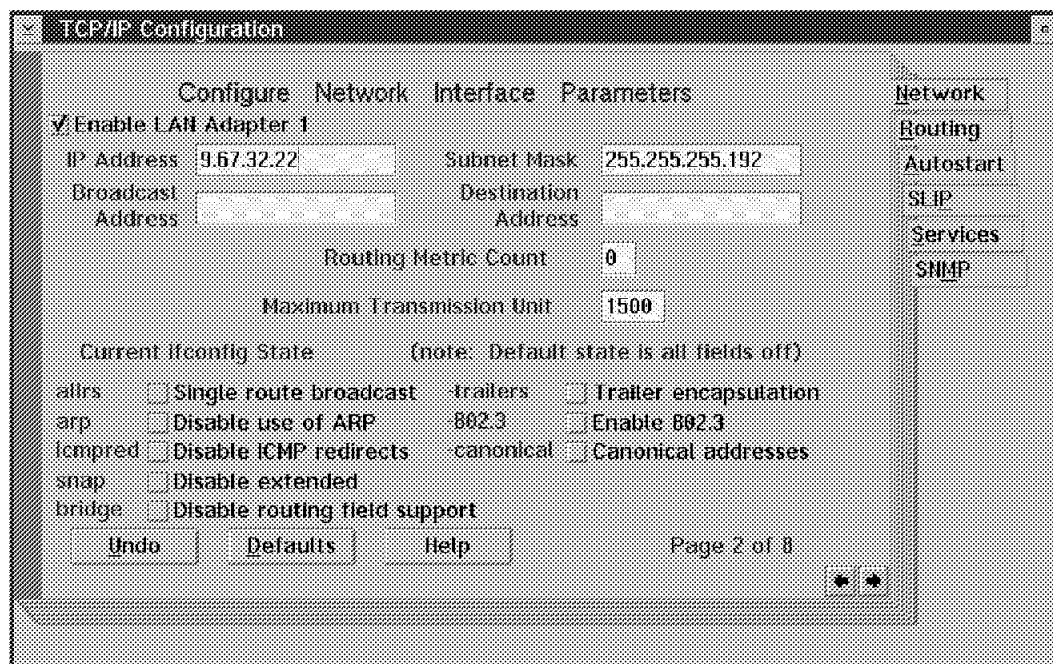
Figure 111. 3172 TCP/IP Configuration Network Page for LAN Adapter 1 (Ethernet)

Step 2. At the TCP/IP Configuration Network page for the ESCON adapter (LAN Adapter 3 for the ITSO environment), we entered 127.1.1.2 in the IP address field and 127.1.1.1 in the Destination Address field.

The window, when properly filled in, should look like Figure 94 on page 170.

Step 3. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.8.3 Workstation Definitions

Workstation LAPS for OS/2 Definition:

Step 1. At the Configure Workstation window, make sure that the Current Configuration field includes the proper Ethernet adapter name for the Ethernet adapter type you have installed in your workstation. Use IBM PS/2 Adapter for Ethernet Networks if you have an IBM Ethernet Adapter/A installed or IBM Bus Master Ethernet Adapter if you have an IBM Ethernet Busmaster Adapter. Ensure that IBM TCP/IP is included under the name for the Ethernet adapter as shown in Figure 112.
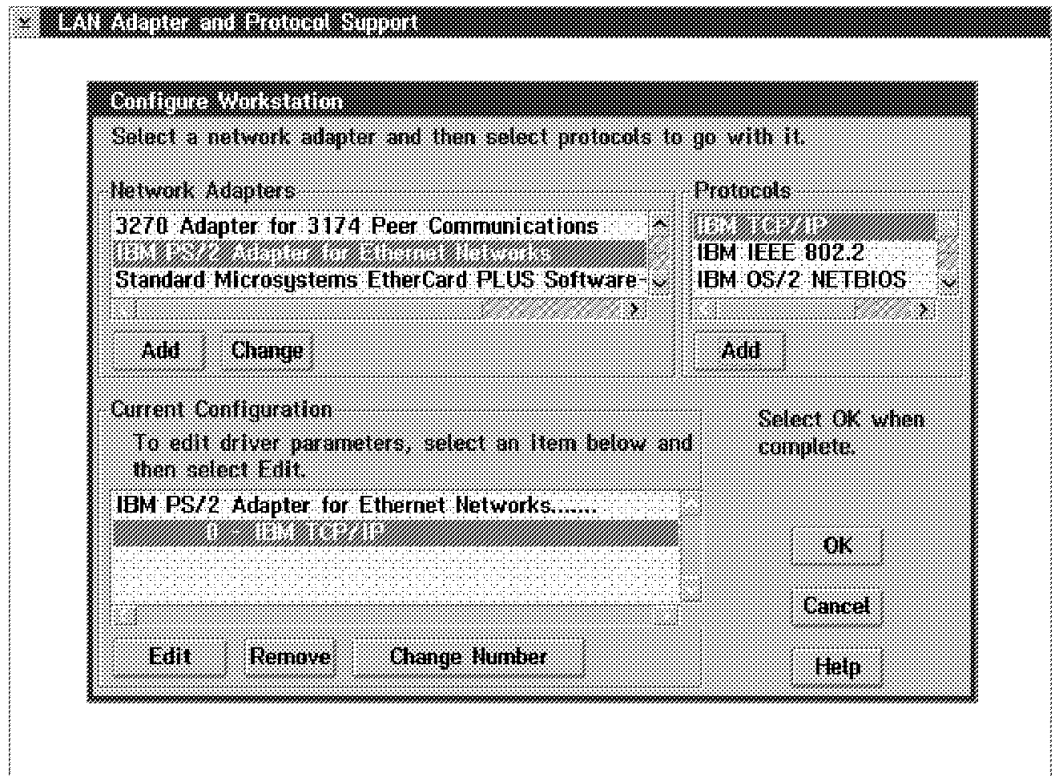
Figure 112. LAPS Configure Workstation Window for Workstation LAN Adapter (Ethernet)

Step 2. In the Edit Adapter Parameters window, enter the Micro Channel slot number where the workstation Ethernet adapter is installed. For the ITSO setup, enter 3 in the Micro Channel Slot Number field as shown in Figure 113. Leave all other parameters at their default values.
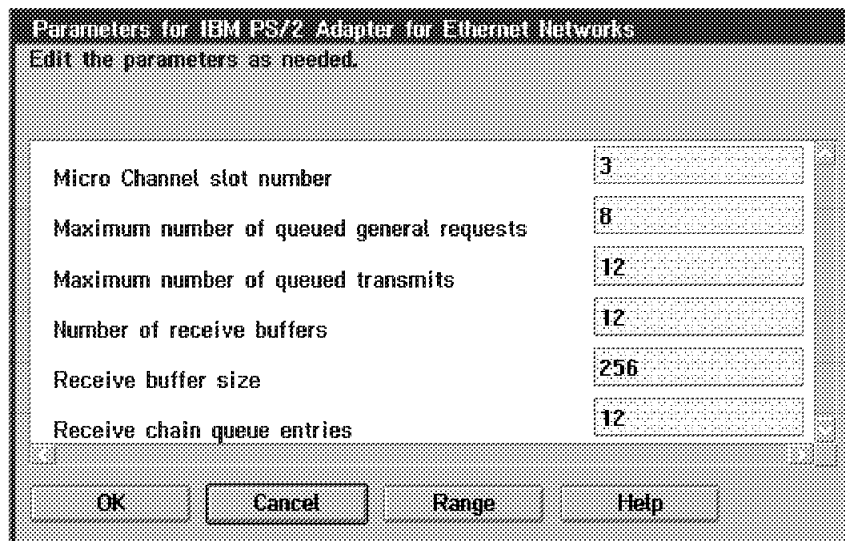
Figure 113. Edit Adapter Parameters for Workstation LAN Adapter (Ethernet)

Step 3. Press **OK** to close the window.

Step 4. Select **OK** when you are done.

Step 5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

Workstation TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for the Ethernet adapter, we
           entered the IP address and subnet mask for the Ethernet adapter.

           We entered 9.67.32.23 in the IP Address field and 255.255.255.192 in
           the Subnet Mask field.

Step   2. Ensure that the Maximum Transmission Unit is 1500.

> ┌─ **Important** ──┐
> │ For Ethernet LAN-attached workstations, make sure that the MTU   │
> │ size is set to *1500*.   │
> └───┘

           The window, when properly filled in, should look like Figure 114.
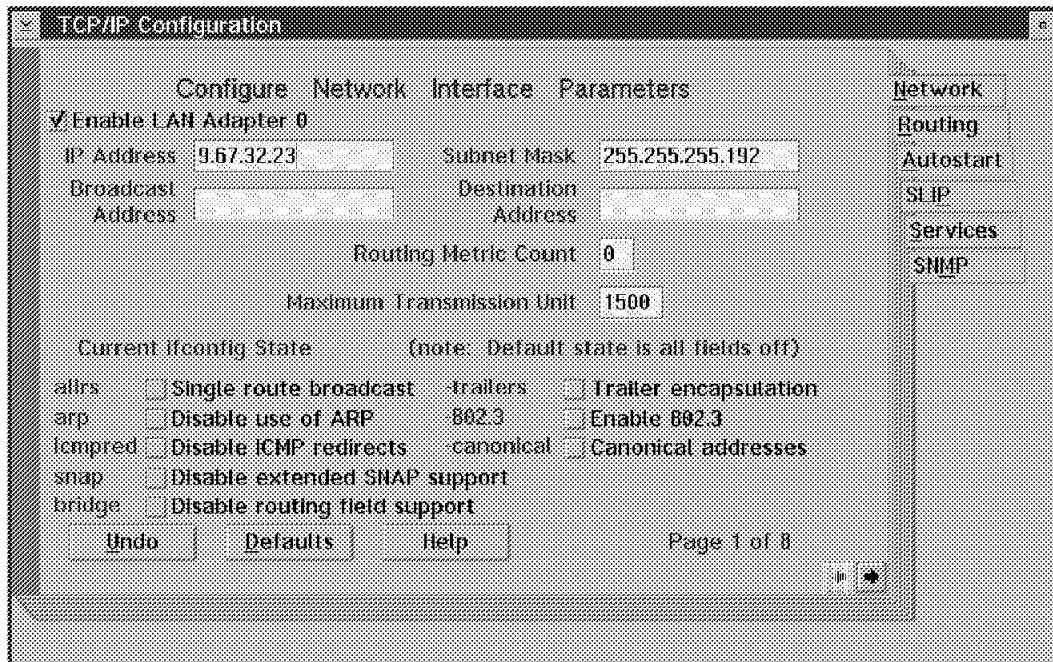
Figure 114. TCP/IP Configuration Network Page for Workstation Ethernet Adapter

Step   3. Go to the Autostart page by pressing Alt+↑ (Up Arrow) then pressing **A**
           or by clicking on the Autostart tab.

           Select, by placing a checkmark in the checkbox, Enable this machine to
           start the inetd super server, Enable other users to login to this
           machine, and Enable other users to access your files by using FTP. For
           the last two items, click on the inetd radio button.

           The window, when properly filled in, should look like Figure 98 on
           page 174.

Step   4. Go to the Services page by pressing Alt+↑ (Up Arrow) then pressing **S**
           or by clicking on the Services tab.

Step   5. Click on the TRUSERS field, then press the **Edit** button.

Step 6. Enter, in their proper fields, the Username (lapitan in the ITSO setup), Password, and Directory access for read and write (both C:\ in the ITSO setup). Press the **Edit** button to save the settings.

> ┌─ **Important** ───
>
> Entries in the Username field are *case-sensitive*. Make sure you remember this when you FTP into the workstation.

Step 7. The window, when properly filled in, should look like Figure 99 on page 175.

Step 8. Press the Right arrow key ($\rightarrow$) twice to go to Page 3 of 3 of TCP/IP Configuration Services.

Step 9. Enter the telnet password in the Telnet Password field.

Step 10. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.8.4 Verification Tests

Ping from OS/2

```
[C:\]ping 9.67.32.22
PING 9.67.32.22: 56 data bytes
64 bytes from 9.67.32.22: icmp_seq=0. time=32. ms
64 bytes from 9.67.32.22: icmp_seq=1. time=0. ms
64 bytes from 9.67.32.22: icmp_seq=2. time=0. ms
64 bytes from 9.67.32.22: icmp_seq=3. time=0. ms
64 bytes from 9.67.32.22: icmp_seq=4. time=0. ms

----9.67.32.22 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/6/32

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Figure 115. PING Command Issued for MVS TCP/IP from the Workstation

Notes:

1. Press Ctrl+C (Break) to stop the PING command.

2. Using this test verifies connectivity to the Offload host and *not* to the S/390 TCP/IP address space. Use the next test to fully verify connectivity between the workstation and the MVS TCP/IP address space.

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR -----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.32.23

TCPPNG015I Ping V2R2.1: Pinging host 9.67.32.23. Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.023 seconds. Successes so far 1.
***
```

Figure 116. PING Command Issued for the Workstation from MVS TCP/IP

Telnet from OS/2

For this test, we use PMANT, which is an OS/2 Presentation Manager Telnet implementation. To use it, enter PMANT *IP address of remote host* on the OS/2 command prompt.

```
[C:\]pmant 9.67.32.22
```

Figure 117. PMANT Command Issued for MVS TCP/IP from the Workstation

The screen or window, after entering the command, should look like Figure 118.

```
                                                    Hot Line: 17-6666
                                                    Date . .: 01/13/94
                                                    Time . .: 13:47:53
                                                    Terminal: RAIAE001
          N  E  T  V  I  E  W
          *******   *******    *******   *********   *******   *******
        **    **  **    **  **      **  **      **    **  **  **    **
        **    **  **         **      **            **  **      **
        *********  **          **     *********  *******   *******
       **    **  **          **      **            **          **
      **    **  **    **  **    **  **            **  **  **    **
     **    **  ******    ******  *********  *******   *******
                                                    S E R V I C E S
       NetView Access Services, Release 3.1 - Program Number 5665-365
          (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

              Enter Logon information:
                User . . . . . .         (User ID/LOGOFF)
                Password . . . .         New Password . .

                Application  . .
                Group  . . . . .
                Location . . . .
   PF 1=Help 2=Language
```

Figure 118. NetView Access Services Logon Screen from the Workstation

Note: In our scenarios, the MVS TCP/IP Telnet default application is NetView Access Services.

Telnet from TSO

```
------------------------- TSO COMMAND PROCESSOR -----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> telnet 9.67.32.23

TCPTEL001I MVS TCP/IP Telnet V2R2.1
TCPUTM110I Connecting to 9.67.32.23, port TELNET (23)
***
```

Figure 119. Telnet Command Issued for the Workstation from MVS TCP/IP

```
TCPUTM118I
TCPUTM119I Using Line Mode...
TCPUTM120I
TCPUTM121I Notes on using Telnet when in Line Mode:
TCPUTM122I - To hide Password, Hit PF3 or PF15
TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
***
```

Figure 120. MVS TCP/IP Response after Telnet Command

```
 OS/2 Version 2.1 (OLLE)

 Enter your password: .......

 <OLLE>-C:\dir/w

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is 6539:E5F3
 Directory of C:\

 .            ..            AUTOEXEC.BAT  CONFIG.SYS    Desktop
 Etc          IBMCOM        IBMLAN        IBMLVL.INI    MUGLIB
 Nowhere      OS2           PSFONTS       SPOOL         STARTUP.CMD
        15 file(s)      5962 bytes used
                      639488 bytes free

  <OLLE>-C:\

 Telnet command: quit

 Session ended. <ENTER> to return to TSO.

 TCPUTM101I Telnet terminated
 ***
```

Figure 121. Telnet Session into Workstation from MVS TCP/IP

Note: The Telnet command: prompt is invoked by pressing PF4.

FTP from OS/2

```
 [C:\]ftp 9.67.32.22
 Connected to 9.67.32.22.
 220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 14:17:09 on 01/13/94
 220 Connection will close if idle for more than 10 minutes.
 Name (9.67.32.22): lapitan
 331 Send password please.
 Password:
 230 LAPITAN is logged on.
 ftp> pwd
 257 "'LAPITAN.'" is working directory
 ftp> get esa4.ispprof(ispprof)
 200 Port request OK.
 125 Sending data set LAPITAN.ESA4.ISPPROF(ISPPROF) FIXrecfm 80
 250 Transfer completed successfully.
 local: esa4.ispprof(ispprof) remote: esa4.ispprof(ispprof)
 1558 bytes received in 0 seconds (1 Kbytes/s)
 ftp> quit
 221 Quit command received. Goodbye.

 [C:\]
```

Figure 122. FTP from the Workstation into MVS TCP/IP

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.32.23

FTPALL001I MVS TCP/IP FTP V2R2.1
FTPALL105I Connecting to 9.67.32.23, port 21
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
FTPALL010I USER (identify yourself to the host):
lapitan
FTPALL252I >>>USER lapitan
331 Password required for lapitan.
FTPALL228I Password:

FTPALL252I >>>PASS ********
230 User lapitan logged in.
FTPALL011I Command:
pwd
FTPALL252I >>>PWD
257 "C:\" is current directory.
FTPALL011I Command:
get autoexec.bat
FTPALL252I >>>PORT 9,67,32,22,4,11
200 PORT command successful.
FTPALL252I >>>RETR autoexec.bat
150 Opening ASCII mode data connection for autoexec.bat (311 bytes).
226 Transfer complete.
FTPALL168I 311 bytes transferred. Transfer rate 1.18 Kbytes/sec.
FTPALL011I Command:
quit
FTPALL252I >>>QUIT
221 Goodbye.
***
```

Figure 123. FTP from MVS TCP/IP into the Workstation

3.9 Scenario 3 - TCP/IP over Fiber Distributed Data Interface

The following section describes the conditions, requirements, and setup
considerations that are applicable when using the 3172 Offload host as a LAN
host gateway between an S/390 host running TCP/IP and a Fiber Distributed Data
Interface LAN-attached workstation. The section will also describe tests which
will verify the connectivity between the S/390 host and the workstation.

```
┌─────────────────────────────────────────────────────────────────────────────────────┐
│                                                                                       │
│                        ┌─────────────────────┐                                        │
│                        │    MVS/ESA 4.3       │                                        │
│                        │                     │                                        │
│                        ├─────────────────────┤                                        │
│                        │   TCP/IP  2.2.1      │                                        │
│                        └──────────┬──────────┘                                        │
│                                   │                                                   │
│                        ESCON      │   Subchannel                                      │
│                        Attached   │   Addr : 340                                      │
│                        ┌──────────┴──────────┐        ┌─────────────────────┐        │
│                        │   ESCON Adapter      │        │   PS/2 Model        │        │
│                        │                     │        ├─────────────────────┤        │
│                        ├─────────────────────┤        │   OS/2 2.1          │        │
│                        │   3172 Model 3       │  * * * * * *   │   TCP/IP 2.0        │        │
│                        │                     │ *   * * * * * * ├─────────────────────┤        │
│                        ├─────────────────────┤ *  *         * │   FDDI              │        │
│                        │   OS/2 2.1          │ * *  FDDI LAN  * │   Adapter           │        │
│   IP Addr : 9.67.32.200 │   TCP/IP 2.0        │ * *           * IP Addr : 9.67.32.202   │        │
│   LAA    : 4000 013C 3172 ├─────────────────────┤  **          * LAA    : 4000 8580 FDDF  │        │
│                        │   FDDI              │   ** * * * * * *                       │        │
│                        │   Adapter           ├──────────                               │        │
│                        └─────────────────────┘                                        │
│                                                                                       │
└─────────────────────────────────────────────────────────────────────────────────────┘
```
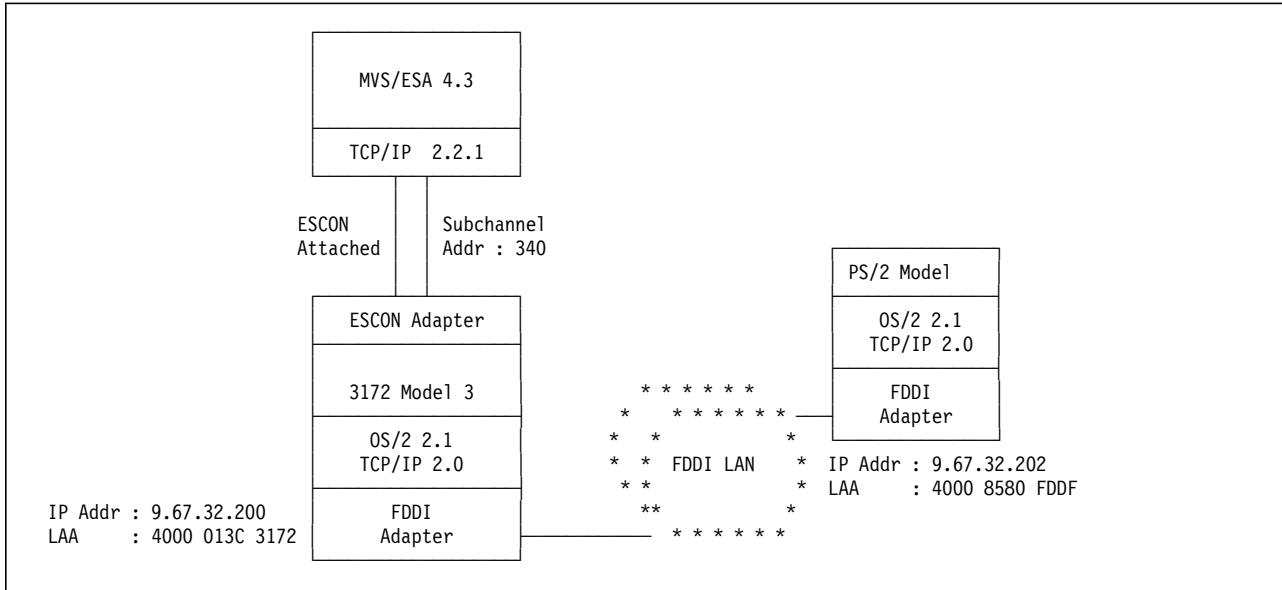
Figure 124. Scenario 3 -- TCP/IP over Fiber Distributed Data Interface

This scenario applies to setups wherein the 3172 Offload host is used as a
TCP/IP LAN gateway between an Fiber Distributed Data Interface LAN-attached
workstation and an S/390 host. In this scenario, the S/390 host must be directly
connected to the 3172 through either a parallel channel adapter or an ESCON
adapter. Meanwhile, the FDDI LAN-attached workstation need not be in the
same physical ring as the 3172 Offload host, but should be on the same logical
ring.

3.9.1 Host Definitions

IOCP Definitions:

See Scenario 1 definitions in "IOCP Definitions" on page 168.

MVS/ESA IODEVICE Macro:

See Scenario 1 definitions in "MVS/ESA IODEVICE Macro:" on page 168.

VM/ESA HCPRIO Definition:

See Scenario 1 definitions in "VM/ESA HCPRIO Definition:" on page 168.

TCP/IP Profile Definitions:

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set.
The selected parameters are the ones deemed to be significant for this scenario.

Buffer definitions:

```
DATABUFFERPOOLSIZE            150  28672
SMALLDATABUFFERPOOLSIZE      1200
TINYDATABUFFERPOOLSIZE        500
```

Device and link definitions:

```
DEVICE OFFDEV   CLAW 340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1 1  OFFDEV
LINK   OFFFD1    OFFLOADAPIBROAD 9.67.32.200 OFFDEV  OFFIPLINK
```

Device startup definition:

```
START OFFDEV
```

3.9.2 3172 Definitions

3172 LAPS for OS/2 Definition:

Step   1. At the Configure Workstation window, make sure that the Current
          Configuration field includes IBM PS/2 FDDI Adapter Device Driver and
          under it has IBM TCP/IP as shown in Figure 125.
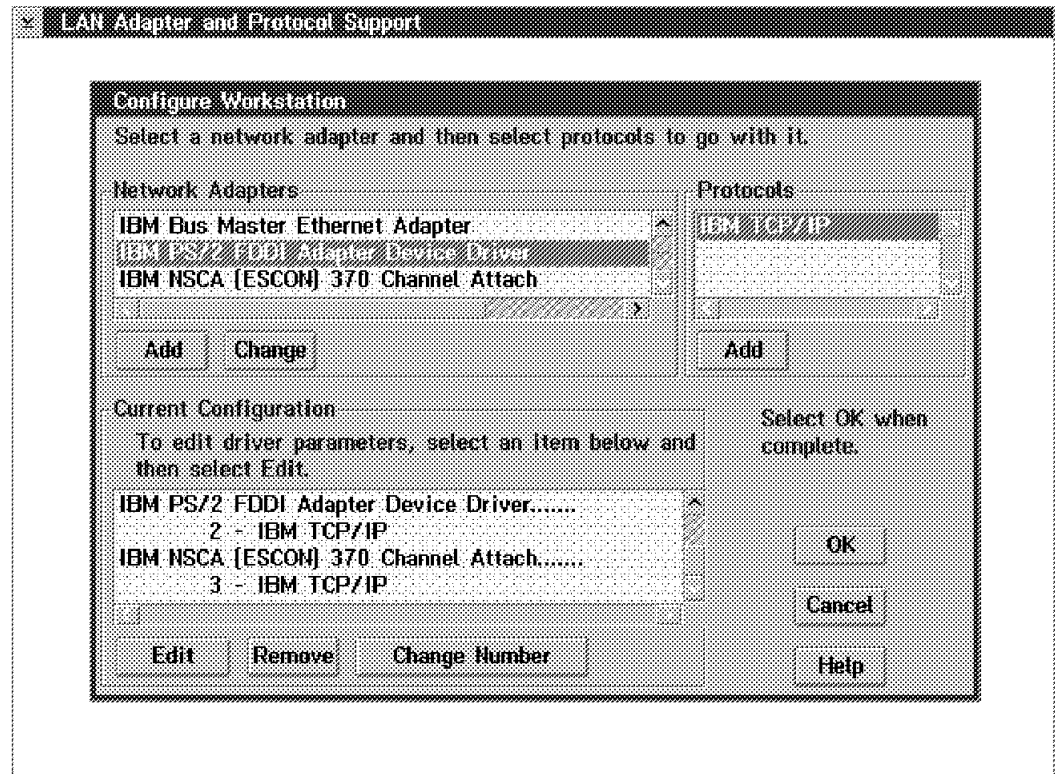
2 and 3

Figure 125. 3172 LAPS Configure Workstation Window Showing LAN Adapters

Step   2. In the Edit Adapter Parameters window for FDDI Adapter, we entered
          the network address of the FDDI adapter, 4000013C3172 as shown in
          Figure 126. We left all other parameters at their default values.
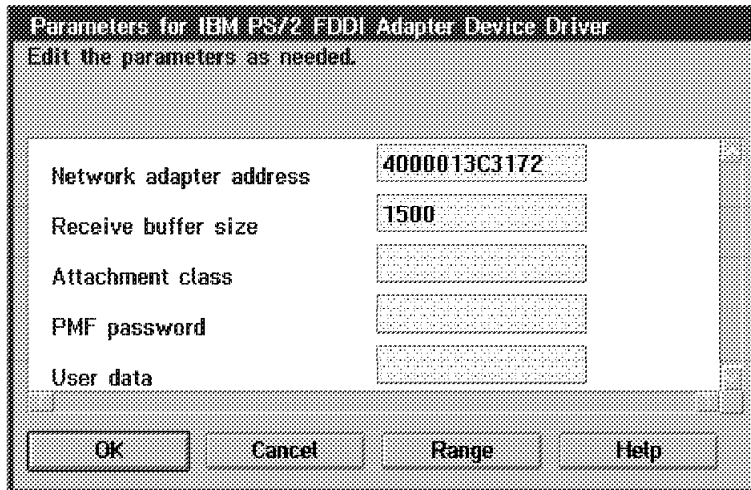
Figure 126. 3172 Edit Adapter Parameters Window for FDDI Adapter

Step   3. Press **OK** to close the window.

Step   4. Select **OK** when you are done.

Step   5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

3172 TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for LAN Adapter 2, enter the IP address and subnet mask for the FDDI adapter.

Enter 9.67.32.200 in the IP Address field and 255.255.255.192 in the Subnet Mask field.

Step   2. Select Disable routing field support and Canonical addresses.

The window, when properly filled in, should look like Figure 127 on page 191.
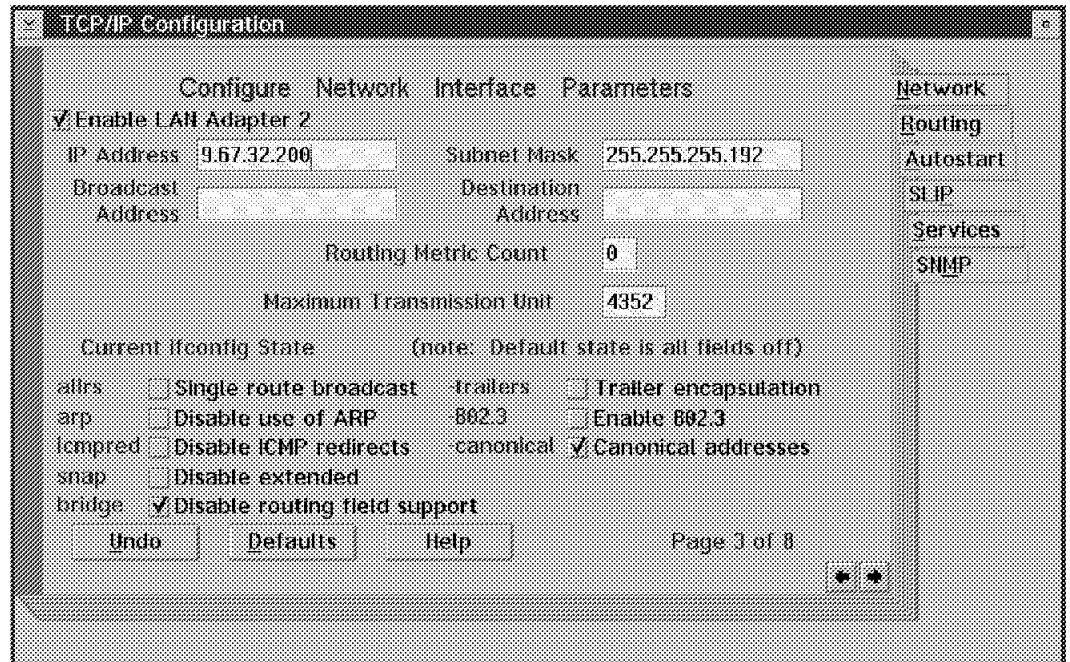
Figure 127. 3172 TCP/IP Configuration Network Page for LAN Adapter 2 (FDDI)

Step 3. At the TCP/IP Configuration Network page for the ESCON adapter (LAN Adapter 3 for the ITSO environment), we entered 127.1.1.2 in the IP address field and 127.1.1.1 in the Destination Address field.

The window, when properly filled in, should look like Figure 94 on page 170.

Step 4. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.9.3 Workstation Definitions

Workstation LAPS for OS/2 Definition:

Step 1. At the Configure Workstation window, make sure that the Current Configuration field includes the proper FDDI adapter name for the FDDI adapter type you have installed in your workstation. Use IBM PS/2 FDDI Adapter Device Driver if you have an IBM FDDI adapter installed. Ensure that IBM TCP/IP is included under the name for the FDDI adapter as shown in Figure 128.
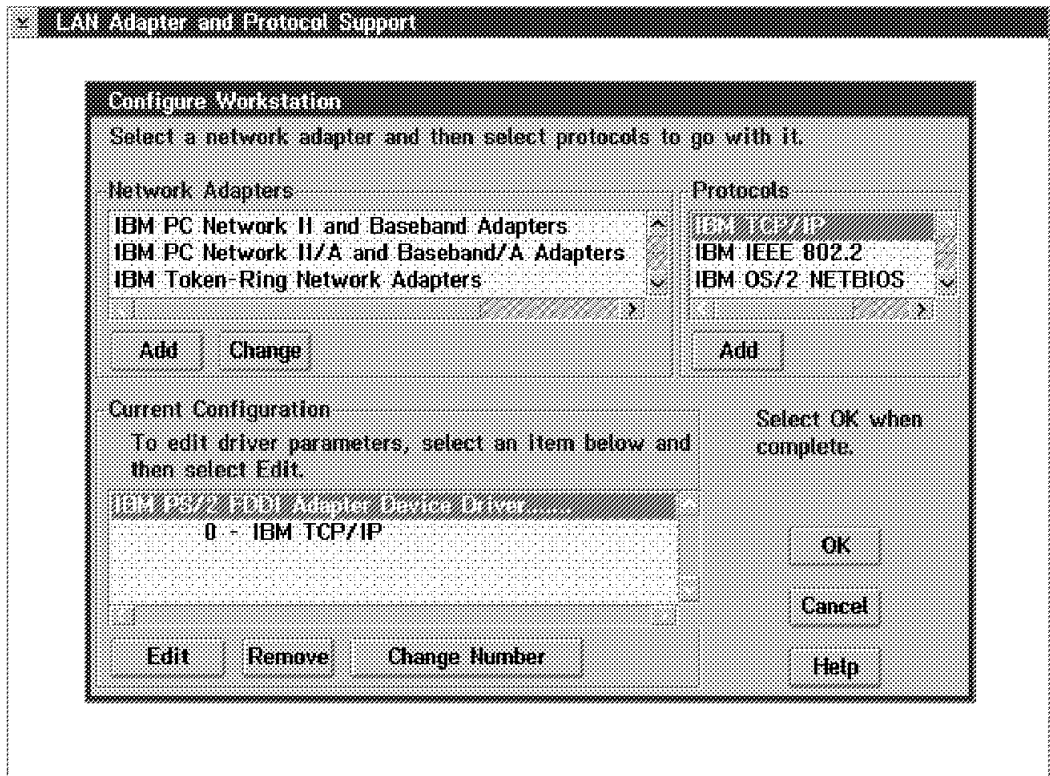
Figure 128. LAPS Configure Workstation Window for Workstation LAN Adapter (FDDI)

Step   2. In the Edit Adapter Parameters window, enter the network address of
the FDDI adapter, 40008580FDDF as shown in Figure 129.
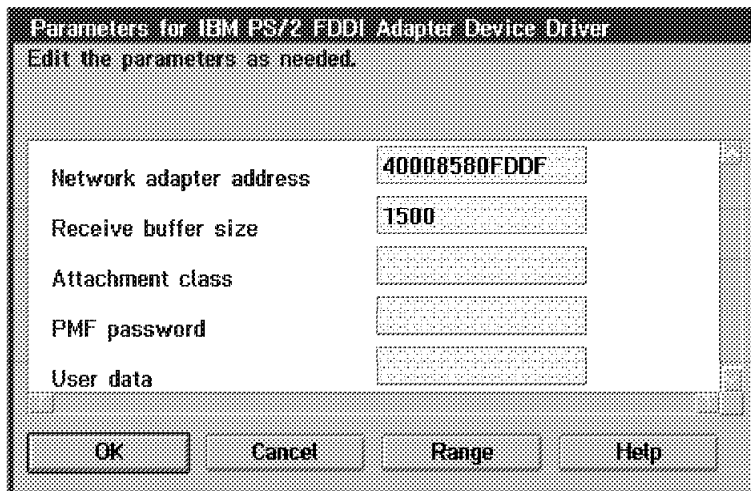
Figure 129. Edit Adapter Parameters for Workstation LAN Adapter (FDDI)

Step   3. Press **OK** to close the window.

Step   4. Select **OK** when you are done.

Step   5. Select **Exit** at the main LAPS window to exit.

Step   6. Select **Continue** to update your CONFIG.SYS file.

Step   7. Select **OK** to confirm changes to CONFIG.SYS.

Step   8. Select **Exit** to exit LAPS.

Workstation TCP/IP for OS/2 Definition:

Step   1. At the TCP/IP Configuration Network page for the FDDI adapter, enter the IP address and subnet mask for the FDDI adapter.

We entered 9.67.32.200 in the IP Address field and 255.255.255.192 in the Subnet Mask field.

Step   2. Change the Maximum Transmission Unit to 4352.

> ┌─ **Important** ─────────────────────────────────┐
> For FDDI LAN-attached workstations, make sure that the MTU size is set to *4352*.
> └──┘

Step   3. Select Disable routing field support and Canonical addresses.

The window, when properly filled in, should look like Figure 130.
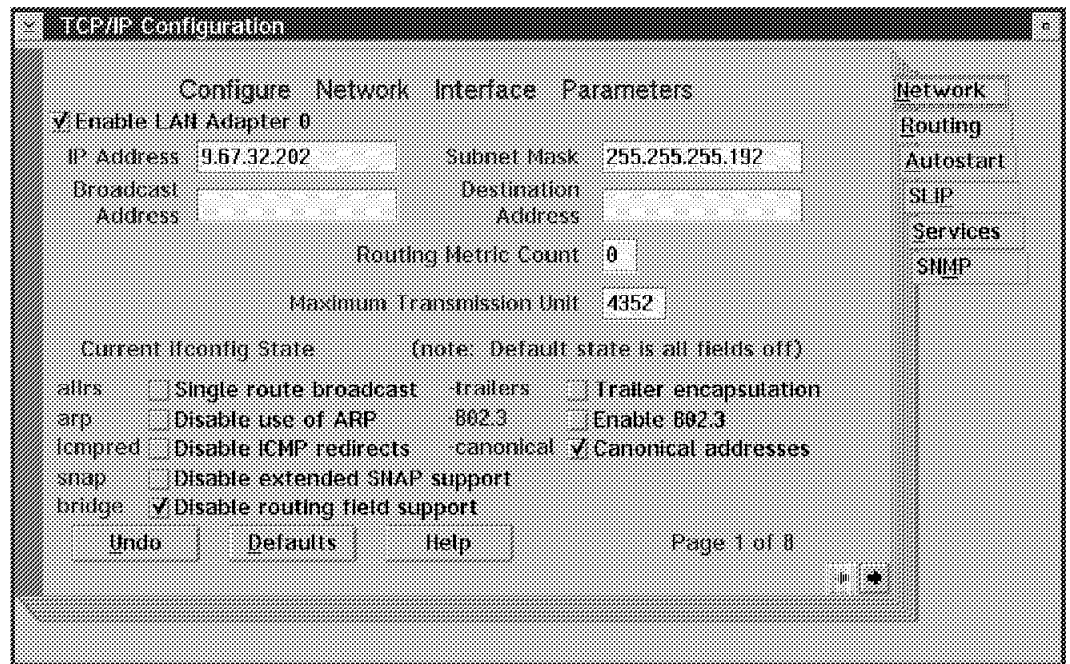
Figure 130. TCP/IP Configuration Network Page for Workstation FDDI Adapter

Step   4. Go to the Autostart page by pressing Alt+↑ (Up Arrow) then pressing **A** or by clicking on the Autostart tab.

Select, by placing a checkmark in the checkbox, Enable this machine to start the inetd super server, Enable other users to login to this machine, and Enable other users to access your files by using FTP. For the last two items, click on the inetd radio button.

The window, when properly filled in, should look like Figure 98 on page 174.

Step   5. Go to the Services page by pressing Alt+↑ (Up Arrow) then pressing **S** or by clicking on the Services tab.

Step   6. Click on the TRUSERS field, then press the **Edit** button.

Step   7. Enter, in their proper fields, the Username (lapitan in the ITSO setup), Password, and Directory access for read and write (both C:\ in the ITSO setup). Press the **Edit** button to save the settings.

> ┌─ **Important** ─────────────────────────────────────
>
> Entries in the Username field are *case-sensitive*. Make sure you remember this when you FTP into the workstation.

Step   8. The window, when properly filled in, should look like Figure 99 on page 175.

Step   9. Press the Right arrow key (→) twice to go to Page 3 of 3 of TCP/IP Configuration Services.

Step 10. Enter the telnet password in the Telnet Password field.

Step 11. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.9.4 Verification Tests

Ping from OS/2

```
[C:\]ping 9.67.32.200
PING 9.67.32.200: 56 data bytes
64 bytes from 9.67.32.200: icmp_seq=0. time=30. ms
64 bytes from 9.67.32.200: icmp_seq=1. time=0. ms
64 bytes from 9.67.32.200: icmp_seq=2. time=0. ms
64 bytes from 9.67.32.200: icmp_seq=3. time=0. ms
64 bytes from 9.67.32.200: icmp_seq=4. time=0. ms

----9.67.32.200 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/6/30

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Figure 131. PING Command Issued for MVS TCP/IP from the Workstation

Notes:

1. Press Ctrl+C (Break) to stop the PING command.

2. Using this test verifies connectivity to the Offload host and *not* to the S/390 TCP/IP address space. Use the next test to fully verify connectivity between the workstation and the MVS TCP/IP address space.

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR -----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.32.202

TCPPNG015I Ping V2R2.1: Pinging host 9.67.32.202.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.023 seconds. Successes so far 1.
***
```

Figure 132. PING Command Issued for the Workstation from MVS TCP/IP

Telnet from OS/2: For this test, we use PMANT, which is an OS/2 Presentation Manager Telnet implementation. To use it, enter PMANT *IP address of remote host* on the OS/2 command prompt.

```
 [C:\]pmant 9.67.32.200
```

Figure 133. PMANT Command Issued for MVS TCP/IP from the Workstation

The screen or window, after entering the command, should look like Figure 134.

```
                                                        Hot Line: 17-6666
                                                        Date . .: 01/13/94
                                                        Time . .: 13:49:27
                                                        Terminal: RAIAE001
              N E T V I E W
              *******   *******   *******   *********   *******   *******
           **      ** **      ** **      **              **    ** **    **
          **      **  **           **           **       **        **
          ********* **           **     *********   *******   *******
          **      ** **           **           **              **        **
        **      ** ** **    ** ** ** **           **    ** ** **    **
        **      **  ******   ******   *********   *******   *******
                                                        S E R V I C E S
       NetView Access Services, Release 3.1 - Program Number 5665-365
          (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

                   Enter Logon information:
                      User . . . . . .          (User ID/LOGOFF)
                      Password . . . .           New Password . .

                      Application  . .
                      Group  . . . . .
                      Location . . . .
 PF 1=Help 2=Language
```

Figure 134. NetView Access Services Logon Screen from the Workstation

Note: In our scenarios, the MVS TCP/IP Telnet default application is NetView Access Services.

Telnet from TSO

```
 ------------------------ TSO COMMAND PROCESSOR ----------------------
 ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

 ===> telnet 9.67.32.202

 TCPTEL001I MVS TCP/IP Telnet V2R2.1
 TCPUTM110I Connecting to 9.67.32.202, port TELNET (23)
 ***
```

Figure 135. Telnet Command Issued for the Workstation from MVS TCP/IP

```
TCPUTM118I
TCPUTM119I Using Line Mode...
TCPUTM120I
TCPUTM121I Notes on using Telnet when in Line Mode:
TCPUTM122I - To hide Password, Hit PF3 or PF15
TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
***
```

Figure 136. MVS TCP/IP Response after Telnet Command

```
OS/2 Version 2.1(OLLE)

Enter your password: .......

<OLLE>-C:\dir/w

The volume label in drive C is C_DRIVE.
The Volume Serial Number is 7D56:F5E2
Directory of C:\

.             ..            AUTOEXEC.BAT  CONFIG.SYS    Desktop
Etc           IBMCOM        IBMLAN        IBMLVL.INI    MUGLIB
Nowhere       OS2           PSFONTS       SPOOL         STARTUP.CMD
       15 file(s)      5962 bytes used
                     161288 bytes free

 <OLLE>-C:\

Telnet command: quit

Session ended. <ENTER> to return to TSO.

TCPUTM101I Telnet terminated
***
```

Figure 137. Telnet Session into Workstation from MVS TCP/IP

Note: The Telnet command: prompt is invoked by pressing PF4.

FTP from OS/2

```
[C:\]ftp 9.67.32.200
Connected to 9.67.32.200.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 14:18:15 on 01/13/94
220 Connection will close if idle for more than 10 minutes.
Name (9.67.32.200): lapitan
331 Send password please.
Password:
230 LAPITAN is logged on.
ftp> pwd
257 "'LAPITAN.'" is working directory
ftp> get esa4.ispprof(ispprof)
200 Port request OK.
125 Sending data set LAPITAN.ESA4.ISPPROF(ISPPROF) FIXrecfm 80
250 Transfer completed successfully.
local: esa4.ispprof(ispprof) remote: esa4.ispprof(ispprof)
1558 bytes received in 0 seconds (1 Kbytes/s)
ftp> quit
221 Quit command received. Goodbye.

[C:\]
```

Figure 138. FTP from the Workstation into MVS TCP/IP

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.32.202

FTPALL001I MVS TCP/IP FTP V2R2.1
FTPALL105I Connecting to 9.67.32.202, port 21
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
FTPALL010I USER (identify yourself to the host):
lapitan
FTPALL252I >>>USER lapitan
331 Password required for lapitan.
FTPALL228I Password:

FTPALL252I >>>PASS ********
230 User lapitan logged in.
FTPALL011I Command:
pwd
FTPALL252I >>>PWD
257 "C:\" is current directory.
FTPALL011I Command:
get autoexec.bat
FTPALL252I >>>PORT 9,67,32,200,4,11
200 PORT command successful.
FTPALL252I >>>RETR autoexec.bat
150 Opening ASCII mode data connection for autoexec.bat (311 bytes).
226 Transfer complete.
FTPALL168I 311 bytes transferred. Transfer rate 1.18 Kbytes/sec.
FTPALL011I Command:
quit
FTPALL252I >>>QUIT
221 Goodbye.
***
```

Figure 139. FTP from MVS TCP/IP into the Workstation

3.10 Scenario 4 - TCP/IP Routing on the 3172 Offload Host

The following section describes the conditions, requirements, and setup
considerations that are applicable when utilizing the routing function of the 3172
Offload host while it is a LAN host gateway between an S/390 host running
TCP/IP and a LAN-attached workstation. The section will also describe tests
which will verify the connectivity between the S/390 host and various
workstations.

```
┌──────────────────────────────────────────────────────────────────────────────────────────┐
│                              ┌─────────────────────┐                                        │
│                              │    MVS/ESA 4.3      │                                        │
│              ┌───────────────┼─────────────────────┼───────────────────┐                   │
│              │ ESCON Adapter │   TCP/IP   2.2.1    │ Parallel Chan. Ad. │                   │
│              ├───────────────┴─────────────────────┴───────────────────┤                   │
│              │  3172 Model 3                        3172 Model 3        │                   │
│              │                                     ┌──────────────────┐ │                   │
│              │   OS/2 2.1                          │ Interconnect Ctrl│ │                   │
│              │   TCP/IP 2.0      IP Addr: 9.67.32.22│  Program 3.2     │ │                   │
│  * * * * * * ├───────────────┬─────────────┐ LAA : 4000 012C 3172     │ │ * * * * * *       │
│  *         * │ Token-ring    │  Ethernet   │       │   Token-ring     │─│─*         *       │
│  * Token-ring│   Adapter     │   Adapter   │       │    Adapter       │ │ * Token-ring *    │
│  * LAN   4 Mb│               │             │       └──────────────────┘ │ * LAN   4 Mb *    │
│  *           * IP Addr: 9.67.38.22                 IP Addr: 9.67.36.21  │ *           *     │
│  * * * * * * LAA    : 4000 011C 3172               LAA    : 4000 021B 3172 * * * * * *       │
│                                                                                             │
│  ┌───────────────┐          ┌───────────────┐              ┌───────────────┐               │
│  │ PS/2 Model 80 │          │ PS/2 Model 65 │              │ PS/2 Model 80 │               │
│  ├───────────────┤          ├───────────────┤              ├───────────────┤               │
│  │   OS/2 2.1    │          │   OS/2 2.1    │              │   OS/2 2.1    │               │
│  │   TCP/IP 2.0  │          │   TCP/IP 2.0  │              │   TCP/IP 2.0  │               │
│  ├───────────────┤          ├───────────────┤              ├───────────────┤               │
│  │  Token-ring   │          │   Ethernet    │              │  Token-ring   │               │
│  │   Adapter     │          │   Adapter     │              │   Adapter     │               │
│  └───────────────┘          └───────────────┘              └───────────────┘               │
│  IP Addr: 9.67.38.29        IP Addr: 9.67.32.23            IP Addr: 9.67.36.27             │
│  LAA    : 4000 0003 2257    LAA    : 4000 014A 8565        LAA    : 4000 0003 2203         │
└──────────────────────────────────────────────────────────────────────────────────────────┘
```

Figure 140. Scenario 4 -- TCP/IP Routing on the 3172

One of the functions of the Offload feature is IP routing within the Offload 3172.
This scenario will show, as a first example, a 3172 attached to both token-ring
and Ethernet LANs. When properly configured, this 3172 will pass data coming
from the token-ring LAN-attached workstation directly from the token-ring
adapter to the Ethernet adapter and out to the Ethernet LAN-attached workstation
without going through the host. This will save the S/390 host CPU cycles since it
will not process any of this data.

It is important to note that the routing which happens in the Offload 3172 is
dependent on the routing statements which are established in the host
TCPIP.PROFILE data set.

As a second example, MVS TCP/IP will pass data from the Offload 3172 directly
to the ICP 3172 passing through the Offload 3172′s IP Link, the IP layer of the
S/390 TCP/IP, and to the conventional network interface on the S/390 TCP/IP.
This will save the S/390 host some CPU cycles as it does not have to process
any TCP or UDP data. In this example, no data ever goes above the IP layer in
the host TCP/IP address space.

Take note that cycle savings of this type apply only when the IP datagrams are
not destined for the S/390 host. Data that is destined for the S/390 host is
passed from the TCP/IP protocol stack in the Offload 3172 to the Offload Server
in the 3172 to the 3172 CLAW driver. The CLAW driver then passes the data
directly to the API layer of the S/390 stack through the API link. Thus, no TCP,
UDP, or IP processing need be done on the S/390 host.

3.10.1 Host Definitions

IOCP Definitions:

See Scenario 1 definitions in "IOCP Definitions" on page 168.

MVS/ESA IODEVICE Macro:

See Scenario 1 definitions in "MVS/ESA IODEVICE Macro:" on page 168.

VM/ESA HCPRIO Definition:

See Scenario 1 definitions in "VM/ESA HCPRIO Definition:" on page 168.

TCP/IP Profile Definitions:

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set.
The selected parameters are the ones deemed to be significant for this scenario.

Definitions and parameters for the ICP box will not be shown here. See the ICP
DEVICE, LINK, HOME, and START definitions in "TCP/IP Definitions" on page 81.

Buffer definitions:

```
DATABUFFERPOOLSIZE              150   28672
SMALLDATABUFFERPOOLSIZE        1200
TINYDATABUFFERPOOLSIZE          500
```

Device and link definitions:

```
DEVICE OFFDEV    CLAW 340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
LINK   OFFTR1    OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
LINK   OFFEN1    OFFLOADAPIBROAD 9.67.32.22  OFFDEV  OFFIPLINK
```

IP routing definitions:

```
GATEWAY
; Network  First hop   Driver   Packet Size  Subnet mask  Subnet value
   9           =        OFFTR1      2000       0.255.255.192 0.67.38.0
   9           =        OFFEN1      1500       0.255.255.192 0.67.32.0
   9           =        ICPTR1      2000       0.255.255.192 0.67.36.0
```

> **Important**
>
> Make sure you use the proper packet size for each interface you use.
>
> Use 1500 for Ethernet, 2000 for token-ring, and 4352 for FDDI.

Device startup definition:

```
START OFFDEV
```

3.10.2 3172 Definitions

3172 LAPS for OS/2 Definition:

See Scenario 1 (token-ring) definitions in "3172 LAPS for OS/2 Definition:" on page 169 *and* Scenario 2 (Ethernet) definitions in "3172 LAPS for OS/2 Definition:" on page 180.

3172 TCP/IP for OS/2 Definition:

See Scenario 1 (token-ring) definitions in "3172 TCP/IP for OS/2 Definition:" on page 169 *and* Scenario 2 (Ethernet) definitions in "3172 TCP/IP for OS/2 Definition:" on page 180.

3.10.3 Workstation Definitions

Workstation LAPS for OS/2 Definition

Step   1. For the Offload 3172-attached workstations, see Scenario 1 (token-ring) definitions in "Workstation LAPS for OS/2 Definition:" on page 170 *and* Scenario 2 (Ethernet) definitions in "Workstation LAPS for OS/2 Definition:" on page 181.

Step   2. For the ICP 3172-attached workstation, see Scenario 1 (token-ring) definitions in "Workstation LAPS for OS/2 Definition:" on page 170 but we used 4000 0003 2203 as the network address.

Workstation TCP/IP for OS/2 Definition

Step   1. For the Offload 3172-attached workstations, see Scenario 1 (token-ring) definitions in "Workstation TCP/IP for OS/2 Definition:" on page 172 *and* Scenario 2 (Ethernet) definitions in "Workstation TCP/IP for OS/2 Definition:" on page 183.

Step   2. For the ICP 3172-attached workstation, see Scenario 1 (token-ring) definitions in "Workstation TCP/IP for OS/2 Definition:" on page 172 but we used 9.67.36.27 as the IP address.

Step   3. On the Offload 3172-attached token-ring workstation, go to the TCP/IP Configuration Routing page by pressing Alt+↑ (Up Arrow) then pressing **R** or by clicking on the Routing tab.

Step   4. Press **Insert Before** to display the Route Entry - Insert Before window.

Step   5. Press **D** at the Route Type field to insert a default router.

Step   6. At the Router field, we entered 9.67.38.22 to make the 3172 token-ring interface the default router.

The window, when properly filled in, should look like Figure 141.
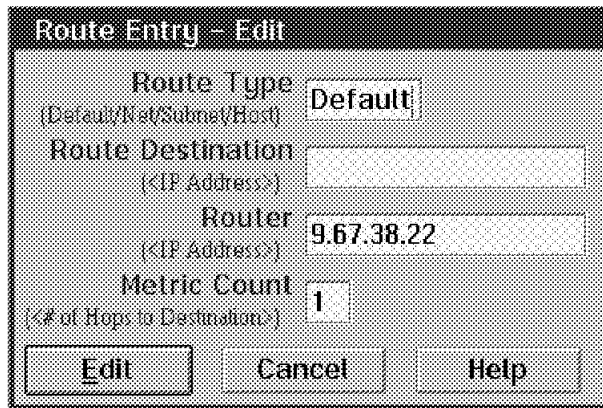
Figure 141. Route Entry - Insert before Page for Token-Ring Offload Workstation

Step 7. Press **Insert** to close the window.

The Routing page should now look like Figure 142.
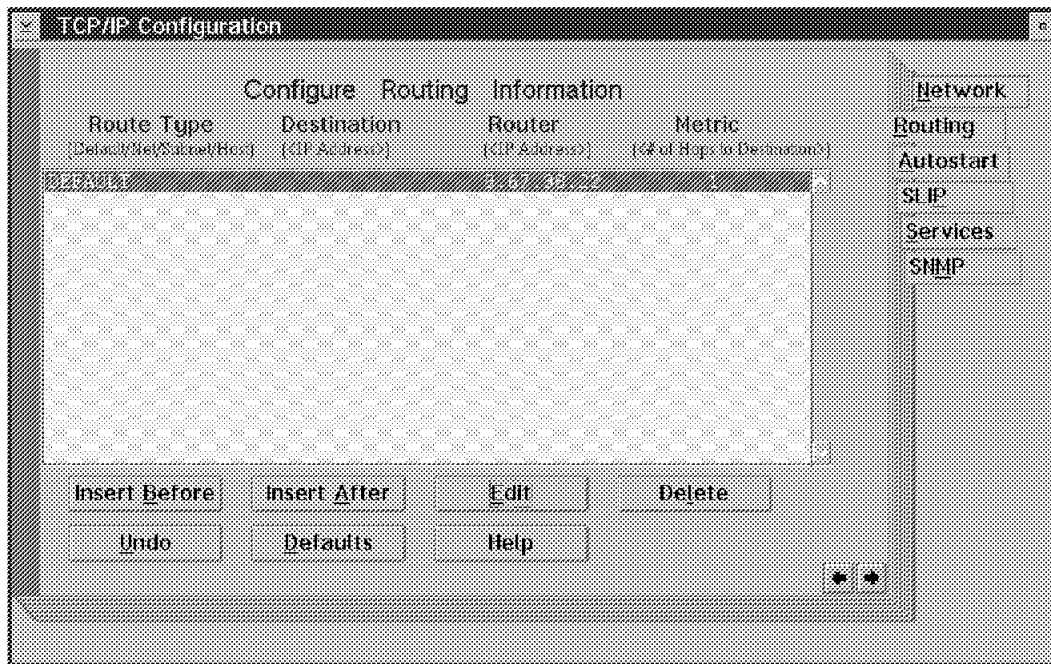
Workstation

Figure 142. TCP/IP Configuration Routing Page for Token-Ring Offload

Step 8. Repeat this procedure for the Ethernet Offload workstation; we used 9.67.32.22 for the router address.

Step 9. Repeat this procedure for the ICP workstation; we used 9.67.36.21 for the router address.

Step 10. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.10.4 Verification Tests

Defined and Active Routes on the Network
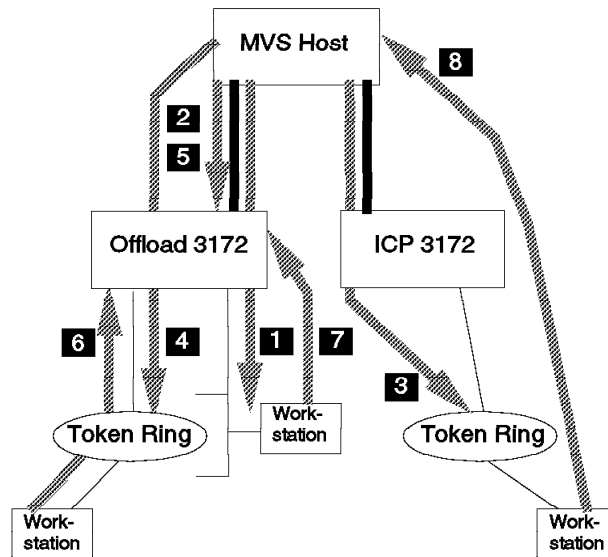
Figure 143. Defined and Active Routes

```
                         ------------------------ TSO COMMAND PROCESSOR  ----------------------
                         ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:


                         ===> netstat gate

                         MVS TCP/IP Netstat V2R2.1
                         Known gateways:

                          NetAddress    FirstHop   Link     Pkt Sz  Subnet Mask     Subnet Value
                          ----------    --------   ------   ------  -----------     ------------
                         1 9.0.0.0      <direct>   OFFEN1    1492   0.255.255.192   0.67.32.0
                         2 9.67.32.22   <direct>   OFFIPLINK8520   HOST
                         3 9.0.0.0      <direct>   ICPTR1    2000   0.255.255.192   0.67.36.0
                         4 9.0.0.0      <direct>   OFFTR1    2000   0.255.255.192   0.67.38.0
                         5 9.67.38.22   <direct>   OFFIPLINK8520   HOST
                         ***
```

Figure 144. Routing Table at MVS TCP/IP

1 Route to the local subnet attached to the Ethernet adapter in the Offload 3172, as defined in the GATEWAY statement.

2 Route to the IP address of the Ethernet adapter in the Offload host. This route is used for the IP link between the MVS host and the Offload host, and is created automatically by the TCP/IP address space.

3 Route to the local subnet attached to the token-ring adapter in the ICP 3172, as defined in the GATEWAY statement.

4 Route to the local subnet attached to the token-ring adapter in the Offload 3172, as defined in the GATEWAY statement.

.5. Route to the IP address of the token-ring adapter in the Offload host. This route is used for the IP link between the MVS host and the Offload host, and is created automatically by the TCP/IP address space.

Routing Table at the Offload Token-Ring Workstation

```
 [C:\]netstat -r

 destination        router      refcnt      use flags    snmp  intrf
                                                          metric
.6  default      9.67.38.22     0          0    U       -1    lan0
    9.67.38.0    9.67.38.29     0         10    U       -1    lan0
 [C:\]
```

Figure 145. Routing Table at the Offload Token-Ring Workstation

.6. Route to the 3172 token-ring adapter as the default router for the workstation.

Routing Table at the Offload Ethernet Workstation

```
 [C:\]netstat -r

 destination        router      refcnt      use flags    snmp  intrf
                                                          metric
.7  default      9.67.32.22     0          0    U       -1    lan0
    9.67.32.0    9.67.32.23     0         10    U       -1    lan0
 [C:\]
```

Figure 146. Routing Table at the Offload Ethernet Workstation

.7. Route to the 3172 Ethernet adapter as the default router for the workstation.

Routing Table at the ICP Workstation

```
 [C:\]netstat -r

 destination        router      refcnt      use flags    snmp  intrf
                                                          metric
.8  default      9.67.36.21     0          0    U       -1    lan0
    9.67.36.0    9.67.36.27     0         10    U       -1    lan0
 [C:\]
```

Figure 147. Routing Table at the ICP Workstation

.8. Route to the MVS host as the default router for the workstation. (The MVS TCP/IP address space will do the IP routing.)

Ping from Offload Token-Ring Workstation to Offload Ethernet Workstation

```
[C:\]ping 9.67.32.23
PING 9.67.32.23: 56 data bytes
64 bytes from 9.67.32.23: icmp_seq=0. time=32. ms
64 bytes from 9.67.32.23: icmp_seq=1. time=0. ms
64 bytes from 9.67.32.23: icmp_seq=2. time=0. ms
64 bytes from 9.67.32.23: icmp_seq=3. time=0. ms
64 bytes from 9.67.32.23: icmp_seq=4. time=0. ms

----9.67.32.23 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/6/32

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Offload Token-Ring Workstation

Figure 148. PING Command Issued for the Offload Ethernet Workstation from the

Note: Press Ctrl+C (Break) to stop the PING command.

Ping from Offload Token-Ring Workstation to ICP Workstation

```
[C:\]ping 9.67.36.27
PING 9.67.36.27: 56 data bytes
64 bytes from 9.67.36.27: icmp_seq=0. time=35. ms
64 bytes from 9.67.36.27: icmp_seq=1. time=0. ms
64 bytes from 9.67.36.27: icmp_seq=2. time=0. ms
64 bytes from 9.67.36.27: icmp_seq=3. time=0. ms
64 bytes from 9.67.36.27: icmp_seq=4. time=0. ms

----9.67.36.27 PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/7/35

The external process was cancelled by a Ctrl+Break or another process.
^C

[C:\]
```

Figure 149. PING Command Issued for the ICP Workstation from the Offload Token-Ring Workstation

Note: Press Ctrl+C (Break) to stop the PING command.

Telnet from Offload Token-Ring Workstation to Offload Ethernet Workstation

```
  [C:\]telnet 9.67.32.23
```

Figure 150. Telnet Command Issued for the Offload Ethernet Workstation from the Offload Token-Ring Workstation

```
  OS/2 Version 2.1 (OLLE)

  Enter your password: .......

[<OLLE>-C:\]dir/w

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is 6539:E5F3
 Directory of C:\

[.]             [..]            AUTOEXEC.BAT    CONFIG.SYS      [Desktop]
[Etc]           [IBMCOM]        [IBMLAN]        IBMLVL.INI      [MUGLIB]
[Nowhere]       [OS2]           [PSFONTS]       [SPOOL]         STARTUP.CMD
       15 file(s)       5962 bytes used
                      639488 bytes free

[<OLLE>-C:\]exit

 [C:\]
```

Figure 151. Telnet Session into the Offload Ethernet Workstation from the Offload Token-Ring Workstation

Telnet from Offload Token-Ring Workstation to ICP Workstation

```
  [C:\]telnet 9.67.36.27
```

Figure 152. Telnet Command Issued for the ICP Workstation from the Offload Token-Ring Workstation

```
  OS/2 Version 2.1 (RESIDENT)

  Enter your password: .......

[<RESIDENT>-C:\]dir/w

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is 652F:F814
 Directory of C:\

[.]             [..]            AUTOEXEC.BAT    CONFIG.SYS      [Desktop]
[Etc]           [IBMCOM]        [IBMLAN]        IBMLVL.INI      [MUGLIB]
[Nowhere]       [OS2]           [PSFONTS]       [SPOOL]         STARTUP.CMD
       15 file(s)       5962 bytes used
                      425362 bytes free

[<RESIDENT>-C:\]exit

 [C:\]
```

Figure 153. Telnet Session into the ICP Workstation from the Offload Token-Ring Workstation

FTP from Offload Token-Ring Workstation to Offload Ethernet Workstation

```
[C:\]ftp 9.67.32.23
Connected to 9.67.32.23.
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
Name (9.67.32.23): lapitan
331 Password required for lapitan.
Password:
230 User lapitan logged in.
ftp> pwd
257 ″C:\″ is current directory.
ftp> get autoexec.bat autoOlle.bat
200 PORT command successful.
150 Opening ASCII mode data connection for autoexec.bat (311 bytes).
226 Transfer complete.
local: autoOlle.bat remote: autoexec.bat
311 bytes received in 0.02 seconds (20 Kbytes/s)
ftp> quit
221 Goodbye.
[C:\]
```

Figure 154. FTP from the Offload Token-Ring Workstation into the Offload Ethernet Workstation

---

Important

Be careful not to overwrite files when copying files between the workstations. For example, when you copy the Ethernet workstation's CONFIG.SYS file to the token-ring workstation, you may overwrite the token-ring workstation's own CONFIG.SYS file.

Either change your working directory (use the CD or LCD commands) or rename the file in the copy process (as shown in the example).

FTP from Offload Token-Ring Workstation to the ICP Workstation

```
[C:\]ftp 9.67.36.27
Connected to 9.67.36.27.
220 RESIDENT FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
Name (9.67.36.27): lapitan
331 Password required for lapitan.
Password:
230 User lapitan logged in.
ftp> pwd
257 ″C:\″ is current directory.
ftp> get autoexec.bat autoRes.bat
200 PORT command successful.
150 Opening ASCII mode data connection for autoexec.bat (311 bytes).
226 Transfer complete.
local: autoRes.bat remote: autoexec.bat
311 bytes received in 0.02 seconds (20 Kbytes/s)
ftp> quit
221 Goodbye.
[C:\]
```

Figure 155. FTP from the Offload Token-Ring Workstation into the ICP Workstation

```
┌─ Important ─────────────────────────────────────────────────────────┐
│                                                                      │
│  Be careful not to overwrite files when copying files between the workstations. │
│  For example, when you copy the ICP workstation's CONFIG.SYS file to the │
│  token-ring Offload workstation, you may overwrite the token-ring Offload │
│  workstation's own CONFIG.SYS file.                                  │
│                                                                      │
│  Either change your working directory (use the CD or LCD commands) or │
│  rename the file in the copy process (as shown in the example).      │
│                                                                      │
└──────────────────────────────────────────────────────────────────────┘
```

3.11 Scenario 5 - Identical Daemons on Both S/390 Host and 3172

The following section describes the conditions, requirements, and setup
considerations that are applicable when running identical TCP/IP server
daemons on both the S/390 host TCP/IP address space and the Offload 3172.
While this is not a standard setup as the Offload box is treated as an extension
of the host address space, having TCP/IP server daemons running in the Offload
box is sometimes advantageous for purposes of checking the status of the
Offload box, controlling some of its functions from a remote site, and backing up
files on the Offload fixed disk.
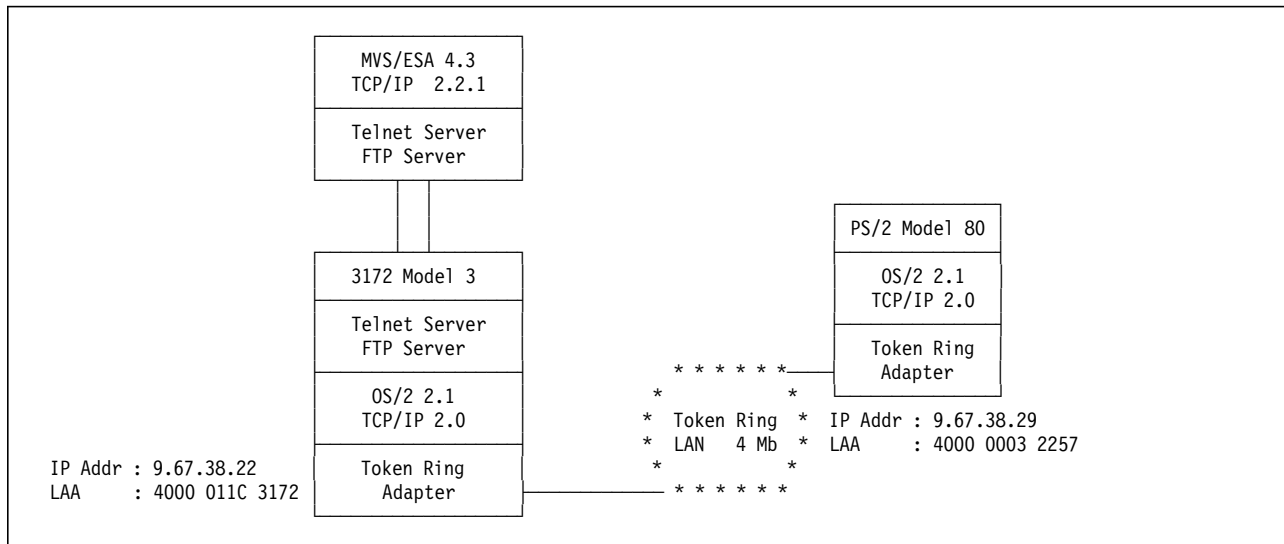
Figure 156. Scenario 5 -- Identical Daemons on both S/390 and 3172

This scenario applies to setups wherein you want to be able to communicate
with and access the 3172 itself as a separate entity from the S/390 TCP/IP
address space. In this scenario, the host TCP/IP servers for telnet and FTP will
be running on their well-known ports while the 3172 TCP/IP servers for telnet and
FTP will be running on reassigned ports. By default, we would be accessing the
servers on the S/390 host. If we want to specifically access the 3172, we would
do this by specifying the ports its servers are listening to.

We would want to telnet into the 3172, for example, if we need to check files on
the 3172's fixed disk or check the system status. Meanwhile, we would want to
FTP into the 3172 if we want to backup the files on its fixed disk to another
TCP/IP host's disk.

In this scenario, we would telnet and FTP from both the S/390 host and the token-ring LAN-attached workstation.

3.11.1 Host Definitions

IOCP Definitions:

See Scenario 1 definitions in "IOCP Definitions" on page 168.

MVS/ESA IODEVICE Macro:

See Scenario 1 definitions in "MVS/ESA IODEVICE Macro:" on page 168.

VM/ESA HCPRIO Definition:

See Scenario 1 definitions in "VM/ESA HCPRIO Definition:" on page 168.

TCP/IP Profile Definitions:

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set. The selected parameters are the ones deemed to be significant for this scenario.

Buffer definitions:

```
DATABUFFERPOOLSIZE            150   28672
SMALLDATABUFFERPOOLSIZE      1200
TINYDATABUFFERPOOLSIZE        500
```

Device and link definitions:

```
DEVICE OFFDEV    CLAW  340  TCPIP  OS2TCP  NONE
LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
LINK   OFFTR1    OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
```

Port definition:

```
PORT
   2221 TCP OFFLFTP   ; reserved port for Offload 3172 FTP      1
   2223 TCP OFFLTN    ; reserved port for Offload 3172 Telnet   2
```

1 We choose 2221 to signify the Offload 3172 FTP port. This can be any unused port number but we arrived at this number by selecting 22 (from the Offload IP address) and 21 (from the FTP well-known port).

2 We choose 2223 to signify the Offload 3172 telnet port. This can be any unused port number but we arrived at this number by selecting 22 (from the Offload IP address) and 23 (from the telnet well-known port).

Device startup definition:

```
START OFFDEV
```

3.11.2 3172 Definitions

3172 LAPS for OS/2 Definition:

See Scenario 1 definitions in "3172 LAPS for OS/2 Definition:" on page 169.

3172 TCP/IP for OS/2 Definition

Step   1. See Scenario 1 definitions in "3172 TCP/IP for OS/2 Definition:" on page 169.

Step   2. Go to the Autostart page by pressing Alt+↑ (Up Arrow) then pressing **A** or by clicking on the Autostart tab.

Step   3. Select, by placing a checkmark in the checkbox, Enable other users to login to this machine and Enable other users to access your files by using FTP. For the last two items, click on the Foreground session button.

Step   4. In the Parameter field for Enable other users to login..., enter -p 2223.

Step   5. In the Parameter field for Enable other users to access..., enter -p 2221.

Step   6. The window, when properly filled in, should look like Figure 157.
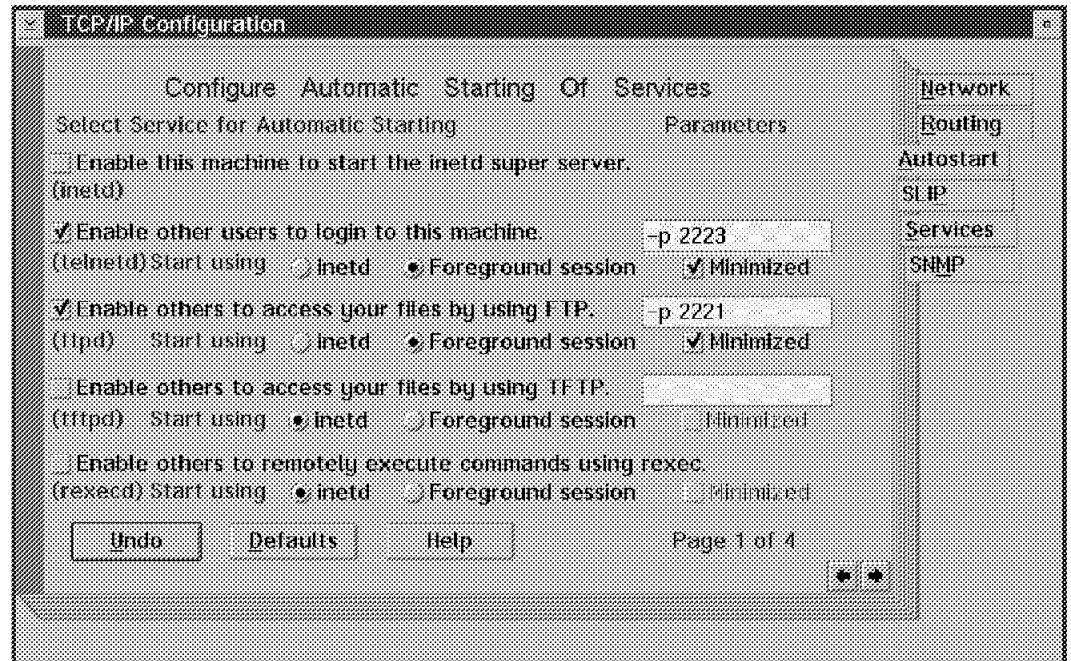
Figure 157. 3172 TCP/IP Configuration Autostart Page

Step   7. Go to the Services page by pressing Alt+↑ (Up Arrow) then pressing **S** or by clicking on the Services tab.

Step   8. Click on the TRUSERS field, then press the **Edit** button.

Step   9. Enter, in their proper fields, the Username (lapitan in the ITSO setup), Password, and Directory access for read and write (both C:\ in the ITSO setup). Press the **Edit** button to save the settings.

┌─ **Important** ──┐
│   │
│ Entries in the Username field are *case-sensitive*. Make sure you │
│ remember this when you FTP into the 3172.   │
│   │
└──┘

Step 10. The window, when properly filled in, should look like Figure 99 on page 175.

Step 11. Press the Right arrow key (→) twice to go to Page 3 of 3 of TCP/IP Configuration Services.

Step 12. Enter the telnet password in the Telnet Password field.

Step 13. Exit and save your settings by closing the TCP/IP Configuration notebook (press Alt+F4 or double-click on the Title Bar icon).

3.11.3 Workstation Definitions

Workstation LAPS for OS/2 Definition:

See Scenario 1 definitions in "Workstation LAPS for OS/2 Definition:" on page 170.

Workstation TCP/IP for OS/2 Definition:

See Scenario 1 definitions in "Workstation TCP/IP for OS/2 Definition:" on page 172.

3.11.4 Verification Tests

Telnet from Workstation OS/2 to 3172

```
[C:\]telnet 9.67.38.22 -p 2223
```

Figure 158. Telnet Command Issued for the 3172 from the Workstation

Note: The OS/2 telnet command syntax is telnet *IP address* -p *port number*.

```
 OS/2 Version 2.1 (Offload3172)

 Enter your password: .......

[<Offload3172>-C:\]dir/w

 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\

[OS2]          [PSFONTS]      SWAPPER.DAT     [SPOOL]         [DESKTOP]
[NOWHERE]      [LANLK]        CONFIG.SYS      [TCPIP]         README
[OFFLOAD]      [IBMCOM]       IBMLVL.INI
       13 file(s)    2140439 bytes used
                     48316416 bytes free

[<Offload3172>-C:\]exit

[C:\]
```

Figure 159. Telnet Session into the 3172 from the Workstation

Telnet from TSO to 3172

```
------------------------ TSO COMMAND PROCESSOR -----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> telnet 9.67.38.22 2223

TCPTEL001I MVS TCP/IP Telnet V2R2.1
TCPUTM110I Connecting to 9.67.38.22, port 2223
***
```

Figure 160. Telnet Command Issued for the 3172 from MVS TCP/IP

Note: The TSO telnet command syntax is telnet *IP address port number*.

```
TCPUTM118I
TCPUTM119I Using Line Mode...
TCPUTM120I
TCPUTM121I Notes on using Telnet when in Line Mode:
TCPUTM122I - To hide Password, Hit PF3 or PF15
TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
***
```

Figure 161. MVS TCP/IP Response after Telnet Command

```
OS/2 Version 2.1 (Offload3172)

Enter your password: .......

<Offload3172>-C:\dir/w

 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\

OS2          PSFONTS       SWAPPER.DAT    SPOOL        DESKTOP
NOWHERE      LANLK         CONFIG.SYS     TCPIP        README
OFFLOAD      IBMCOM        IBMLVL.INI
        13 file(s)    2140439 bytes used
                      48316416 bytes free

<Offload3172>-C:\

Telnet command: quit

Session ended. <ENTER> to return to TSO.

TCPUTM101I Telnet terminated
***
```

Figure 162. Telnet Session into the 3172 from MVS TCP/IP

Note: The Telnet command: prompt is invoked by pressing PF4.

FTP from Workstation OS/2 to 3172

```
[C:\]ftp 9.67.38.22 2221
Connected to 9.67.38.22.
220 Offload3172 FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
Name (9.67.38.22): lapitan
331 Password required for lapitan.
Password:
230 User lapitan logged in.
ftp> pwd
257 "C:\" is current directory.
ftp> get config.sys conf3172.sys
200 PORT command successful.
150 Opening ASCII mode data connection for config.sys (2650 bytes).
226 Transfer complete.
local: conf3172.sys remote: config.sys
2650 bytes received in 0.13 seconds (20 Kbytes/s)
ftp> quit
221 Goodbye.
[C:\]
```

Figure 163. FTP from the Workstation into the 3172

Note: The OS/2 FTP command syntax is ftp *IP-address port-number*.

```
 ┌─ Important ──────────────────────────────────────────────────────────

   Be careful not to overwrite files when copying files between the 3172 and
   your workstation.  For example, when you copy the 3172's CONFIG.SYS file to
   your workstation, you may overwrite your workstation's own CONFIG.SYS file.

   Either change your working directory (use the CD or LCD commands) or
   rename the file in the copy process (as shown in the example).

 └──────────────────────────────────────────────────────────────────────
```

FTP from TSO to 3172

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.38.22 2221

 FTPALL001I MVS TCP/IP FTP V2R2.1
 FTPALL105I Connecting to 9.67.38.22, port 2221
 220 Offload3172 FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
 FTPALL010I USER (identify yourself to the host):
lapitan
 FTPALL252I >>>USER lapitan
 331 Password required for lapitan.
 FTPALL228I Password:

 FTPALL252I >>>PASS ********
 230 User lapitan logged in.
 FTPALL011I Command:
pwd
 FTPALL252I >>>PWD
 257 "C:\" is current directory.
 FTPALL011I Command:
get config.sys
 FTPALL252I >>>PORT 9,67,38,22,4,8
 200 PORT command successful.
 FTPALL252I >>>RETR config.sys
 150 Opening ASCII mode data connection for config.sys (2650 bytes).
 226 Transfer complete.
 FTPALL168I 2650 bytes transferred. Transfer rate 12.50 Kbytes/sec.
 FTPALL011I Command:
quit
 FTPALL252I >>>QUIT
 221 Goodbye.
 ***
```

Figure 164. FTP from MVS TCP/IP into the 3172

Note: The TSO FTP command syntax is ftp *IP-address port-number*.

Chapter 4. 3172 Multiprotocol Extensions

This chapter describes the 3172 Model 3 configured as a Multiprotocol Extensions (MPE) system. The term *Multiprotocol Extensions* denotes the extended connectivity provided by combining a Wide Area Connector card with RouteXpander/2 software in a 3172 Model 3 with the Offload of TCP/IP feature. IP routing and source route bridging over a frame relay network, or a point-to-point link, are the current connectivity extensions provided by MPE. RouteXpander/2 Version 1.0 which is part of the MPE package has been superseded by Version 1.01. This release has extended the available functions to include transparent bridging and IPX routing over a frame relay network. This version of RouteXpander/2 may be included in the MPE package at a later date.

A brief description of the functionality of the frame relay connection from 3172 is included as well as several connectivity scenarios with configuration descriptions.

The first part of this chapter will deal with the installation and configuration processes involved in setting up the 3172 MPE test environment at the ITSO Raleigh Center and the steps you may take in doing these things in your environment.

The MPE functions can be implemented in a 3172 Model 3 provided the hardware prerequisites are met, by ordering and installing the required software packages individually. Alternatively, the *3172 Multiprotocol Networking Software Solution* may be ordered. The 3172 Multiprotocol Networking Software Solution is delivered as a preconfigured 3172 Model 3 with all required software installed and partly configured for you. The steps needed to configure a 3172 MPE is described in two ways:

1. Installing and configuring all the programs manually for a 3172-3 with token-ring and Ethernet LANs. See 4.5, "Manual Installation and Customization" on page 221.

2. Configuring the same 3172-3 when a *3172 Multiprotocol Networking Software Solution* is received. See 4.6, "The 3172 Multiprotocol Networking Software Solution Customization" on page 232.

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4.1 Hardware and Software Requirements and Options

This section lists the required hardware and software for the 3172 MPE function. It also mentions optional hardware that is supported in the MPE environment.

4.1.1 Hardware Requirements

The 3172 MPE function requires the following hardware to be installed on the 3172 Model 3.

3172 Model 3 with the Offload hardware feature (FC 2700) which includes:

- 9524 XGA color monitor and power cord
- IBM keyboard
- XGA display adapter
- 8MB memory expansion (for a total of 16MB RAM)

Other hardware

- Mouse accessory kit

LAN Adapters

- IBM 3172 Token-Ring 16/4 Adapter (FC 2210)
- IBM 3172 Wide Area Connector Adapter (WAC Adapter), ordered with one of three feature codes depending on the interface desired:
  - CCITT X.21 interface
  - CCITT V.35 interface
  - EIA RS-422/449 interface

One of the following channel adapters:

- IBM 3172 System/370 Parallel Channel Adapter (FC 2501)
- IBM 3172 ESCON Adapter (FC 2800)

Both the following processor cards are supported:

- 25 MHz 80486SX processor card for the 3172 Model 3
- 50 MHz 80486DX processor card for the 3172 Model 3

Optional hardware features

Up to two additional LAN adapters are supported in the MPE environment. For allowed combinations see 4.2, "Supported Adapter Combinations on the 3172 MPE System" on page 215.

> **Important**
>
> If you are upgrading an Offload 3172, take note that you *cannot* use the token-ring adapter with feature code 2215 on the MPE environment. You have to replace it with the token-ring adapter with feature code 2210.

4.1.2 Software Requirements

The following programs are required to run the MPE function. Note that all these programs, plus NetView DM/2 Entry (5621-439), are included on a preconfigured 3172 Model 3 with the Multiprotocol Networking Software Solution installed.

- OS/2 2.1 (5604-467) or later
- RouteXpander/2 1.0 (5621-398)
  - CSD WR20160 and WR20307 must be added
- Network Transport Services/2 (5622-002)
- TCP/IP Version 2.0 for OS/2 (5622-086)
- TCP/IP Offload feature for VM or MVS, either:
  - IBM DUA for offload feature MVS (5775-AQP)
  - IBM DUA for offload feature VM (5775-BDW)

Important

- IBM TCP/IP Version 2 Release 2 for VM requires the application of PTF for APAR PN35887 on the host to enable the Offload feature.

- If you are running TCP/IP on a guest system under VM, this guest system must be defined to the first level system as follows depending on the level of VM that you have:
  - V=R if you are running VM/ESA 1.0 or 1.1
  - V = X if you are running VM/ESA 1.2 or later, where X can be V, F, or R

- Make sure you have the latest version of the Offload Feature diskette for your environment. The latest version provides you with the latest ESCON and parallel channel adapter device drivers.

4.2 Supported Adapter Combinations on the 3172 MPE System

When running the Multiprotocol Networking Software Solution, the 3172 may be attached to other LANs. The 3172 Model 3 supports physical attachment to two other LANs besides the token-ring and wide area network attachment required for MPE function. These LANs can be token-ring networks, Ethernet V.2 networks, IEEE 802.3 networks or FDDI networks. The number of LANs supported depends on hardware compatibility restrictions on the 3172 Model 3 itself.

Adapter Configurations

The following table shows the 3172 Model 3 configurations supported when running the MPE function. Note that other combinations are possible and might work under certain circumstances but these 12 configurations are the only ones that are supported.

Config. Number	LANs	Slot 8	Slot 7	Slot 6	Slot 5	Slot 4	Slot 3	Slot 2	Slot 1
1	1	FDA	TRN	WAC	XGA	PCA	NU	NU	NU
2	1	FDA	TRN	WAC	XGA	NU	NU	ESC	ESC
3	2	FDA	FDDI	FDDI	XGA	PCA	TRN	WAC	NU
4	2	FDA	TRN	TRN	XGA	PCA	WAC	NU	NU
5	2	FDA	TRN	ETH	XGA	PCA	WAC	NU	NU
6	2	FDA	TRN	TRN	XGA	WAC	NU	ESC	ESC
7	2	FDA	TRN	ETH	XGA	WAC	NU	ESC	ESC
8	2	FDA	FDDI	FDDI	XGA	WAC	TRN	ESC	ESC
9	3	FDA	TRN	TRN	XGA	PCA	ETH	WAC	NU
10	3	FDA	TRN	ETH	XGA	PCA	ETH	WAC	NU
11	3	FDA	TRN	TRN	XGA	ETH	WAC	ESC	ESC
12	3	FDA	TRN	ETH	XGA	ETH	WAC	ESC	ESC

Table 14. Supported Card Combinations when Running 3172 MPE

Abbreviations used in the table are:

FDA　　　　　　　　Fixed Disk Adapter

TRN　　　　　　　　Token-Ring Adapter (FC 2210)

PCA　　　　　　　　Parallel Channel Adapter

XGA　　　　　　　　XGA Adapter

ETH　　　　　　　　Ethernet/802.3 Adapter

ESC　　　　　　　　ESCON Adapter (occupies 2 card slots)

FDDI　　　　　　　　FDDI Adapter (occupies 2 card slots)

NU　　　　　　　　Not used

WAC　　　　　　　　WAC Adapter

4.3 The ITSO MPE Environment

The configuration that was used in the following installation is according to
configuration number 7 in Table 14 on page 216. The channel adapter is ESCON
and, in addition to the required token-ring adapter and the WAC card, it has an
Ethernet Busmaster adapter.

```
┌─────────────────────────────────────────────────────────────────────┐
│           ┌───────────────────────────────┐                          │
│           │      VM/ESA              9121-320                         │
│           │      MVS/ESA                                              │
│           │      TCPIP 2.1.1                                          │
│           │                                                           │
│           │  MPETR1  IP address 9.67.38.20                            │
│           │  MPEWAC  IP address 9.67.32.20                            │
│           │  MPEEN1  IP address 9.67.46.85                            │
│           │                                                           │
│           │    ChPID  │ 18 │                                          │
│           └───────────┴────┴─────────────┘                           │
│                        ││                                             │
│                        ││      device address = 320                  │
│                        ││                                             │
│              ┌─────────┴┴──────────┐                                 │
│              │  port │ E1 │   9032-002                                │
│              │       └────┘   ESCON                                   │
│              │                Director                                │
│              │  port │ E4 │                                           │
│              └───────┴────┴────────┘                                 │
│                        │                                              │
│              ┌─────────┴───────────┐                                 │
│              │    3172 Model 3                                        │
│              │        MPE                                             │
│              │  ESCON base subch   320                                │
│              │  ESCON card slot    1-2                                │
│              │                                                        │
│  TCP/IP link →  MPETR1 MPEWAC MPEEN1                                  │
│  Log. adp nr →    0      1      2                                     │
│                                                                       │
│  Card slot   →    7      4      6                                     │
│              └────┬──────┬──────┬──┘                                 │
│  MAC               │      │      └──→ 4000 012A 3172                 │
│  addresses  →      │      └──────→ 4000 014A 3172                    │
│                    └──────────────→ 4000 011A 3172                   │
└─────────────────────────────────────────────────────────────────────┘
```
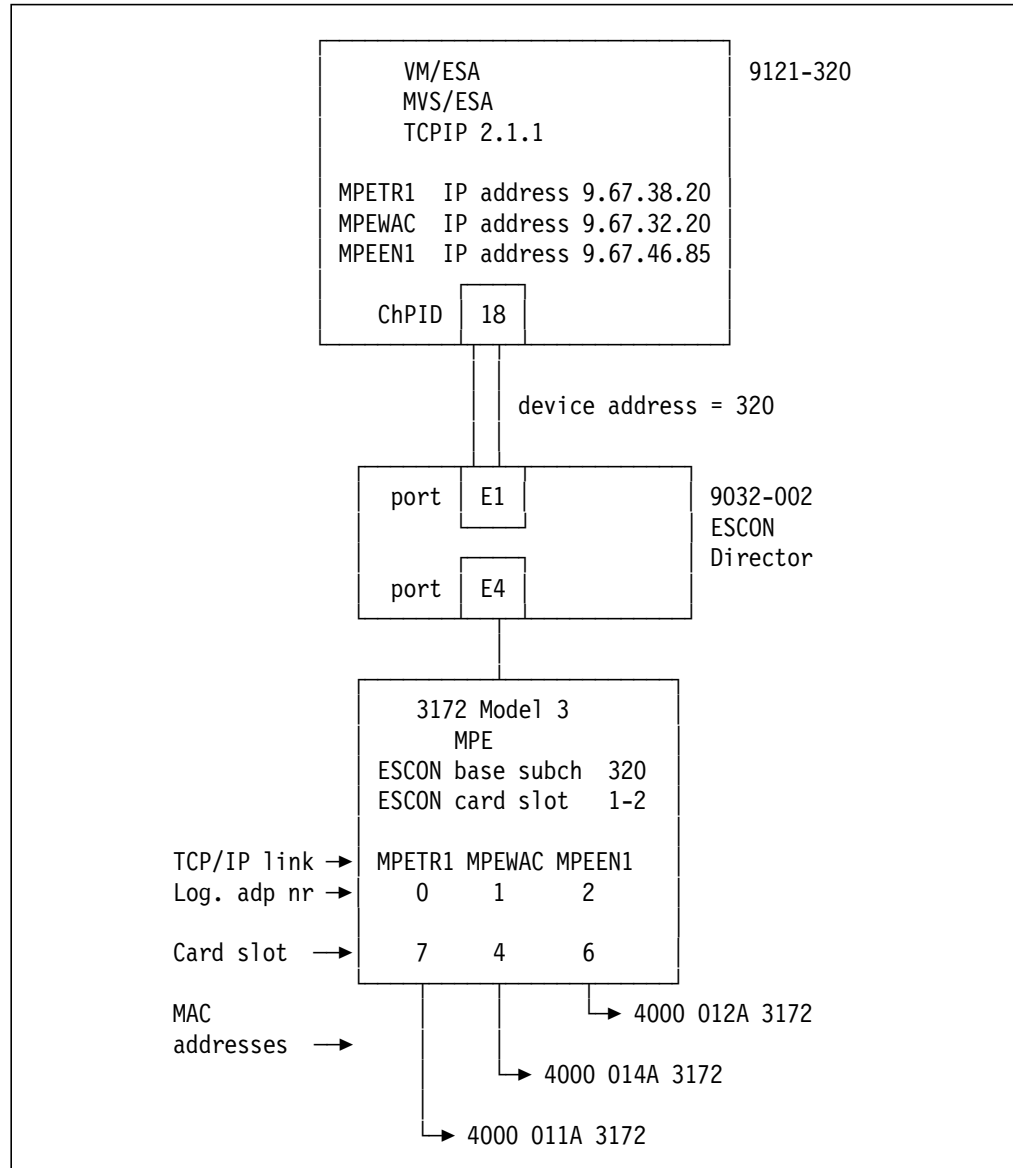
Figure 165. ITSO MPE Environment with the Hardware and Addresses Configured

4.3.1 The ITSO MPE Environment, Logical Appearance

To the network users, TCP/IP, and the bridged protocols, the environment in
Figure 165 on page 217 looks like the network depicted below:

```
┌─────────────────────────────────────────────────────────────────┐
│     ┌─────────────────────────────────────────────────────┐      │
│     │  TCP/IP Host        ┌──────────────────────────────┐ │      │
│     │                     │  TCP and UDP Applications     │ │      │
│     │                     │      on IP addresses          │ │      │
│     │                     │        9.67.38.20             │ │      │
│     │     ┌──────────┐    │        9.67.32.20             │ │      │
│     │     │IP ROUTER │    │        9.67.46.85             │ │      │
│     │     │127.1.1.1 │    └──────────────────────────────┘ │      │
│     │     └──────────┘                                      │      │
│     └─────────────────────────────────────────────────────┘      │
│                    ┌──────────────────────────────┐               │
│                    │     I P   R O U T E R         │               │
│                    └──────────────────────────────┘               │
│                        ┌──────────┐                               │
│                        │   SR     │                               │
│                        │ BRIDGE   │                               │
│                        │  # 15    │                               │
│                        └──────────┘                               │
│          ┌──────────┐  ┌──────────┐  ┌──────────┐                 │
│          │9.67.38.20│  │9.67.46.85│  │9.67.32.20│                 │
│          └──────────┘  └──────────┘  └──────────┘                 │
│          ┌──────────┐  ┌──────────┐                               │
│          │  Real    │  │frame relay│   Ethernet                   │
│          │Token Ring│  │Token Ring │                              │
│          │          │  │           │                              │
│          │Ring # 582│  │Ring # FFF │                              │
│          └──────────┘  └──────────┘                               │
└─────────────────────────────────────────────────────────────────┘
```
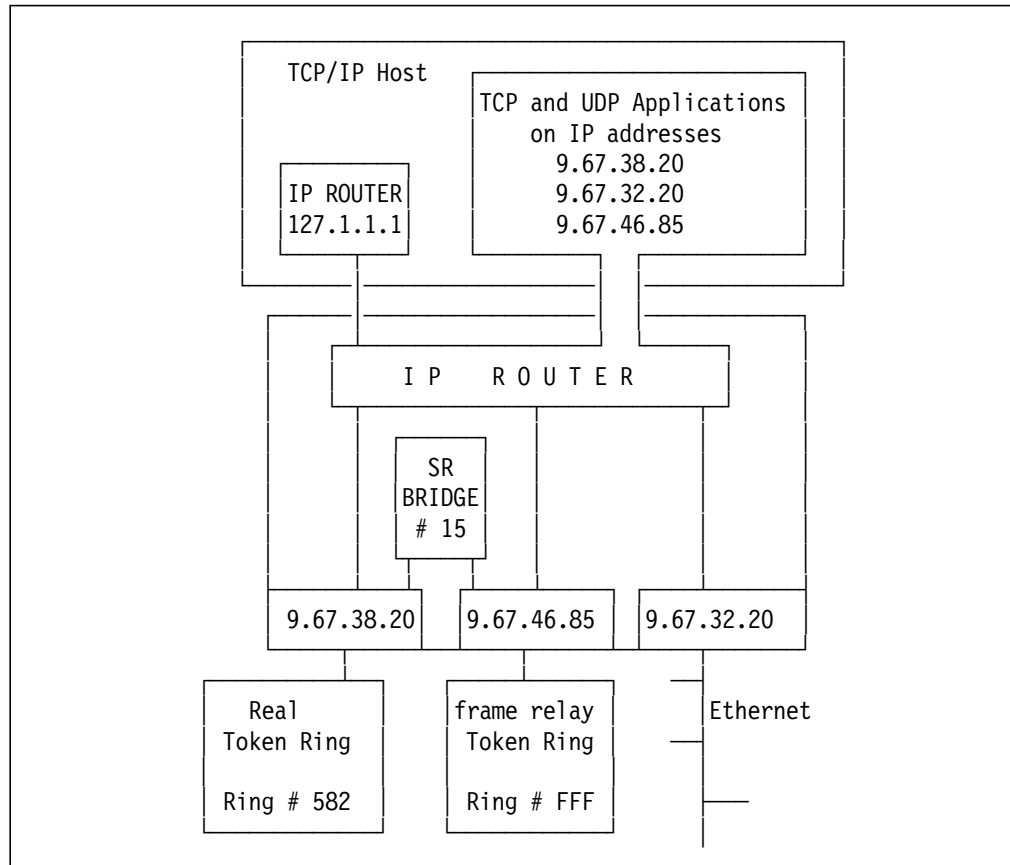
Figure 166. The Logical Network Appearance of the ITSO MPE Environment

Note: The routing table used in the 3172 will automatically be downloaded and
kept updated from the host TCP/IP. In that table IP address 127.1.1.1 will be
shown as next hop for all destinations that are not routed through one of the
3172 LAN adapters.

4.3.2 Completed Worksheet for the ITSO MPE Environment

```
                        LAN ADAPTERS
                        ============
                                           TR/FR
      Adapter          IP address    Subnet mask    Slot  Speed    MAC address
      -------          ----------    -----------    ----  -------  --------------

 TR Primary   (req)    9.67.38.20    255.255.255.192   7   4Mbps    4000 014A 3172

 TR alternate (opt)    ..............  ..............  ....  .......  ..............

 Ethernet     (opt)    9.67.32.20    255.255.255.192   6            4000 012A 3172

 WAC          (req)    9.67.46.85    255.255.255.192   4   256Kbps  4000 011A 3172

 FDDI         (opt)    ..............  ..............  ....           ..............

                    WAC LMI TYPE  (select 2 or 3)
                    ==============================

   For LMI Revision 1 select 2     For LMI ANSI T1.617 select 3-x

                        HOST ATTACHMENT
                        ===============
                                          ESCON      PCA
      Adapter     IP address   Base subchl addr  dir path or  Speed
      -------     ----------   ----------------  --------   -------

 PCA / ESCON-x   9.67.38.20          320          E11       .......

                    RING NUMBER AND BRIDGE NUMBER
                    ============================
                                              * Note *************
 frame relay ring number     FFF              *                  *
                                              * You will find    *
 Token Ring ring number      582              * blank worksheets *
                                              * for your own use *
 Bridge Number               15               * in Appendix A    *
                                              *                  *
                                              *******************

                NETVIEW DISTRIBUTION MANAGER/2 NAMES
                ====================================

 LDU Distributor name (server)    ITSOSERV

 LDU Receiver name (client)       MPECLIENT

                    LAN LOGICAL ADAPTER NUMBERS
                    ===========================

 LAN Adapter #    Adapter type (select one for each adapter number)
 -------------
 Adapter  0       TRN-x  -      -      -      -      -
 Adapter  1       WAC-x  -      -      -      -      -
 Adapter  2       TRN    ETH-x  FDDI   PCA    ESC    -
 Adapter  3       TRN    ETH    FDDI   PCA    ESC-x  None
 Adapter  4       PCA    ESC    None-x -      -      -
```

Figure 167. 3172 MPE Worksheet Completed with ITSO MPE Configuration Data

4.4 Host Definitions

The following section describes the IOCP, operating system, and host TCP/IP profile definitions that were used in the ITSO MPE environment.

Preparing the host for Offload includes the following tasks:

- Defining the 3172 to the IOCP

- Defining the 3172 to the operating system (MVS or VM)

- Defining the 3172 to the host TCP/IP
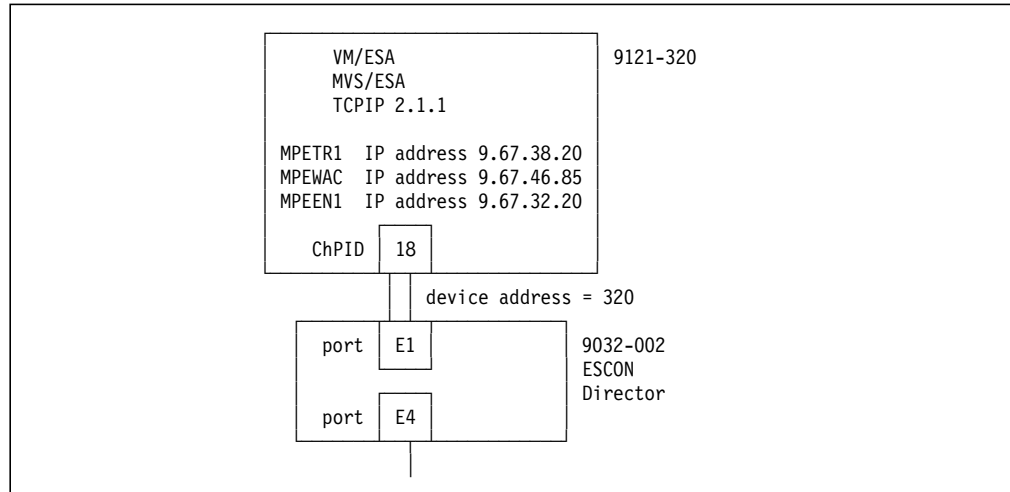
Figure 168. ITSO MPE Environment Host Definitions

4.4.1 IOCP Definition

Channel path definition:

```
CHPID   PATH=((18)),TYPE=CNC,SWITCH=E1
```

Control unit and device definitions with logical addressing = 1 for the MPE 3172:

```
          CTRLUNIT  CUNUMBR=320,UNIT=3172,PATH=(18),          X
                    CUADD=1,LINK=(E4),UNITADD=((20,32))
DEV340  IODEVICE  UNIT=SCTC,ADDRESS=(320,32),               X
                    CUNUMBR=(320)
```

4.4.2 VM/ESA Definition

VM/ESA HCPRIO definition:

```
RDEVICE ADDRESS=(320,8),DEVTYPE=CTCA
```

4.4.3 MVS/ESA Definition

MVS/ESA IODEVICE macro for ESCON channel:

```
IODEVICE UNIT=SCTC,ADDRESS=(320,8)
```

4.4.4 TCP/IP Definition

Buffer definitions:

```
DATABUFFERPOOLSIZE          150  28672
SMALLDATABUFFERPOOLSIZE    1200
TINYDATABUFFERPOOLSIZE      500
```

Device and link definitions:

```
DEVICE OFFDEV     CLAW  320  TCPIP  OS2TCP  NONE
LINK   MPEIPLINK OFFLOADLINK1  1  OFFDEV
LINK   MPETR1     OFFLOADAPIBROAD 9.67.38.20  OFFDEV  MPEIPLINK
LINK   MPEWAC     OFFLOADAPIBROAD 9.67.46.85  OFFDEV  MPEIPLINK
LINK   MPEEN1     OFFLOADAPIBROAD 9.67.32.20  OFFDEV  MPEIPLINK
```

Device startup definition:

```
START MPEDEV
```

4.5 Manual Installation and Customization

This section describes installation and customization of all software products that constitute the ITSO 3172 Multiprotocol Extension environment. The products must be installed in the order described. The cards installed are according to configuration number 7 in Table 14 on page 216. Our reconfiguration process also involved changes to the default parameters on the reference diskette system setup.

4.5.1 Hardware Reconfiguration

This procedure has to be followed to change hardware default values. If you are running a 16 Mbps token-ring, you must change the token-ring speed from the default value 4 Mbps. In our case, with an ESCON adapter installed, we had to change the ESCON card interrupt level due to a conflict with the token-ring adapter.

If the messages shown below are displayed when you boot your 3172, you will have to do the reconfiguration described here.

```
PRO0030 Multiple adapters are trying to use the same interrupt level.
The request to bind Fi6 to IBMTOK_NIF cannot be completed.
Press enter to continue.
```

Note: If your 3172 has been preconfigured with the Multiprotocol Networking Software Solution this configuration change is done for you if it is required.

To use the reference diskette with 3172 MPE you must alternate between using the 3172 operator panel and the PS/2 keyboard attached to the 3172. The term *keypad* will be used for the operator panel and *keyboard* for the OS/2 keyboard.

Step   1. Insert the reference diskette in the diskette drive and reboot the system. The reference main menu appears on the monitor and 1000 is displayed on the operator panel display.

Step   2. Press **2** and then **Enter** on the *keypad* to select option 2, Diagnostic Utilities. The Diagnostic Utilities menu appears on the monitor and b000 is displayed on the operator panel.

Step 3. Press **6** and then **Enter** on the *keypad* to select Set Configuration. The Set Configuration window appears on the monitor.

Step 4. Now use the *keyboard* to select Change Configuration. The Set Configuration window appears.

Step 5. Use the down arrow to locate the ESCON adapter and with the cursor on SRAM, I/O, Interrupt, press **PF6** until D00000,IO 10A0, INT 3/10 appears in the parameter field.

Step 6. Press **PF10** to save the changes.

Step 7. Press **PF3** twice to exit.

Step 8. Remove the reference diskette.

Step 9. Press **Enter** to reboot the system.

4.5.2 OS/2 2.1 Installation

Follow this procedure to install OS/2 2.1 in the 3172 Model 3.

Step 1. Insert the OS/2 installation diskette in the diskette drive. Reboot the system and follow the on-screen instructions until you are returned to the Installation Drive Selection window.

Step 2. Press **Enter** to accept drive C. Follow the on-screen instructions. The Formatting the Installation Partition window appears.

Step 3. Select **Format the Partition** to format drive C. The Select File System window appears.

Step 4. Select **FAT File System**. The OS/2 Setup and Installation window appears.

Note: The FAT file system is recommended for the 80MB fixed disk installed in the 3172.

Step 5. Select **Select Features and Install**. The System Configuration window appears.

Step 6. Use the tab key and spacebar to select **Mouse** and deselect **Default Printer**. Press **Enter**. The Mouse window appears.

Step 7. Press **Enter** to select **PS/2 Style Pointing Device**. The System Configuration window appears.

Step 8. Press **Enter**. The OS/2 Setup and Installation window appears.

Step 9. Use the spacebar and *deselect* the following features:

- Tools & Games
- WIN-OS/2 support
- High Performance File System
- Advanced Power Management
- PCMCIA support
- Optional Bit Maps

   Note: These OS/2 features should be deselected to conserve disk space as they are not used in the 3172 Model 3.

Step 10. Press **Enter**.

Step 11. On the Advanced Options window, deselect **Migrate Applications** and press **Enter**. You select no items on this panel.

Step 12. Follow the on-screen instructions to install the printer and display device drivers and complete the OS/2 installation.

4.5.3 TCP/IP 2.0 for OS/2 Installation

Follow this procedure to install TCP/IP 2.0.

Step 1. Insert the TCP/IP for OS/2 diskette 1 in the diskette drive.

Step 2. At an OS/2 prompt, enter A:tcpinst and the TCP/IP Installation Tool window appears.

Step 3. Select the option **Base TCP/IP for OS/2** only.

Step 4. Ensure that you select **Install/Run LAN Adapter and Protocol Support** and **Update CONFIG.SYS**.

Step 5. Deselect **Configure Network Connection**.

Step 6. Click on **Install**. The TCP/IP Installation tools window appears.

Step 7. Click on **OK** to select default directory **C:\TCPIP**.

Step 8. When prompted, insert the LAPS diskette and start the LAPS installation and configuration program. The IBM LAN Adapter and Protocol Support window appears.

Step 9. Click on **Install**. The Target Drive window appears.

Step 10. Click on **OK** to accept target drive C. The Installation Complete window appears.

Step 11. Click on **OK**. The IBM LAN Adapter and Protocol Support window appears.

Step 12. Click on **Configure**. You will now configure LAPS.

Step 13. To Configure the token-ring adapter for TCP/IP, select **Configure LAN Transports** and select **Continue**. The Configure workstation window appears. It contains three smaller windows:

- Network Adapters
- Protocols
- Current Configuration

Step 14. Select **IBM Token-Ring Network Adapters** from the Network Adapters window and double-click. This adds the Adapter to the Current Configuration window.

Step 15. With **IBM Token-Ring Network Adapters** highlighted in the Current Configuration Window, double-click on **IBM TCP/IP**. This adds the TCP/IP protocol under IBM Token-Ring Network Adapters.

Step 16. Click on **OK**. The LAN Adapter and Protocol Support window appears.

Step 17. Click on **Exit**.

Step 18. Follow the on-screen instructions to exit LAPS, save the changes and update the required files.

> **Note:** When you exit the LAPS Installation and Configuration program, you are instructed to shut down your workstation. **Do NOT shut down**

your workstation now as you have not completed the TCP/IP installation.

Step 19. Follow the on-screen prompts to insert the installation diskettes. When you have successfully installed TCP/IP for OS/2, a message is displayed informing you that the installation is complete.

Step 20. Remove the diskette, shut down OS/2 using the OS/2 shutdown procedure, and reboot the system.

4.5.4 Offload of TCP/IP Feature Installation

Follow this procedure to install the Offload of TCP/IP Feature.

Step 1. Insert the Offload of TCP/IP feature diskette in the diskette drive.

Step 2. Enter A:Install at an OS/2 command prompt.

Step 3. When prompted to configure an ESCON or a Parallel Channel Adapter, enter 2 for ESCON. See the worksheet in Figure 167 on page 219.

Step 4. When prompted for Base Subchannel address, enter 20. See the worksheet in Figure 167 on page 219.

Step 5. When prompted for ESCON Director Path, enter E11. See worksheet in Figure 167 on page 219.

Step 6. Enter Yes to enable Offload SNMP Subagent.

Step 7. When prompted for Community name, enter the SNMP community name defined in your VM or MVS host TCP/IP.

Step 8. Remove the Offload feature diskette, shut down OS/2 using the OS/2 shutdown procedure, and reboot the system.

4.5.5 Network Transport Services/2 Installation

Follow this procedure to install Network Transport Services/2.

Step 1. Insert the NTS/2 LAN Adapter and Protocol Support diskette in the diskette drive.

Step 2. Enter A:LAPS at an OS/2 command prompt. The LAN Adapter and Protocol Support main menu appears.

Step 3. Click on **Install**. The Target Drive window appears.

Step 4. Click on **OK** to accept target drive C.

Step 5. Follow the on-screen instructions to install LAPS. The Installation Complete window appears.

Note: You might be prompted to accept installation of an older version of LAPS than the one already installed with TCP/IP. Click on **OK** to accept that. This only means that the LAPS shipped with TCP/IP was more recent than NTS/2 but the TCP/IP support will not be deleted or overlaid.

Step 6. Follow the on-screen instructions to exit LAPS, save the changes and update the required files.

Step 7. Remove the NTS/2 diskette, shut down OS/2 using the OS/2 shutdown procedure, and reboot the system.

4.5.6 WAC Device Driver Installation

Follow this procedure to install the WAC adapter device driver. The WAC installation and Diagnostics diskette used in this procedure was provided with the 3172 or with the WAC card if it was separately ordered.

Step 1. Insert the WAC Installation and Diagnostics diskette in the diskette drive.

Step 2. Enter C:\IBMCOM\LAPS at an OS/2 command prompt. The LAN Adapter and Protocol Support main menu appears.

Step 3. Click on **Install**.

Step 4. Click on **OK** to accept the A: drive as the source drive. The Installation Complete window appears.

Step 5. Follow the on-screen instructions to exit LAPS, save the changes and update the required files.

Step 6. Remove the WAC Installation and Diagnostics diskette.

4.5.7 RouteXpander/2 Installation

Follow this procedure to install RouteXpander/2.

Step 1. Insert the RouteXpander/2 product diskette in the diskette drive.

Step 2. Enter A:GSDINST at an OS/2 command prompt. The RouteXpander main menu appears.

Step 3. Click on **Install**. The Installation window appears.

Step 4. Click on **OK** to accept source drive A and destination drive C. The RXR/2 Installation Results window appears.

Step 5. Click on **OK**. The RouteXpander/2 Options window appears.
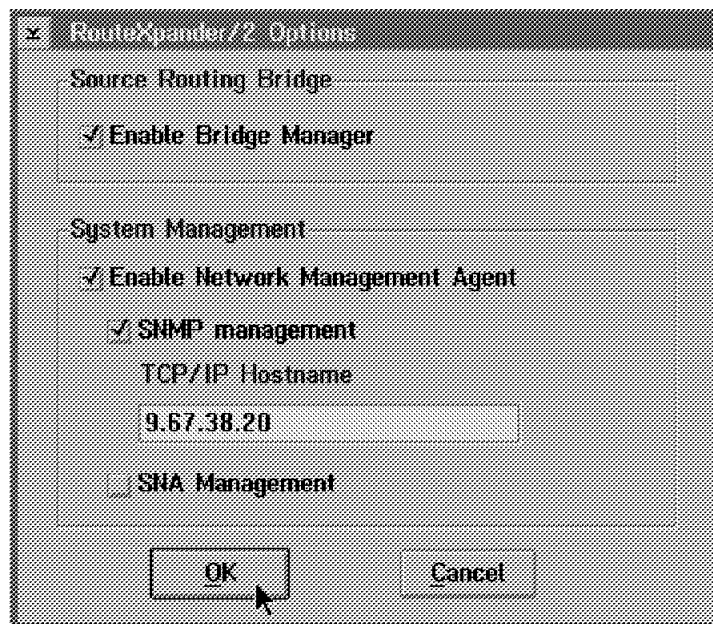
Figure 169. RouteXpander/2 Options Window

Step 6. Select **Enable Bridge Manager**.

> **Note:**
>
> Enable Bridge Manager will add the statement
> `RUN=C:\GSD\GSDBRMGR.EXE` to your CONFIG.SYS file. If for any reason
> you want to disable bridging in your 3172 you should make this
> statement a comment by adding `REM` in front of it on the same line.

Step 7. Select **Enable Network Management Agent** and **SNMP management**. As
TCP/IP Hostname enter the IP address on your first `LINK` statement for
this 3172 in the VM or MVS TCPIP PROFILE dataset. In our
environment this is the token-ring adapter link named MPETR1; see
4.4.4, "TCP/IP Definition" on page 221.

> **Note:**
>
> The options selected in Figure 169 on page 225 will add the
> statement
> `START /MIN C:\GSD\GSDNMA.EXE /SNMP=9.67.38.20` in your
> STARTUP.CMD file. This will start a Network Management window
> on your 3172 that displays status messages for RouteXpander/2.
>
> It will also let the RXR/2 SNMP subagent connect to the SNMP
> agent that resides in the VM or MVS host TCP/IP. This allows for
> SNMP managers to access MIB values maintained by the RXR/2
> subagent, by accessing the VM or MVS agent. See also 4.7.1,
> "Starting the 3172 with MPE" on page 239 for a description of the
> GSDNMA program.

Step 8. Click on **OK**. The LAPS main menu appears.

Step 9. Follow the on-screen instructions to exit LAPS, save the changes and
update the required files. The RouteXpander Installation window
appears.

Step 10. Exit RouteXpander/2 and remove the RXR/2 product diskette.

4.5.8 RouteXpander/2 CSD Installation

After installation of the RXR/2 base level, obtain CSD diskettes WR20160 and
WR20307 and follow the steps below.

Step 1. Insert the WR20160 diskette in the diskette drive.

Step 2. If the diskette contains the file WR20160.EXE, enter `A:WR20160` at the
OS/2 command prompt. This command will ′explode′ the files and
remove the WR20160.EXE from the diskette. If the file does not exist,
the command has already been executed.

Step 3. Enter `A:GSDINST`. The RouteXpander main menu appears.

Step 4. Click on **Install**. The installation window appears.

Step 5. Click on **OK** to accept source drive A and destination drive C. The
RXR/2 Installation Results Window appears.

Step 6. Exit RouteXpander/2 and remove the RXR/2 product diskette.

Step 7. Shut down OS/2 using the OS/2 shutdown procedure and reboot the
system. This is necessary to get all files locked during installation
completely installed.

Step 8. Repeat the steps with the WR20307 diskette.

4.5.9 NetView Distribution Manager/2 Installation

Follow this procedure to install NetView DM/2 LAN Download Utility.

Step 1. Insert diskette 9 of NetView DM/2 in the diskette drive.

Step 2. Enter A:NVDMIREC. The NetView DM/2 installation progress indicator appears. When installation is complete, the OS/2 window appears.

Step 3. Remove the NetView DM/2 diskette.

Step 4. Use the OS/2 editor to edit file CONFIG.SYS and add the following two lines at the bottom:

- SET SESSIONS=1

- SET LDSSERVER=ITSOSERV

  See worksheet in Figure 167 on page 219.

4.5.10 LAPS Configuration for the ITSO MPE 3172

This section describes the LAPS definitions needed to define all the adapters, the protocols and also some parameter settings for the token-ring adapter.

Step 1. Enter C:\IBMCOM\LAPS at an OS/2 command prompt. The LAPS menu appears.

Step 2. Click on **Configure**. The Configuration window appears.

Step 3. With Configure LAN Transports selected, click on **Continue**. The Configure Workstations window appears.

Step 4. Select **IBM Wide Area Connector** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

Step 5. Select **RouteXpander/2 FR MAC Driver** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

Step 6. Select **IBM Bus Master Ethernet Adapter** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

Step 7. Select **IBM NSCA (ESCON) 370 Channel Attach** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

Note: At this point the Current Configuration will look like this:

```
IBM Token-Ring Network Adapters
   0 - IBM TCP/IP
IBM Wide Area Connector
RouteXpander/2 FR MAC Driver
IBM Bus Master Ethernet Adapter
IBM NSCA (ESCON) 370 Channel Attach
```

Step 8. With IBM Token-Ring Network Adapters highlighted in the Current Configuration window, double-click on the following protocols to add them under Token-Ring Network Adapters:

a. **IBM IEEE 802.2**

b. **IBM OS/2 NETBIOS**

c. **IBM TCP/IP**

d. **RouteXpander/2 Source Routing bridge**.

Step 9. With IBM Wide Area Connector highlighted in the Current Configuration window, double-click on the following protocol to add it under IBM Wide Area Connector:

a. **RouteXpander/2 Frame Relay Protocol Driver**.

Step 10. With RouteXpander/2 FR MAC Driver highlighted in the Current Configuration window, double-click on the following protocols to add them under RouteXpander/2 FR MAC Driver:

a. **IBM IEEE 802.2**

b. **IBM OS/2 NETBIOS**

c. **IBM TCP/IP**

d. **RouteXpander/2 Source Routing bridge**.

Step 11. With IBM Bus Master Ethernet Adapter highlighted in the Current Configuration window, double-click on the following protocols to add them under IBM Busmaster Ethernet Adapter:

a. **IBM IEEE 802.2**

b. **IBM OS/2 NETBIOS**

c. **IBM TCP/IP**.

Step 12. With IBM NSCA (ESCON) 370 Channel Attach highlighted in the Current Configuration window, double-click on the following protocol to add it under IBM NSCA (ESCON) 370 Channel Attach:

a. **IBM TCP/IP**.

Note: At this point the current configuration will look like this:

```
IBM Token-Ring Network Adapters
   0 - IBM IEEE 802.2
   0 - IBM OS/2 NETBIOS
   0 - IBM TCP/IP
   0 - RouteXpander/2 Source Routing Bridge
IBM Wide Area Connector
   1 - RouteXpander/2 frame relay protocol driver
RouteXpander/2 FR MAC Driver
   1 - IBM IEEE 802.2
   1 - IBM OS/2 NETBIOS
   1 - IBM TCP/IP
   1 - RouteXpander/2 Source Routing Bridge
IBM Bus Master Ethernet Adapter
   2 - IBM IEEE 802.2
   2 - IBM OS/2 NETBIOS
   2 - IBM TCP/IP
IBM NSCA (ESCON) 370 Channel Attach
   3 - IBM TCP/IP
```

Step 13. If any of the logical adapter numbers is not as listed above, follow this procedure to change it:

a. With the protocol highlighted, click on **Change Number**. The Change Logical Adapter Number window appears.

b. Change to desired number and click on **Change**.

Step 14. In the Current Configuration window, select **IBM Token-Ring Network Adapters**, click on **Edit** and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for the MAC address. The other values are recommendations.

```
Network Adapter Address            4000 014A 3172
Max Number of queued transmits     12
Number of receive buffers          3
Receive buffer size                2040
Number of Adapter transmit buffers 12
Transmit buffer size               2040
Enable Bridging                    YES
```

Click on **OK**.

Step 15. In the Current Configuration window, select **IBM IEEE 802.2** under IBM Token-Ring Network Adapters, click on **Edit**, and insert the MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address            4000 014A 3172
```

Click on **OK**.

Step 16. In the Current Configuration window, select **IBM OS/2 NETBIOS** under IBM Token-Ring Network Adapters, click on **Edit**, and insert the MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address            4000 014A 3172
```

Click on **OK**.

Step 17. In the Current Configuration window, select **RouteXpander/2 Source Routing Bridge** under IBM Token-Ring Network Adapters, click on **Edit** and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
Ring Number                        582
Bridge Number                      15
Line speed                         4000000
```

Click on **OK**.

Step 18. In the Current Configuration window, select **IBM Wide Area Connector**, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values. Port number 0 is the top connector of the two on the WAC card.

```
Slot number                                    4
Port Number                                    0
NRZI                                           0
Line speed                                     64K
Maximum frame size to be sent and received  2272
```

> **Notes:**
>
> Port number 0 is the top connector of the two on the WAC card.
>
> The NRZI parameter is 0 (for NRZ) or 1 for (for NRZI). NRZ encoding is most commonly used when connecting to a frame relay network. When connecting to a 6611 across a leased line or modem eliminator NRZI encoding is required. When connecting to a 6611 through a frame relay network, NRZ is required.
>
> The change of Maximum frame size (from the default value 4486) shall only be done if an Ethernet LAN is attached to the 3172.

Click on **OK**.

Step 19. In the Current Configuration window, select **RouteXpander/2 Frame Relay Protocol Driver** under IBM Wide Area Connector, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
Locally Administered Address        4000011A3172
Specify LMI type                    3
Default ring number                 FFF
Maximum size of transmitted package 600
Maximum transmit fragment size      614
```

> **Note:**
>
> Set maximum transmitted package size according to the following table and maximum transmitted fragment size to the same value plus 14.
>
> | Table 15. Maximum Transmitted Package Size | |
> |---|---|
> | **Network Speed** | **Maximum Packet Size** |
> | 56 Kbps or less | 600 |
> | 256 Kbps | 1600 |
> | T1/E1 connected to 6611 | 2052 |
> | T1/E1 connected to RXR/2 on point-to-point line | 4472 |
> | T1/E1 connected to RXR/2 by a frame relay network | Maximum packet size allowed by the network provider or 4472 (RXR/2 maximum) |

Click on **OK**.

Step 20. In the Current Configuration window, select **IBM IEEE 802.2** under RouteXpander/2 FR MAC Driver, click on **Edit**, and insert the MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address        4000 011A 3172
```

Click on **OK**.

Step 21. In the Current Configuration window, select **IBM OS/2 NETBIOS** under RouteXpander/2 FR MAC Driver, click on **Edit**, and insert the MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address        T4000 011A 3172
```

Click on **OK**.

Step 22. In the Current Configuration window, select **RouteXpander/2 Source Routing Bridge** under RouteXpander/2 FR MAC Driver, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
  Ring Number                    FFF
  Bridge Number                  15
  Line speed                     256000
```

Click on **OK**.

Step 23. In the Current Configuration window, select **IBM Busmaster Ethernet Adapter**, click on **Edit**, and insert the MAC address from the worksheet in Figure 167 on page 219.

```
  Network Adapter Address        4000 012A 3172
```

Click on **OK**.

Step 24. In the Current Configuration window, select **IBM NSCA (ESCON) 370 Channel Attach**, click on **Edit**, and change the Protocol parameter to 1.

```
  Protocol                       1 (CLAW)
```

Click on **OK**.

Step 25. Click on **OK**. The LAPS main menu appears.

Step 26. Follow the on-screen instructions to exit LAPS, save the changes, and update the files required.

Step 27. Shut down OS/2 using the OS/2 shutdown procedure and reboot the system.

4.5.11 TCP/IP Configuration

No TCP/IP configuration is done on the *3172 Multiprotocol Networking Software Solution* when it is delivered. The TCP/IP configuration steps will thus be the same as for the manual installation process. The configuration steps are described in 4.6.4, "TCP/IP Configuration" on page 236.

4.6 The 3172 Multiprotocol Networking Software Solution Customization

This section describes the configuration of the ITSO MPE 3172, when it is delivered as *3172 Multiprotocol Networking Software Solution* with the following software products preloaded and partly configured:

- OS/2 2.1
- TCP/IP 2.0 for OS/2
- Offload feature for TCP/IP for MVS (or VM)
- NTS/2
- RouteXpander/2 V1.0
- NetView DM/2

The configuration should be done in the following order:

1. Set token-ring speed
2. Configure LAPS, including configuration of LAN adapters other than the required token-ring adapter
3. Configure TCP/IP for OS/2
4. Configure the Offload feature
5. Configure NetView DM/2

4.6.1 Changing the Token-Ring Data Rate

If your token-ring runs at 16 Mbps, you will have to boot the 3172 reference diskette to change the speed from the default speed of 4 Mbps. See 4.5.1, "Hardware Reconfiguration" on page 221 for a description of how to change hardware default values on the 3172.

4.6.2 Checking the RouteXpander/2 CSD Level

To function properly RouteXpander/2 must have CSDs WR20160 and WR20307 installed. To check your CSD level, go to an OS/2 prompt and issue the command syslevel. If the CSD level of RXR/2 is not as shown below, install the required CSDs as described in 4.5.8, "RouteXpander/2 CSD Installation" on page 226.

```
C:\SYSLEVEL.GSD
              IBM - RouteXpander/2
Version 1.00     Component ID 562139800
Current CSD level: WR20307
Prior  CSD level: WR20160
```

4.6.3 Configuring LAPS

Only the token-ring adapter and the wide area connector will be preconfigured. The channel adapter (ESCON or Parallel Channel Adapter) and any extra LAN adapters will have to be configured in LAPS. Follow this procedure to complete the LAPS configuration using the worksheets as necessary.

Step   1. Enter C:\IBMCOM\LAPS at an OS/2 command prompt. The LAPS menu appears.

Step   2. Click on **Configure**. The Configuration window appears.

Step 3. With Configure LAN Transports selected, click on **Continue**. The Configure Workstations window appears.

> **Note:** At this point the current configuration will look like this:

```
IBM Token-Ring Network Adapters
   0 - IBM IEEE 802.2
   0 - IBM OS/2 NETBIOS
   0 - IBM TCP/IP
   0 - RouteXpander/2 Source Routing Bridge
IBM Wide Area Connector
   1 - RouteXpander/2 frame relay protocol priver
RouteXpander/2 FR MAC Driver
   1 - IBM IEEE 802.2
   1 - IBM OS/2 NETBIOS
   1 - IBM TCP/IP
   1 - RouteXpander/2 Source Routing Bridge
```

Step 4. Select **IBM Bus Master Ethernet Adapter** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

Step 5. Select **IBM NSCA (ESCON) 370 Channel Attach** from the Network Adapters window and double-click. This adds the adapter to the current configuration window.

> **Note:** At this point the current configuration will look like this:

```
IBM Token-Ring Network Adapters
   0 - IBM IEEE 802.2
   0 - IBM OS/2 NETBIOS
   0 - IBM TCP/IP
   0 - RouteXpander/2 Source Routing Bridge
IBM Wide Area Connector
   1 - RouteXpander/2 frame relay protocol driver
RouteXpander/2 FR MAC Driver
   1 - IBM IEEE 802.2
   1 - IBM OS/2 NETBIOS
   1 - IBM TCP/IP
   1 - RouteXpander/2 Source Routing Bridge
IBM Bus Master Ethernet Adapter
IBM NSCA (ESCON) 370 Channel Attach
```

Step 6. With IBM Bus Master Ethernet Adapter highlighted in the Current Configuration window, double-click on the following protocols to add them under IBM Busmaster Ethernet Adapter:

a. IBM IEEE 802.2

b. IBM OS/2 NETBIOS

c. IBM TCP/IP.

Step 7. With IBM NSCA (ESCON) 370 Channel Attach highlighted in the Current Configuration window, double-click on the following protocol to add it to IBM NSCA (ESCON) 370 Channel Attach:

a. IBM TCP/IP.

> **Note:** At this point the current configuration will look like this:

```
IBM Token-Ring Network Adapters
   0 - IBM IEEE 802.2
   0 - IBM OS/2 NETBIOS
   0 - IBM TCP/IP
   0 - RouteXpander/2 Source Routing Bridge
IBM Wide Area Connector
   1 - RouteXpander/2 frame relay protocol driver
RouteXpander/2 FR MAC Driver
   1 - IBM IEEE 802.2
   1 - IBM OS/2 NETBIOS
   1 - IBM TCP/IP
   1 - RouteXpander/2 Source Routing Bridge
IBM Bus Master Ethernet Adapter
   2 - IBM IEEE 802.2
   2 - IBM OS/2 NETBIOS
   2 - IBM TCP/IP
IBM NSCA (ESCON) 370 Channel Attach
   3 - IBM TCP/IP
```

Step   8. If any of the logical adapter numbers is not as listed above, follow this
procedure to change it:

   a. With the protocol highlighted, click on **Change Number**. The
      Change Logical Adapter Number window appears.

   b. Change to desired number and click on **Change**.

Step   9. In the Current Configuration window, select **IBM Token-Ring Network
Adapters**, click on **Edit**, and change the following fields to the values
shown here. See the worksheet in Figure 167 on page 219 for the
MAC address. The other values are recommendations.

```
Network Adapter Address            4000 014A 3172
Max Number of queued transmits     12
Number of receive buffers          3
Receive buffer size                2040
Number of Adapter transmit buffers 12
Transmit buffer size               2040
Enable Bridging                    YES
```

Click on **OK**.

Step 10. In the Current Configuration window, select **IBM IEEE 802.2** under IBM
Token-Ring Network Adapters, click on **Edit**, and enter MAC address from
the worksheet in Figure 167 on page 219.

```
Network Adapter Address            4000 014A 3172
```

Click on **OK**.

Step 11. In the Current Configuration window, select **IBM OS/2 NETBIOS** under
IBM Token-Ring Network Adapters, click on **Edit**, and enter MAC address
from the worksheet in Figure 167 on page 219.

```
Network Adapter Address            4000 014A 3172
```

Click on **OK**.

Step 12. In the Current Configuration window, select **RouteXpander/2 Source
Routing Bridge** under **IBM Token-Ring Network Adapters**, click on **Edit**,
and change the following fields to the values shown here. See the
worksheet in Figure 167 on page 219 for values.

```
Ring Number                    582
Bridge Number                  15
Line speed                     4000000
```

Click on **OK**.

Step 13. In the Current Configuration window, select **IBM Wide Area Connector**, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
Slot number                              4
Port Number                              0
NRZI                                     0
Line speed                               64K
Maximum frame size to be sent and received  2272
```

> **Notes:**
>
> Port number 0 is the top connector of the two on the WAC card.
>
> The NRZI parameter is 0 (for NRZ) or 1 for (for NRZI). NRZ encoding is most commonly used when connecting to a Frame-Relay network. When connecting to a 6611 across a leased line or modem eliminator NRZI encoding is required. When connecting to a 6611 through a frame relay network, NRZ is required.
>
> The change of Maximum frame size (from the default value 4486) shall only be done if an Ethernet LAN is attached to the 3172.

Click on **OK**.

Step 14. In the Current Configuration window, select **RouteXpander/2 Frame Relay Protocol Driver** under IBM Wide Area Connector, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
Locally Administered Address      4000 011A 3172
Specify LMI type                  3
Default ring number               FFF
Maximum size of transmitted package  600
Maximum transmit fragment size    614
```

> **Note**
>
> Set Maximum transmitted package size according to Table 15 on page 230 and Maximum transmitted fragment size to the same value plus 14.

Click on **OK**.

Step 15. In the Current Configuration window, select **IBM IEEE 802.2** under RouteXpander/2 FR MAC Driver, click on **Edit**, and enter MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address           4000 011A 3172
```

Click on **OK**.

Step 16. In the Current Configuration window, select **IBM OS/2 NETBIOS** under RouteXpander/2 FR MAC Driver, click on **Edit**, and enter MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address            T4000 011A 3172
```

Click on **OK**.

Step 17. In the Current Configuration window, select **RouteXpander/2 Source Routing Bridge** under RouteXpander/2 FR MAC Driver, click on **Edit**, and change the following fields to the values shown here. See the worksheet in Figure 167 on page 219 for values.

```
Ring Number                 FFF
Bridge Number               15
Line speed                  256000
```

Click on **OK**.

Step 18. In the Current Configuration window, select **IBM Bus Master Ethernet Adapter**, click on **Edit**, and enter MAC address from the worksheet in Figure 167 on page 219.

```
Network Adapter Address            4000 012A 3172
```

Click on **OK**.

Step 19. In the Current Configuration window, select **IBM NSCA (ESCON) 370 Channel Attach**, click on **Edit**, and change the following fields to the values shown here.

```
Protocol                    1 (CLAW)
```

Click on **OK**.

Step 20. Click on **OK**. The LAPS main menu appears.

Step 21. Follow the on-screen instructions to exit LAPS, save the changes, and update the files required.

Step 22. Shut down OS/2 using the OS/2 shutdown procedure and reboot the system.

4.6.4 TCP/IP Configuration

Follow this procedure to configure TCP/IP in the 3172. The IP addresses, subnet mask, and the logical adapter numbers come from the worksheet in Figure 167 on page 219.

Step 1. Enter TCPIPCFG at an OS/2 command prompt. The TCP/IP configuration window appears.
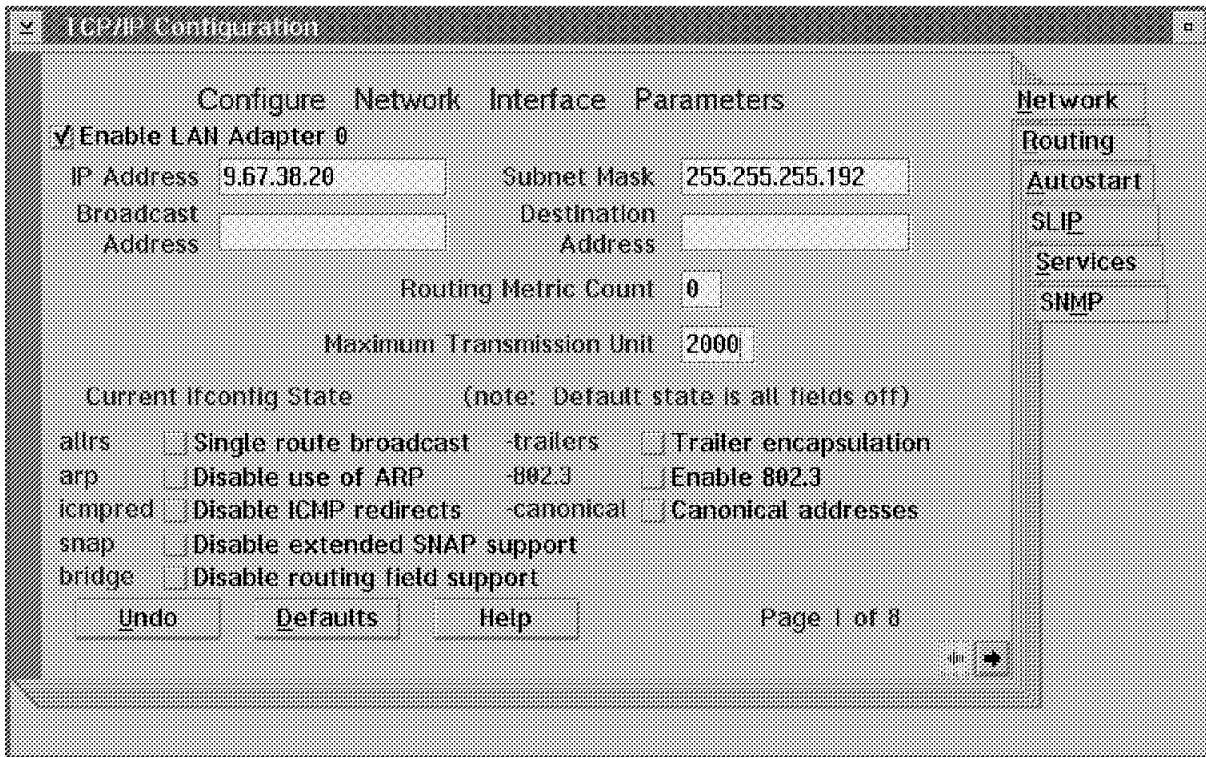
Figure 170. TCP/IP Configuration Page for LAN Adapter 0 (Token Ring)

Step 2. On page 1 of 8 in the Configure Network Interface Parameters folder, fill out the following fields for the token-ring adapter:

a. Select **Enable LAN Adapter 0**. Note that the logical adapter number has to match the LAPS protocol number in the configuration shown in step 7 in 4.6.3, "Configuring LAPS" on page 232.

b. Enter IP address 9.67.38.20.

c. Enter subnet mask 255.255.255.192.

d. Enter MTU size 2000. This is the recommended value for token-ring.

MTU size considerations

The MTU size defined for TCP/IP on the LAN and WAC adapters is not critical. This parameter tells TCP/IP OS/2 the size to use to build IP packets. 3172 normally only forwards IP packets built by the attached host or by LAN-attached stations so for normal traffic no IP packets are built in the 3172.

Step 3. On page 2 of 8 in the Configure Network Interface Parameters folder, fill out the following fields for the WAC card:

a. Select **Enable LAN Adapter 1**.

b. Enter IP address 9.67.46.85.

c. Enter subnet mask 255.255.255.192.

d. Enter MTU size 2000. This is the recommended value for token-ring.

Step   4. On page 3 of 8 in the Configure Network Interface Parameters folder, fill out the following fields for the Ethernet card:

    a. Select **Enable LAN Adapter 2**.

    b. Enter IP address 9.67.32.20.

    c. Enter subnet mask 255.255.255.192.

    d. Select **Enable 802.3**. Ethernet V2 is the default.

    e. Enter MTU size 1492. This is the recommended value for Ethernet.

Step   5. On page 4 of 8 in the Configure Network Interface Parameters folder, fill out the following fields for the ESCON channel:

    a. Select **Enable LAN Adapter 3**.

    b. Enter IP address 9.67.38.20. This has to be the same IP address that was entered for LAN adapter 0.

    c. Enter subnet mask 255.255.255.192.

    d. Enter Destination address 127.1.1.1. This defines the address of the IP link to the MVS or VM host.

Step   6. Press Alt-F4 to exit TCPIPCFG. The closing TCP/IP Configuration window appears.

Step   7. Click on **Save**.

Step   8. Shut down OS/2 using the OS/2 shutdown procedure, and reboot the system.

4.6.5 Configuring Offload Feature

Follow this procedure to configure the Offload feature.

Step   1. Enter C:\OFFLOAD\OFFSETUP at an OS/2 command prompt.

Step   2. When prompted to configure an ESCON or parallel channel adapter, enter 2 for ESCON. See the worksheet in Figure 167 on page 219.

Step   3. When prompted for Base Subchannel address, enter 320. See the worksheet in Figure 167 on page 219.

Step   4. When prompted for ESCON Director Path, enter E11. See the worksheet in Figure 167 on page 219.

Step   5. Enter Yes to enable Offload SNMP subagent.

Step   6. Shut down OS/2 using the OS/2 shutdown procedure and reboot the system.

4.6.6 Configuring NetView DM/2

Follow this procedure to configure NetView DM/2 receiver.

Step   1. Use the OS/2 editor to edit CONFIG.SYS and add the following two lines at the bottom:

    • SET SESSIONS=1

    • SET LDSSERVER=ITSOSERV.

    See the worksheet in Figure 167 on page 219 for the server name.

4.7 Using the 3172 with Multiprotocol Extensions

The following section describes the operation of the 3172 Model 3 with MPE function. The 3172 with MPE is a 3172 Offload host plus the RouteXpander/2 code and the Wide Area Connector card. The operation therefore will to a large extent be the same as described in 3.6, "Using the 3172 Offload Host" on page 162. This section will refer you to the Offload section where appropriate and only describe the steps that are unique to a 3172 with MPE.

4.7.1 Starting the 3172 with MPE

See 3.6.1, "Starting the 3172 Offload Host" on page 163. Besides the processes started in an Offload host, two processes will automatically be started at IPL, if they are configured (see Figure 169 on page 225):

- The Bridge Manager program, GSDBRMGR.EXE, will be running in the background and not appear on the Window List.

- The RXR/2 network management agent, GSDNMA.EXE, appears on the Window List and displays a GSDNMA icon on the desktop.

  Click on the GSDNMA icon and you will be presented with the RXR/2 network management window:

```
Network Management Agent for RouteXpander/2
(c) Copyright 1992 International Business Machines
All Rights Reserved.

Attempting to contact host '9.67.38.20'
host snmp port is 1025
opening port 1025 on host 9.67.38.20

Registered MIB subtree 'frame-relay' : '1.3.6.1.2.1.10.32.'
Registered MIB subtree 'rs232' : '1.3.6.1.2.1.10.33.'
Registered MIB subtree 'dot1d' : '1.3.6.1.2.1.17.'

SNA management disabled, alerts will be displayed locally.

01/08 18:40:28 FOUND   RXR/2 frame relay protocol
01/08 18:40:28 FOUND   IBM Wide Area Connector
```

  This screen will continuously be updated with status messages from the network, for example when a DLCI changes status. When the screen fills up the oldest information on the screen (the top lines) will be lost.

  Besides the messages that are displayed in this window, other messages are also logged in \IBMCOM\LANTRAN.LOG.

4.7.2 Shutting Down a 3172 with MPE

Section 3.6.2, "Shutting Down the 3172 Offload Host" on page 165 describes the procedure to shut down the 3172. These procedures are the same in an MPE environment.

4.7.3 Reconfiguring a 3172 with MPE

Section 3.6.3, "Reconfiguring the 3172 Offload Host" on page 165 describes the procedure to reconfigure the Offload function. That procedure is the same in the MPE environment.

Reconfiguration of the following MPE functions will be described in this section:

1. Change parameters for the network management subagent

2. Disable the Bridge function

3. Change bridge filtering.

The Network Management Subagent

If you configured your RouteXpander/2 as in Figure 169 on page 225, you will have the following statement in your STARTUP.CMD file:

```
START /MIN C:\GSD\GSDNMA.EXE /SNMP=9.67.38.20
```

To start the GSDNMA window without connecting to the SNMP agent, delete /SNMP=9.67.38.20 from the statement.

To inhibit starting the GSDNMA window, add **REM** in front of the statement to make it a comment.

The GSDNMA application can be stopped and restarted at any time without affecting the RXR/2 routing or bridging functions. Stop it by closing the GSDNMA window and restart it with the command listed above.

The Bridging Function

If you configured your RouteXpander/2 as in Figure 169 on page 225, you will have the following statement in your CONFIG.SYS file:

```
RUN=C:\GSD\GSDBRMGR.EXE
```

To inhibit the bridging function from starting, add REM in front of the statement to make it a comment. You then have to shut down and reboot the system to start without bridging.

The Bridge Filters

The bridge filters reside in file \IBMCOM\GSDSRB.INI. To change the filters you will have to update that file with your filtering criteria and reboot the system. A sample filter file is installed with file name \GSD\GSDSRB.XMP.

4.7.4 Reestablish Connection after a Failure

The procedures described in 3.6.4, "Reestablishing Connection after a Failure" on page 166 are also valid in the MPE environment.

After the Offload system has re-established contact with the TCP/IP host, the RouteXpander/2 SNMP subagent does not always automatically reconnect to the host SNMP agent.

Lost SNMP connection? Two situations will cause a lost SNMP connection from the RXR/2 SNMP subagent.

1. After rebooting the 3172, action is required on the VM or MVS host to establish connectivity over the channel, as described in 3.6.4, "Reestablishing Connection after a Failure" on page 166. If this connectivity is not present within 150 seconds the GSDNMA program will time-out. The GSDNMA window will display messages that tell you SNMP is disabled:

```
Network Management Agent for RouteXpander/2
(c) Copyright 1992 International Business Machines
All Rights Reserved.

Attempting to contact host '9.67.38.20'
Unable to establish session with host '9.67.38.20'
SNMP management disabled, traps will be displayed locally.
SNA management disabled, alerts will be displayed locally.

01/08 18:54:03 FOUND   RXR/2 frame relay protocol
01/08 18:54:03 FOUND   IBM Wide Area Connector
```

2. Whenever connectivity with host TCP/IP is lost and the 3172 is still running, the GSDNMA program will lose its connection to the host SNMP agent and display:

```
Network Management Agent for RouteXpander/2
-
-
get_packet;;recv; can't read response
lost contact with SNMP daemon

[C:\]
```

To re-establish SNMP connectivity, close the GSDNMA window and then enter the command START /MIN C:\GSD\GSDNMA.EXE /SNMP=:hp1IP-address, where *IP-address* is the **TCP/IP Hostname** as described in 4.5.7, "RouteXpander/2 Installation" on page 225.

4.8 Frame Relay in the MPE Environment

In this section you will find a very brief description of the frame relay protocol and architecture as such. More detailed information on the architecture should be sought in other publications. There is a more elaborate frame relay concepts chapter in *SC31-6606, IBM RouteXpander/2 Users Guide and Reference*. A copy of the Internet *Request For Comment* documents that define the protocols used on the frame relay connection is in Appendix C, "RFC 1294. Multiprotocol Interconnect over Frame Relay" on page 421 and in Appendix D, "RFC 1293. Inverse Address Resolution Protocol" on page 443.

This book will, using generic networking terminology, attempt to explain what is achieved by using the frame relay protocol for multiprotocol routing and bridging. **The purpose is to show that, as a 3172 MPE user, you will have to define very little to make it all happen**. Meanwhile, IP routing concepts and source route bridging will only be put in the context of a frame Relay multiprotocol connection.

4.8.1 All You Need to Know about Frame Relay

The network user, in this case the Wide Area Connector card and the RouteXpander/2 code, connects to the frame relay network with one cable (V.35, X.21 or RS-422). On that cable the user can simultaneously connect up to 200 other users of the same frame relay network. These virtual end-to-end connections are defined within the network. On each interface to a user, the connections are numbered with a *Data Link Connection Identifier (DLCI)*. The DLCI number can be different in the two end-points of a connection, much like a virtual circuit in an X.25 network.

frame relay architecture definitions for *Switched Virtual Circuits* do exist. They are, however, not widely implemented and not supported by the RXR/2 code.

> **What is a frame relay network?**
>
> A frame relay network can be a public network service, where one may attach using a V.35 interface for example, and subscribe to a number of connections (DLCIs) on that interface.
>
> It can also be a private network implemented with privately operated frame relay switches connected together, for example, with E1 or T1 lines. Examples of frame Relay switching equipment, supplied by IBM, that can be used to implement a private frame relay network are:
>
> • IDNX with the FRX module
>
> • 3745 with NCP V6.2 or later
>
> A third possibility is a null-network consisting of a point-to-point connection only, for example a 3172 MPE connected to a RouteXpander/2 with a V.35 256 Kbps leased line. In this configuration there is only one DLCI and the frame relay multiprotocol support will be used on that DLCI. For RXR/2, that DLCI is standardized to #32.
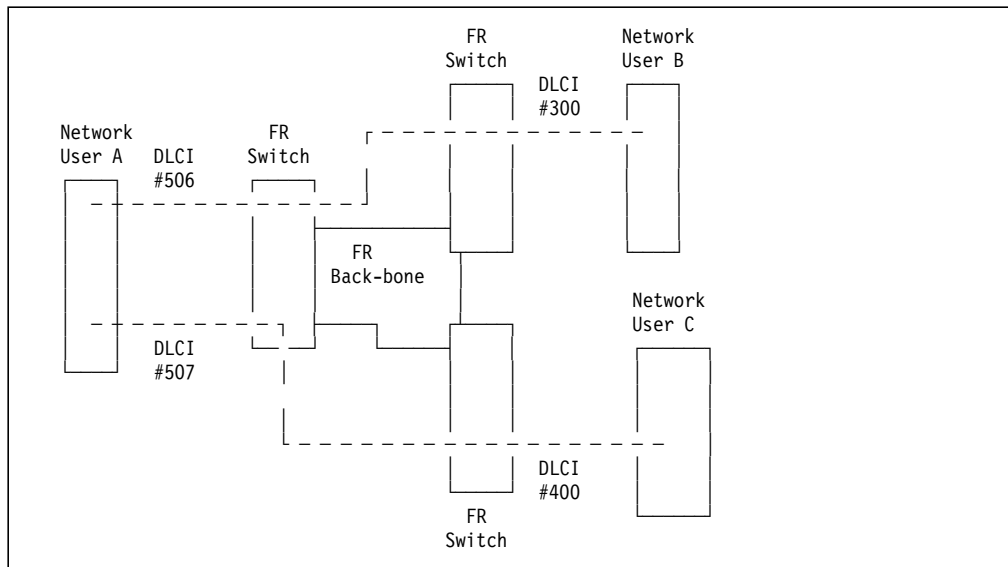
Figure 171. Frame Relay Network Sample

Local Management Interface

One essential part of the frame relay protocol is the *Local Management Interface*. This protocol uses a reserved DLCI number to exchange information between the network user and the network. We will see how this protocol relieves the user from configuring his DLCI connections.

What happens in the sample network?

This configuration allows User A to connect to B using DLCI #506. The connection is seen by B as DLCI #300. A and C can communicate using DLCIs #507 and #400 respectively.

When A activates its interface to the network, it is informed, via the LMI protocol, of the DLCIs currently active. If, for example, B is active but not C, A will be informed that DLCI #506 is active. B will at this point be notified by the network that DLCI #300 just became active.

Later, when C activates its interface, it will learn that DLCI #400 is active and A will be informed that DLCI #507 just became active.

The sum of this is that the network user is always aware of which DLCIs are currently active and usable.

Who is at the other end of the DLCI?

The user, to be able to use the connections sensibly, must know who is at the other end of a DLCI. One way of achieving that would be to manually configure, in the user code, the mapping between DLCI number and remote user specifics. This is not the technique used by RXR/2. Instead, higher layer protocols above the frame relay layers, are used to find out who is at the other end of each DLCI as soon as the RXR/2 code is made aware of the presence of an active DLCI. :12 refid=RFC.1293

The technique used is defined in RFC 1293 and is called *Inverse ARP;* see Appendix D, "RFC 1293. Inverse Address Resolution Protocol" on page 443. In simple terms this protocol defines that each user of a DLCI will send a packet over the DLCI and, in that packet, will present its hardware address and a protocol address. As several protocol addresses can exist in the same user (for example, IPX and IP addresses), this is also handled by the protocol. In our case, the RXR/2 code in 3172 MPE, will only be interested in IP addresses (for IP routing) and hardware addresses (for source route bridging).

Multiprotocol multiplexing

When the RXR/2 code knows who is at the other end of each DLCI, each DLCI can be used to multiplex several protocols. The encapsulation technique used is described in RFC 1294; see Appendix C, "RFC 1294. Multiprotocol Interconnect over Frame Relay" on page 421.

4.8.2 TCP/IP Routing with Wide Area Connector

To the TCP/IP protocol in the 3172, the Wide Area Connector appears as a token-ring card. Each DLCI connection, for example to a RouteXpander/2 or a 6611 router, will be presented as an IP router on that imaginary token-ring. The sample network in Figure 171 on page 242 will, to the TCP/IP routing logic in 3172, appear as in Figure 172 on page 244.
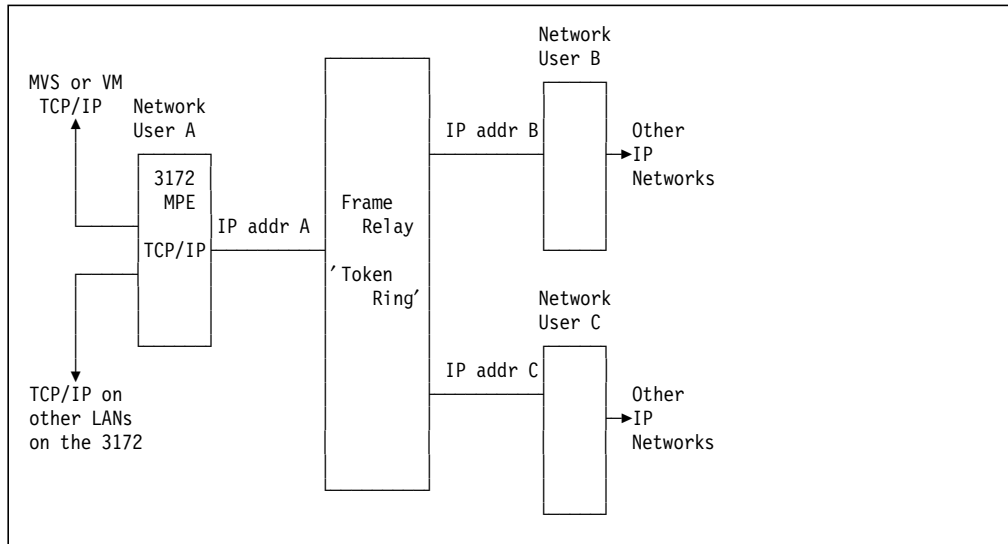
Figure 172. Frame Relay Network Appearance to the IP Router

The IP address of router B and C will be used in

GATEWAY

statements in TCP/IP VM or MVS to define the IP routes over the imaginary token-ring LAN.

4.8.3 Source Route Bridging with Wide Area Connector

To the Source Route Bridge (SRB) implemented in the 3172, the Wide Area Connector card appears as a token-ring card. Each DLCI connection, for example to a RouteXpander/2 or a 6611 router, will be presented as a bridge on that imaginary token-ring. The sample network in Figure 171 on page 242 will appear to the TCP/IP routing logic in a 3172 as in Figure 173.
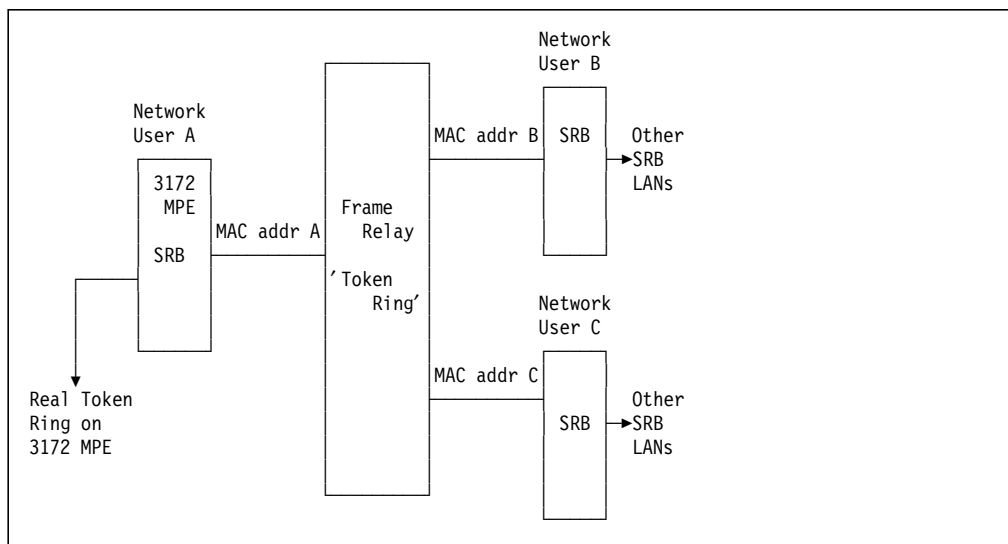
Figure 173. Frame Relay Network Appearance to a Source Routing Bridge

4.8.3.1 SRB Route Determination

The SRB implemented in RouteXpander/2 participates in *automatic single-route broadcast path maintenance* using the spanning tree algorithm. This algorithm, defined by the IEEE 802.1 committee, uses dedicated functional addresses for bridges to communicate with one another. In that communication, a *spanning tree* is formed which designates a single route to each segment in the network. This technique is used to ensure that precisely one copy of every single route broadcast frame will reach every segment in the network.

A source station finds the route to a desired destination by sending out a *discovery frame* marked *single-route-broadcast*. Using the spanning tree method the bridges, including the RXR/2, ensures that one, and only one, copy of that frame reaches every segment in the network. The destination station responds by sending a *discovery response* marked as *all-routes-broadcast*. If several physical routes exist between the source and destination stations, the source station will receive more than one discovery response. The first response received is considered to be the fastest route and that routing information is then used by the source station to set up the connection.

4.8.3.2 Bridge Filtering

Token-ring speed (4 or 16 Mbps) is typically much faster than the WAN connection over a frame relay network (up to 2 Mbps). Bridging high volumes of traffic over the WAN connection can cause undesirable results, such as overflow of buffers, timeouts and lost connections. If much of the bridged traffic is unnecessary, it makes sense to limit that part by using filters. The bridge filter lets you specify precisely the kinds of frames that can cross the bridge by using the following attributes:

- Frame type

- Hop count limit

- Destination address

- Source address

- NetBIOS name

- Data within the frame, at a specified offset

Different filters can be applied to the two sides of the bridge — the token-ring side and the WAC side.

Due to the many filtering possibilities offered, definition of filters is somewhat complex. *SC31-6606, IBM RouteXpander/2 Users Guide and Reference* contains an in-depth tutorial of RXR/2 filters, including many useful examples. As that book describes RXR/2 V1.01 the description also includes filtering of protocols that are not supported by the 3172 MPE. This does not make the tutorial less useful for creating 3172 MPE filters.

See 4.14.3, "Filtering" on page 271 for a sample filter used in the ITSO test environment.

4.9 Scenarios Environment

Figure 174 shows the hardware used in the MPE scenarios. Not all hardware is used in all scenarios and, in some scenarios, the configuration is changed. For every scenario, a picture with the involved hardware and software will be shown.
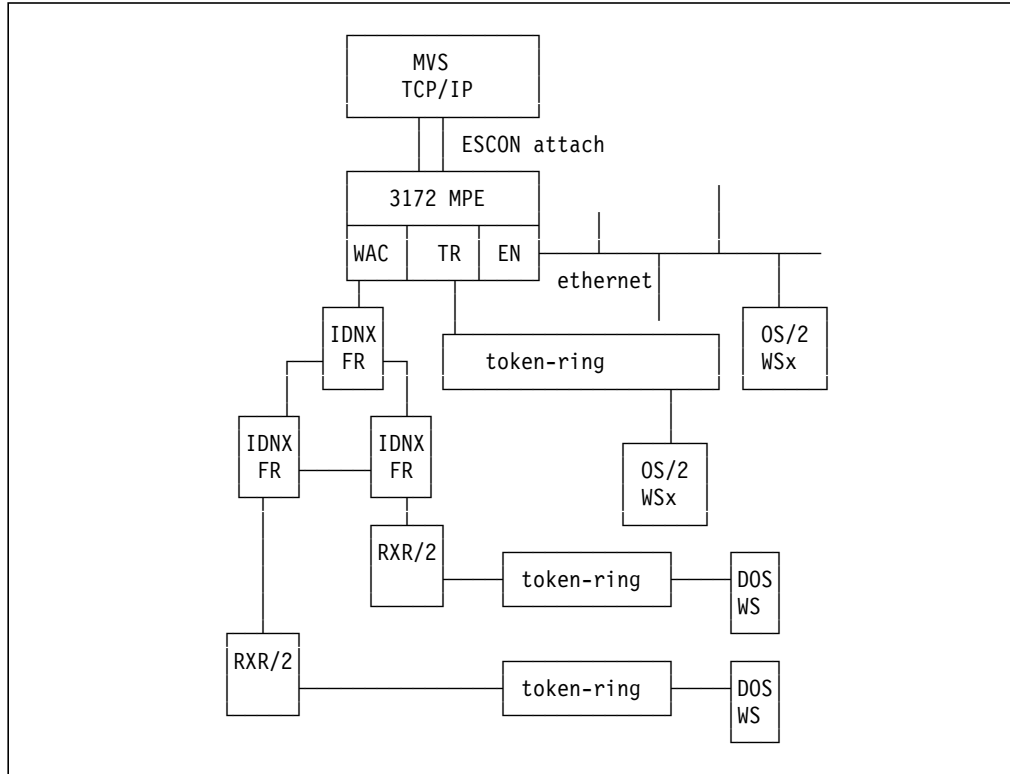
Figure 174. The Environment Used in our MPE Scenarios

Note that, for all TCP/IP scenarios, we will use static routing and show the configuration statements or commands to define the routes used. In a production environment, the Routing Daemon (RIP) will most probably be started in TCP/IP MVS as well as in the attached RouteXpander/2 and workstations. We have chosen to show static routing for simplicity of illustration.

4.10 MPE Scenario 1 - TCP/IP over Token-Ring

The purpose of this scenario is to verify that the Offload installation and setup is correct. This includes MVS, TCP/IP MVS, 3172 OS/2, 3172 TCP/IP, 3172 Offload, and workstation TCP/IP customization.

The definitions that do not change between the scenarios (MVS and 3172 Offload) will not be repeated in the following scenarios.
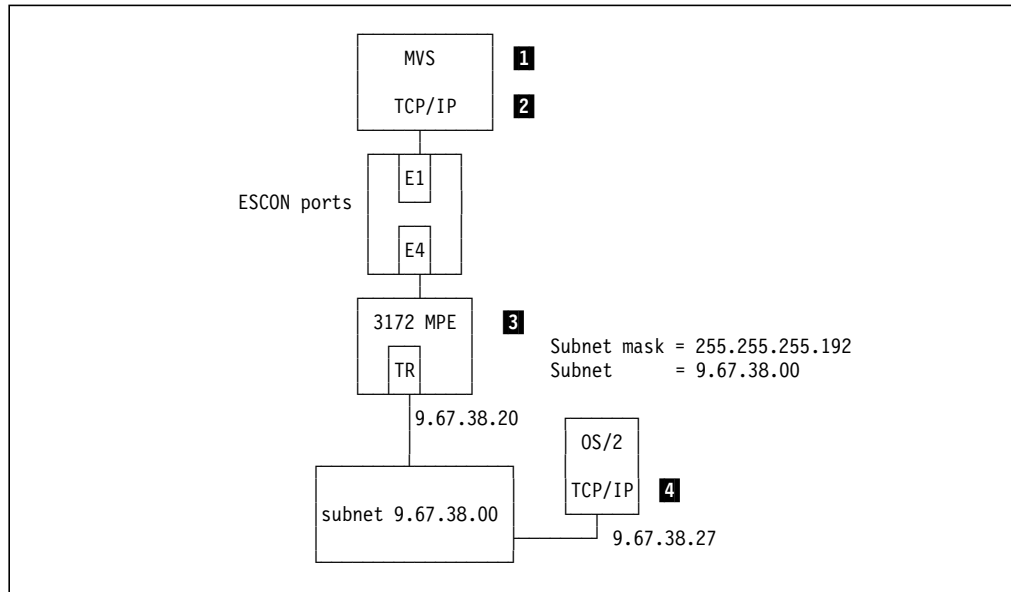
Figure 175. Scenario 1. TCP/IP from MVS TCP/IP to workstation on Token-Ring.

4.10.1 Definitions

1 MVS definitions

IOCP definition of channel path

```
CPHID PATH=((18)),TYPE=CNC,SWITCH=E1
```

Control unit and device definitions

```
        CTRLUNIT CUNUMBR=320,UNIT=3172,PATH=(18),
             CUADD=1,LINK=(E4),UNITADD=((20,32))
DEV320  IODEVICE UNIT=SCTC,ADDRESS=(320,32)
             CUNUMBR=(320)
```

MVS/ESA IODEVICE macro

```
IODEVICE UNIT=SCTC,ADDRESS=(320,8)
```

2 TCP/IP MVS definitions

Definitions in TCPIP.PROFILE.TCPIP

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set.
The selected parameters are the ones deemed significant for this scenario.

```
DEVICE MPEDEV    CLAW 320 TCPIP  OS2TCP  NONE
 LINK   MPEIPLINK OFFLOADLINK1  1  MPEDEV
 LINK   MPETR1    OFFLOADAPIBROAD 9.67.38.20  MPEDEV  MPEIPLINK
 LINK   MPEWAC    OFFLOADAPIBROAD 9.67.46.85  MPEDEV  MPEIPLINK
 LINK   MPEEN1    OFFLOADAPIBROAD 9.67.32.20  MPEDEV  MPEIPLINK

GATEWAY
 9             = MPETR1  DEFAULTSIZE   0.255.255.192 0.67.38.00

DEFAULTAPPL RAKAA    ; Set the default application for all
                     ; TELNET sessions, NetView Access

START  MPEDEV
```

3 3172 Offload

Configuration of the Offload feature is done at installation time; see 4.5.4,
"Offload of TCP/IP Feature Installation" on page 224. The configuration
parameters can be changed at any time after that using the OFFSETUP program.
Below are the steps to reconfigure the Offload feature with the parameters used
in this scenario listed.

Step 1. At an OS/2 prompt, enter \offload\offsetup and press Enter.

Step 2. When prompted enter the information below:

```
Adapter type               = 1
Base subchannel            = 20
Path through ESCON directory = E11
Start SNMP subagent ?      = Y
Community name             = public
```

Step 3. Shut down OS/2 using the OS/2 shutdown procedure and reboot the
         system to implement the changes.

4 Workstation TCP/IP definitions

Definition of your OS/2 TCP/IP will normally be done at installation time using
the TCP/IP configuration notebook invoked by the command TCPIPCFG. This
process involves defining and enabling LAN adapters, routes, and applications.
That process will not be described here. See 2.8.3.1, "Configuring Your PS/2
Token-Ring LAN Adapter for TCP/IP" on page 87 for a step-by-step description of
the TCP/IP OS/2 definition process.

Here you will find the relevant commands used to define the IP address and
necessary routing statements using a token-ring adapter as LAN adapter 0.
Normally these commands would not be issued from an OS/2 prompt but created
with TCPIPCFG and automatically issued at TCP/IP for OS/2 startup.

Define the OS/2 IP address

```
   ifconfig LAN0 9.67.38.27 netmask 255.255.255.192
```

Define the routing to MVS TCP/IP

The OS/2 workstation is attached to the same LAN as the MVS TCP/IP host and
is in the same IP subnet. This means that no routing table entry is needed in
TCP/IP for OS/2.

4.10.2 Verification

To verify that TCP/IP connectivity exists between the OS/2 workstation and the MVS host, we use PING, TELNET and FTP.

Ping from OS/2

```
OS2 C:\>ping 9.67.38.20
PING 9.67.38.20: 56 data bytes
64 bytes from 9.67.38.20: icmp_seq=0. time=32. ms
64 bytes from 9.67.38.20: icmp_seq=1. time=0. ms

----9.67.38.20 PING Statistics----
2 packets transmitted, 2 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 0/16/32

The external process was cancelled by a Ctrl+Break or another process.
[C
```

Ping from TSO

```
------------------------ TSO COMMAND PROCESSOR ----------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ping 9.67.38.27

TCPPNG015I Ping V2R2.1: Pinging host 9.67.38.27.  Use PA1 to interrupt.
TCPPNG020I PING: Ping #1 response took 0.033 seconds. Successes so far 1
***
```

FTP from OS/2

```
OS2 C:\>ftp 9.67.38.20
Connected to 9.67.38.20.
220-FTPSE18 IBM MVS V2R2.1 at MVS18.ITSC.RALEIGH.IBM.COM, 15:24:40 on 01
220 Connection will close if idle for more than 10 minutes.
Name (9.67.38.20): zetter
331 Send password please.
Password:
230 ZETTER is logged on.
ftp> pwd
257 "'ZETTER.'" is working directory
ftp> quit
221 Quit command received. Goodbye.

OS2 C:\>
```

FTP from TSO

```
------------------------ TSO COMMAND PROCESSOR ---------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> ftp 9.67.38.27

FTPALL001I MVS TCP/IP FTP V2R2.1
FTPALL105I Connecting to 9.67.38.27, port 21
220 OLLE FTP server (IBM OS/2 TCP/IP FTP Version 1.2) ready.
FTPALL010I USER (identify yourself to the host):
ollezet
FTPALL252I >>>USER ollezet
331 Password required for ollezet.
FTPALL228I Password:

FTPALL252I >>>PASS ********
230 User ollezet logged in.
FTPALL011I Command:
pwd
FTPALL252I >>>PWD
257 "C::" is current directory.
FTPALL011I Command:
quit
FTPALL252I >>>QUIT
221 Goodbye.
***
```

TELNET (PMANT) from OS/2

PMANT is an OS/2 TCP/IP implementation of the TELNET TN3270 protocol that uses Presentation Manager to display the 3270 screens. To invoke PMANT, enter:

```
OS2 C:\>pmant 9.67.38.20
```

In our scenario the TELNET default application in MVS TCP/IP is NetView Access Services:

```
                                              Hot Line: 17-6666
                                              Date . .: 01/06/94
                                              Time . .: 18:18:00
                                              Terminal: RAIAE001
       N  E  T  V  I  E  W
       *******    *******    *******    *********   *******    *******
     **     **  **    **   **     **  **           **     **  **     **
    **     **  **             **         **         **     **  **
    *********  **             **         *********  *******    ******
   **     **  **             **         **             **         *
  **     **  **    **   **    **   **    **         **     **  **    **
 **     **  ******    ******   *********  *******   *******
                                               S E R V I C E S
   NetView Access Services, Release 3.1 - Program Number 5665-365
      (C) Copyright IBM Corp. 1987, 1991.  All rights reserved

            Enter Logon information:
               User . . . . . .          (User ID/LOGOFF)
               Password . . . .          New Password . .

               Application  . .
               Group  . . . . .
               Location . . . .
PF 1=Help 2=LANguage
```

```
------------------------ TSO COMMAND PROCESSOR ---------------------
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> telnet 9.67.38.27


TCPTEL001I MVS TCP/IP Telnet V2R2.1
TCPUTM110I Connecting to 9.67.38.27, port TELNET (23)
***
```

```
TCPUTM118I
TCPUTM119I Using Line Mode...
TCPUTM120I
TCPUTM121I Notes on using Telnet when in Line Mode:
TCPUTM122I - To hide Password, Hit PF3 or PF15
TCPUTM123I - To enter Telnet Command, Hit PF4-12, or PF16-24
***
```

```
OS/2 Version 2.1 (OLLE)

Enter your password: ....

<OLLE>-C:\

Telnet command: quit
```

Note: The **Telnet command:** prompt is invoked by pressing PF4.

4.11 MPE Scenario 2 - TCP/IP over a Frame Relay Network

The purpose of this scenario is to show connectivity through a frame relay network. This network consists of IDNX switches where two DLCIs are defined. Each DLCI connects the 3172 to a remote RouteXpander/2 with a token-ring network attached to it.

Connectivity will be demonstrated between TCP/IP in the MVS host and TCP/IP on workstations connected to the remote token-ring LANs.
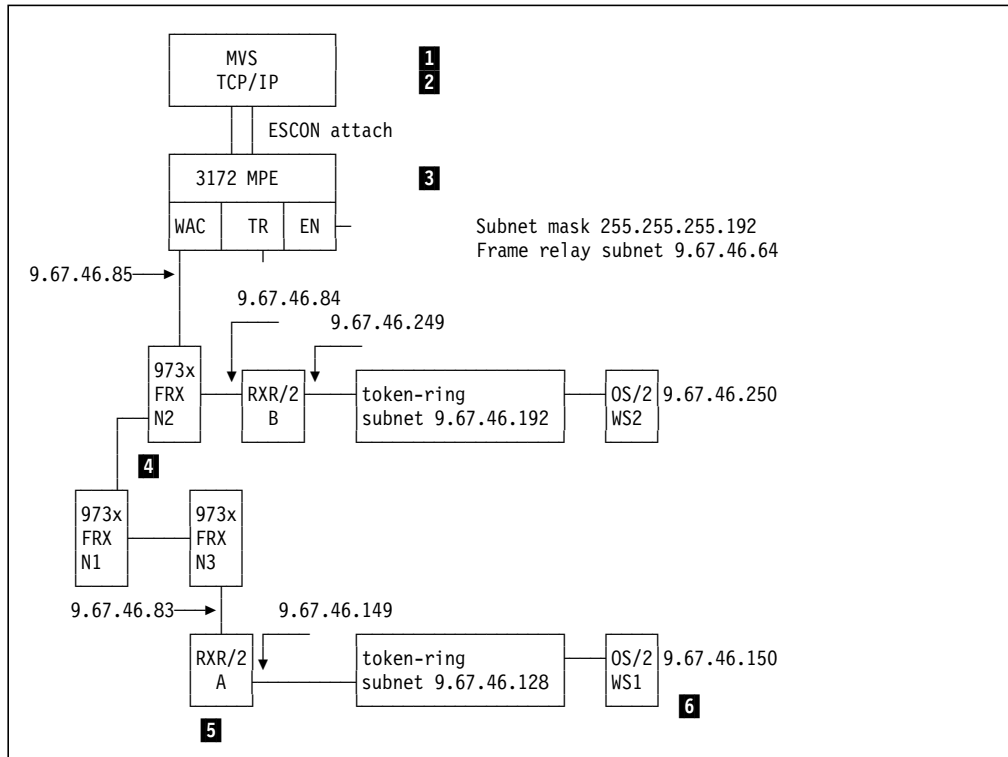
Figure 176. Scenario 2. TCP/IP from MVS to Workstations on remote Token-Rings.

4.11.1 Definitions

1 MVS definitions

See Scenario 1 definitions in 4.10.1, "Definitions" on page 247.

2 TCP/IP definitions

Definitions in TCPIP.PROFILE.TCPIP

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set.
The selected parameters are the ones deemed significant for this scenario.

```
DEVICE MPEDEV    CLAW  320  TCPIP  OS2TCP  NONE
  LINK   MPEIPLINK OFFLOADLINK1  1  MPEDEV
  LINK   MPETR1     OFFLOADAPIBROAD 9.67.38.20  MPEDEV  MPEIPLINK
  LINK   MPEWAC     OFFLOADAPIBROAD 9.67.46.85  MPEDEV  MPEIPLINK
  LINK   MPEEN1     OFFLOADAPIBROAD 9.67.32.20  MPEDEV  MPEIPLINK

GATEWAY
  9              = MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.64
  9   9.67.46.83 MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.128
  9   9.67.46.84 MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.192

DEFAULTAPPL RAKAA   ; Set the default application for all
                    ; TELNET sessions, NetView Access

START  MPEDEV
```

3 3172 Offload

See Scenario 1 definitions in 4.10.1, "Definitions" on page 247.

4 IDNX definitions

This is the only place you define the DLCIs. The 3172 MPE and the RouteXpander/2 will be informed of active DLCIs by the IDNX network using the frame relay *Local Management Interface* protocol. The 3172 and the RXR/2 will then, using RFC 1294 protocol explore who is at the other end of each DLCI that becomes active.

The IDNX definitions will not be explained here as that is beyond the scope of this book. A list of the definitions used is included to be referenced by anyone who masters the art of IDNX definitions.

GG24-4077, IDNX Frame Relay Network Planning and Implementation explains in much more detail the intricacies of defining a frame relay network using IDNX. You will also find examples of how to define RouteXpander/2 and a 6611 attached to an IDNX frame relay network.
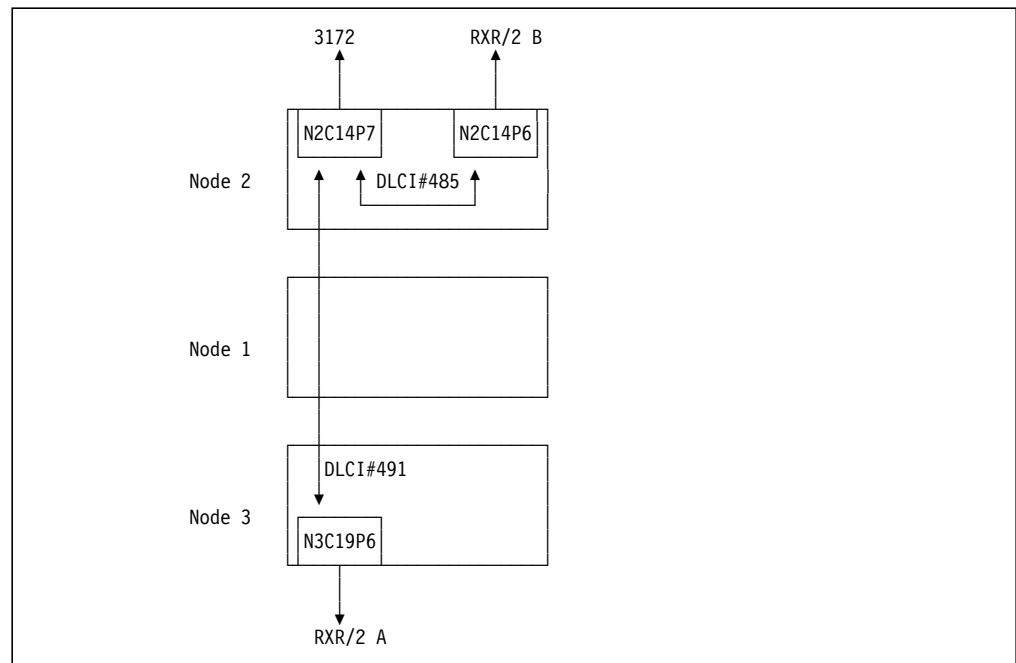
Figure 177. The Frame Relay Connections Defined in the IDNX Network

Assumptions

In the list below the following notation is used to identify ports in IDNX: N2C14P7 means node 2, card 14, port 7.

- The 3172 is attached to N2C22P1 on an HSD-2 card that connects to FRX port N2C14P7.

- RXR/2 A is attached to N3C22P0 on an HSD-2 card that connects to FRX port N3C19P6.

- RXR/2 B is attached to N2C22P0 on an HSD-2 card that connects to FRX port N2C14P6.

- DCLI between 3172 and RXR/2 A is # 491 in both directions.

- DCLI between 3172 and RXR/2 B is # 485 in both directions.

Note: A DLCI between two attached users can be defined with a different DLCI number at the two end points. In our example we have chosen, for simplicity, to use the same DLCI number in both directions.

Display of HSD-2 port configuration for 3172 physical attachment

```
*** HSD-2 PORT N2C22P1 CONFIGURATION ***
     CARD TYPE: HSD-2                       SLOT TYPE: HSD-2
  CARD STATUS: ACTIVE                      PORT STATUS: ACTIVE
ORIG/ANS MODE: ANS-ONLY
   PORT SPEED: 256000                     TRANSP SIGNL: NO
  HW I/F TYPE: DCE/V35                      DB I/F TYPE: DCE
                                           DCE TTIMING: NO
 CALL ANS SIG: NONE
                                          SIGNAL EVENTS: NO
  ACTUAL PATH: 2-2
  DATA FORMAT: NX64                        INVERT DATA: NO
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** HSD-2 PORT N2C22P1 STATUS  (OTHER END IS PORT N2C14P7) ***
   CALL STATE: CALL IN PROGRESS      LAST DISCONNECT: NONE
  LOOP STATUS: HWLCL   HWRMT  SWLCL  SWRMT  RLREQ  SW LOOP-IN
                 0       0      0      0      0        0
  EIA SIGNALS: RTS  DTR  RI  CTS  DCD  DSR  TESTMODE
               1    1    0   1    1    1     0
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of IDNX FRX port configuration for 3172 attachment

```
*** PX-2 PORT N2C14P7 CONFIGURATION (DEST PORT IS PORT N2C22P1) ***
              N2C14P7     N2C22P1                     N2C14P7     N2C22P1


    CARD TYPE: PX-2        HSD-2         SLOT TYPE: PX-2        HSD-2
DBCARD STATUS: ACTIVE      ACTIVE     DB PORT STATUS: ACTIVE      ACTIVE
ORIG/ANS MODE: ORIG-ONLY   ANS-ONLY       DEST PORT: N2C22P1
   PORT SPEED: 256000      256000
CALL PRIORITY: 7                         PREEMPT PRTY: 0
  HW I/F TYPE:             DCE/V35        DB I/F TYPE:             DCE
 TERR ROUTING: DON'T CARE                 TOD RESTRICT: NONE
ENCRY ROUTING: DON'T CARE
FIBER ROUTING: DON'T CARE

                                         TRANSP SIGNL:           NO
                                          DCE TTIMING:           NO
 CALL ANS SIG:            NONE
                                         SIGNAL EVENTS:          NO
  ACTUAL PATH: 2-2 (OP)
  DATA FORMAT: NX64                    (DEST PORT IS NX64)
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** PX-2 PORT N2C14P7 STATUS (OTHER END IS N2C22P1) ***
   CALL STATE:  CALL IN PROGRESS     LAST DISCONNECT: HANG UP
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of HSD-2 port configuration for RXR/2 A physical attachment

```
*** HSD-2 PORT N3C22P0 CONFIGURATION ***
    CARD TYPE: HSD-2                      SLOT TYPE: HSD-2
 CARD STATUS: ACTIVE                    PORT STATUS: ACTIVE
ORIG/ANS MODE: ANS-ONLY
   PORT SPEED: 64000                    TRANSP SIGNL: NO
  HW I/F TYPE: DCE/V35                   DB I/F TYPE: DCE
                                         DCE TTIMING: NO
 CALL ANS SIG: NONE
                                        SIGNAL EVENTS: NO
  ACTUAL PATH: 3-3
  DATA FORMAT: NX64                       INVERT DATA: NO
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** HSD-2 PORT N3C22P0 STATUS  (OTHER END IS PORT N3C19P6) ***
   CALL STATE: CALL IN PROGRESS      LAST DISCONNECT: NONE
  LOOP STATUS: HWLCL   HWRMT   SWLCL   SWRMT   RLREQ   SW LOOP-IN
                0       0       0       0       0         0
  EIA SIGNALS: RTS  DTR  RI  CTS  DCD  DSR  TESTMODE
                0    0   0   0    1    1     0
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of IDNX FRX port configuration for RXR/2 A attachment

```
*** PX-2 PORT N3C19P6 CONFIGURATION (DEST PORT IS PORT N3C22P0) ***
              N3C19P6     N3C22P0                    N3C19P6     N3C22P0

   CARD TYPE: PX-2        HSD-2         SLOT TYPE: PX-2         HSD-2
DBCARD STATUS: ACTIVE     ACTIVE    DB PORT STATUS: ACTIVE      ACTIVE
ORIG/ANS MODE: ORIG-ONLY  ANS-ONLY      DEST PORT: N3C22P0
   PORT SPEED: 64000      64000
CALL PRIORITY: 7                      PREEMPT PRTY: 0
  HW I/F TYPE:            DCE/V35      DB I/F TYPE:             DCE
 TERR ROUTING: DON'T CARE             TOD RESTRICT: NONE
ENCRY ROUTING: DON'T CARE
FIBER ROUTING: DON'T CARE

                                      TRANSP SIGNL:            NO
                                      DCE TTIMING:             NO
 CALL ANS SIG:           NONE
                                      SIGNAL EVENTS:           NO
  ACTUAL PATH: 3-3 (OP)
  DATA FORMAT: NX64                   (DEST PORT IS NX64)
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** PX-2 PORT N3C19P6 STATUS (OTHER END IS N3C22P0) ***
   CALL STATE:   CALL IN PROGRESS    LAST DISCONNECT: NONE
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of HSD-2 port configuration for RXR/2 B physical attachment

```
*** HSD-2 PORT N2C22P0 CONFIGURATION ***
    CARD TYPE: HSD-2                     SLOT TYPE: HSD-2
  CARD STATUS: ACTIVE                  PORT STATUS: ACTIVE
ORIG/ANS MODE: ANS-ONLY
   PORT SPEED: 64000                   TRANSP SIGNL: NO
  HW I/F TYPE: DCE/V35                  DB I/F TYPE: DCE
                                        DCE TTIMING: NO
 CALL ANS SIG: NONE
                                      SIGNAL EVENTS: NO
  ACTUAL PATH: 2-2
  DATA FORMAT: NX64                     INVERT DATA: NO
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** HSD-2 PORT N2C22P0 STATUS  (OTHER END IS PORT N2C14P6) ***
   CALL STATE: CALL IN PROGRESS     LAST DISCONNECT: HANG UP
  LOOP STATUS: HWLCL   HWRMT  SWLCL  SWRMT  RLREQ  SW LOOP-IN
               0       0      0      0      0        0
  EIA SIGNALS: RTS  DTR  RI  CTS  DCD  DSR  TESTMODE
               0    0    0   0    1    1     0
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of IDNX FRX port configuration for RXR/2 B attachment

```
*** PX-2 PORT N2C14P6 CONFIGURATION (DEST PORT IS PORT N2C22P0) ***
               N2C14P6    N2C22P0                    N2C14P6    N2C22P0

    CARD TYPE: PX-2       HSD-2        SLOT TYPE: PX-2       HSD-2
 DBCARD STATUS: ACTIVE    ACTIVE    DB PORT STATUS: ACTIVE     ACTIVE
 ORIG/ANS MODE: ORIG-ONLY ANS-ONLY     DEST PORT: N2C22P0
   PORT SPEED: 64000      64000
CALL PRIORITY: 7                      PREEMPT PRTY: 0
  HW I/F TYPE:            DCE/V35       DB I/F TYPE:          DCE
 TERR ROUTING: DON'T CARE              TOD RESTRICT: NONE
ENCRY ROUTING: DON'T CARE
FIBER ROUTING: DON'T CARE

                                      TRANSP SIGNL:          NO
                                       DCE TTIMING:          NO
 CALL ANS SIG:           NONE
                                     SIGNAL EVENTS:          NO
  ACTUAL PATH: 2-2 (OP)
  DATA FORMAT: NX64                  (DEST PORT IS NX64)
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***

*** PX-2 PORT N2C14P6 STATUS (OTHER END IS N2C22P0) ***
   CALL STATE:   CALL IN PROGRESS    LAST DISCONNECT: HANG UP
*** HIT RETURN TO CONTINUE (ESCAPE TO QUIT) ***
```

Display of FRX port for 3172

```
Port 7 Configuration
--------------------

Interface Protocol              ANSI-Network
Link Integrity Verification     ENABLED
Asynchronous PVC status         DISABLED
N392 (error threshold counter)  3
N393 (monitored events counter) 4
T392 (polling verification timer) 15

Port 7 Status
-------------

Data Base State                 Active
TBus State                      Up
UNI State                       Up
Number of events in error       0 of last 4 events
Number of circuits              5
Receive Congestion State        NOT CONGESTED
Transmit Congestion State       NOT CONGESTED
Access Rate                     256000
Total CIR                       0
(RETURN to continue ...) >

Port 7 Statistics (last cleared 0 days, 0 hours, 40 minutes, 38 seconds ago)
---------------------------------------------------------------------------

Total frames in since clear              259
Total frames out since clear             244
Total bytes in since clear              4931
Total bytes out since clear             9036
Total dropped frames since clear          15
Total dropped DE frames since clear        0
Total frames with unknown DLCI            15
Last Unknown DLCI                         32
Frame rate in                              0 (frames/second last 5 min.)
Frame rate out                             0 (frames/second last 5 min.)
Byte rate in                               1 (bytes/second last 5 min.)
Byte rate out                              4 (bytes/second last 5 min.)
Average input queue depth                  0 (queue depth last 5 min.)
Average output queue depth                 0 (queue depth last 5 min.)
(RETURN to continue ...) >

Port 7 Device Counters
----------------------

Bad Frames Received                        2 (Bad CRC/Non Octet)
Short Receive Frames                       0
Missed Receive Frames                      0
Long Receive Frames                        0
Receiver Overruns                          0
Transmitter Underruns                      0
(RETURN to continue ...) >
```

Display of FRX port for RXR/2 A

```
Port 6 Configuration
--------------------

Interface Protocol            ANSI-Network
Link Integrity Verification   ENABLED
Asynchronous PVC status       DISABLED
N392 (error threshold counter)   3
N393 (monitored events counter)  4
T392 (polling verification timer)  15

Port 6 Status
-------------

Data Base State               Active
TBus State                    Up
UNI State                     Down
Number of events in error     4 of last 4 events
Number of circuits            5
Receive Congestion State      NOT CONGESTED
Transmit Congestion State     NOT CONGESTED
Access Rate                   64000
Total CIR                     0
(RETURN to continue ...) >

Port 6 Statistics (last cleared 0 days, 1 hours, 5 minutes, 31 seconds ago)
--------------------------------------------------------------------------

Total frames in since clear              0
Total frames out since clear             0
Total bytes in since clear               0
Total bytes out since clear              0
Total dropped frames since clear         0
Total dropped DE frames since clear      0
Total frames with unknown DLCI           0
Last Unknown DLCI                      N/A
Frame rate in                            0 (frames/second last 5 min.)
Frame rate out                           0 (frames/second last 5 min.)
Byte rate in                             0 (bytes/second last 5 min.)
Byte rate out                            0 (bytes/second last 5 min.)
Average input queue depth                0 (queue depth last 5 min.)
Average output queue depth               0 (queue depth last 5 min.)
(RETURN to continue ...) >

Port 6 Device Counters
----------------------

Bad Frames Received                      0 (Bad CRC/Non Octet)
Short Receive Frames                     0
Missed Receive Frames                    0
Long Receive Frames                      0
Receiver Overruns                        0
Transmitter Underruns                    0
(RETURN to continue ...) >
```

Display of FRX port for RXR/2 B

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│   Port 6 Configuration                                                    │
│   --------------------                                                    │
│                                                                           │
│   Interface Protocol               ANSI-Network                           │
│   Link Integrity Verification      ENABLED                                │
│   Asynchronous PVC status          DISABLED                               │
│   N392 (error threshold counter)   3                                      │
│   N393 (monitored events counter)  4                                      │
│   T392 (polling verification timer) 15                                    │
│                                                                           │
│   Port 6 Status                                                           │
│   -------------                                                           │
│                                                                           │
│   Data Base State                  Active                                 │
│   TBus State                       Up                                     │
│   UNI State                        Down                                   │
│   Number of events in error        4 of last 4 events                     │
│   Number of circuits               5                                      │
│   Receive Congestion State         NOT CONGESTED                          │
│   Transmit Congestion State        NOT CONGESTED                          │
│   Access Rate                      64000                                  │
│   Total CIR                        0                                      │
│   (RETURN to continue ...) >                                              │
│                                                                           │
│   Port 6 Statistics (last cleared 0 days, 0 hours, 42 minutes, 1 seconds ago)│
│   ------------------------------------------------------------------------│
│                                                                           │
│   Total frames in since clear                  0                          │
│   Total frames out since clear                 0                          │
│   Total bytes in since clear                   0                          │
│   Total bytes out since clear                  0                          │
│   Total dropped frames since clear             0                          │
│   Total dropped DE frames since clear          0                          │
│   Total frames with unknown DLCI               0                          │
│   Last Unknown DLCI                            N/A                        │
│   Frame rate in                                0 (frames/second last 5 min.)│
│   Frame rate out                               0 (frames/second last 5 min.)│
│   Byte rate in                                 0 (bytes/second last 5 min.)│
│   Byte rate out                                0 (bytes/second last 5 min.)│
│   Average input queue depth                    0 (queue depth last 5 min.)│
│   Average output queue depth                   0 (queue depth last 5 min.)│
│   (RETURN to continue ...) >                                              │
│                                                                           │
│   Port 6 Device Counters                                                  │
│   ----------------------                                                  │
│                                                                           │
│   Bad Frames Received                          0 (Bad CRC/Non Octet)      │
│   Short Receive Frames                         0                          │
│   Missed Receive Frames                        0                          │
│   Long Receive Frames                          0                          │
│   Receiver Overruns                            0                          │
│   Transmitter Underruns                        0                          │
│   (RETURN to continue ...) >                                              │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

DLCI # 491 defined in FRX on node 3

```
Port 6 DLCI 491 PVC Configuration
---------------------------------

Source Address           N3C19P6
Source DLCI              491
Destination Address      N2C14P7
Destination DLCI         491
User selected path       Not Selected
Bandwidth Admission      Disabled
(RETURN to continue ...) >

Port 6 DLCI 491 PVC Status
--------------------------

Data Base State          Active
PVC State                Complete
Last Disconnect Reason   Operator Request
PVC Route                N3C19-N1C20-N2C14
Path Towards Destination P1 -> N1C20P1 using DLCI 924
PVC Status               Not Active
PVC Not Active because   UNIdown
(RETURN to continue ...) >
```

DLCI # 485 defined in FRX on node 2

```
Port 7 DLCI 485 PVC Configuration
---------------------------------

Source Address           N2C14P7
Source DLCI              485
Destination Address      N2C14P6
Destination DLCI         485
User selected path       Not Selected
Bandwidth Admission      Disabled
(RETURN to continue ...) >

Port 7 DLCI 485 PVC Status
--------------------------

Data Base State          Active
PVC State                Complete
Last Disconnect Reason   Not Applicable
PVC Route                N2C14
PVC Status               Not Active
PVC Not Active because   RemoteInactive
(RETURN to continue ...) >
```

Display of DLCIs seen by FRX for the 3172 port

```
                **** PVC's originating on Port 7 ****

SourcePort DLCI │ DestPort   DLCI │ CIR      │ State      │ Status
----------------│-----------------│---------│-----------│---------
N2C14P7    485    N2C14P6    485    0          Complete     Inactive

                **** PVC's terminating on Port 7 ****

DestPort   DLCI │ SourcePort DLCI │ CIR      │ State      │ Status
----------------│-----------------│---------│-----------│---------
N2C14P7    491    N3C19P6    491    0          Complete     Inactive
(RETURN to continue ...) >
```

Display of DLCIs seen by FRX for the RXR/2 A port

```
                **** PVC's originating on Port 6 ****

SourcePort DLCI │ DestPort   DLCI │ CIR      │ State      │ Status
----------------│-----------------│---------│-----------│---------
N3C19P6    491    N2C14P7    491    0          Complete     Inactive
(RETURN to continue ...) >
```

Display of DLCIs seen by FRX for the RXR/2 B port

```
                **** PVC's terminating on Port 6 ****

DestPort   DLCI │ SourcePort DLCI │ CIR      │ State      │ Status
----------------│-----------------│---------│-----------│---------
N2C14P6    485    N2C14P7    485    0          Complete     Inactive
(RETURN to continue ...) >
```

5 Remote RouteXpander/2 definitions

RouteXpander/2 definitions are outside the scope of this book. No specific
definitions are needed to enable communication to the MVS host via 3172 MPE.
With the two LAN adapters defined to TCP/IP in RXR/2, routing between the
subnets will automatically be performed.

6 Workstation TCP/IP definitions

Define the OS/2 IP address in WS1

```
   ifconfig LAN0 9.67.46.150 netmask 255.255.255.192
```

Define the routing to MVS in WS1

```
   route add subnet 9.67.46.64 9.67.46.149 2
```

Define the OS/2 IP address in WS2

```
   ifconfig LAN0 9.67.46.250 netmask 255.255.255.192
```

Define the routing to MVS in WS2

```
route add subnet 9.67.46.64 9.67.46.249 2
```

4.11.2 Verification

To verify the TCP/IP connectivity between MVS and the workstations, the methods described in Scenario 1 can be used. See 4.10.2, "Verification" on page 249. We replaced the IP addresses used there with *9.67.46.85*, *9.67.46.150*, and *9.67.46.250* for MVS and the workstations.

The GSDNMA window

In your GSDNMA window, you will see the DLCIs becoming active. This happens when you start the 3172, provided the IDNX network is active and the remote RouteXpander/2 stations are active on their frame relay interface. If a remote RXR/2 is not activated when the 3172 starts, then no information about that DLCI will be seen in the GSDNMA window; when an RXR/2 activates and the DLCI becomes active then information on the link status will appear. The DLCI is not defined to the 3172. Until the network informs the 3172 of a status change on that DLCI, it remains unknown to the 3172.

The following screen reveals GSDNMA messages displayed at the start of a 3172 when remote RXR/2 stations are already active. Note that the DLCIs become automatically active when the 3172 activates the interface.

```
Network Management Agent for RouteXpander/2
(c) Copyright 1992 International Business Machines
All Rights Reserved.

Attempting to contact host '9.67.38.20'
host snmp port is 1025
opening port 1025 on host 9.67.38.20

Registered MIB subtree 'frame-relay' : '1.3.6.1.2.1.10.32.'
Registered MIB subtree 'rs232' : '1.3.6.1.2.1.10.33.'
Registered MIB subtree 'dot1d' : '1.3.6.1.2.1.17.'

SNA management disabled, alerts will be displayed locally.

01/11 21:13:38 FOUND   RXR/2 frame relay protocol
01/11 21:13:38 TRAP    frame relay Status Change DLCI=32 Status=Inactive
01/11 21:13:38 FOUND   RXR/2 Source Routing Bridge
01/11 21:13:38 FOUND   IBM Wide Area Connector
01/11 21:13:38 TRAP    frame relay Status Change DLCI=485 Status=Active
01/11 21:13:38 TRAP    frame relay Status Change DLCI=491 Status=Active
```

The remote RouteXpander/2 GSDNMA screen will, at this time, display the following messages:

On RXR/2 A

```
01/11 21:14:36 TRAP    frame relay DLCI=491 Adapter=1 Status=Active
```

On RXR/2 B

```
  01/11 21:14:55 TRAP     frame relay DLCI=485 Adapter=1 Status=Active
```

Note: The difference in status message format between RXR/2 and the 3172 is explained by the later version of RouteXpander/2 code running in the RXR/2 station (Version 1.01).

TRACERTE command from MVS TCP/IP

The TRACERTE command issued from a TSO command line will trace the route taken from MVS TCP/IP to a destination IP address.

How is this done?

This is accomplished by using the TTL field in the IP packet to provoke ICMP *TTL expired* responses. The first packet sent out has a TTL of 0, which provokes the first router to discard the packet and respond with *TTL expired*. The TTL field is incremented by one until a response is received from the destination host. A list of routers used to reach the destination will be displayed in response to the TRACERTE command.

Note that the TSO user who issues the TRACERTE command must be included in the OBEY list in the MVS TCP/IP profile.

```
  ------------------------ TSO COMMAND PROCESSOR ---------------------
  ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

  ===> tracerte 9.67.46.150

  TCPTRA016I Trace route to 9.67.46.150 (9.67.46.150)
  TCPTRA037I 1   (9.67.46.83) 87 ms 69 ms 39 ms
  TCPTRA037I 2   (9.67.46.150) 62 ms 53 ms 109 ms
  TCPTRA100I
  ***
```

4.12 MPE Scenario 3 - TCP/IP over a Point-to-Point Line

The purpose of this scenario is to demonstrate that you do not need a real frame relay network to connect your 3172 MPE to a remote LAN. You can use any point-to-point line and connect with V.24, V35 or X.21. A point-to-point connection limits the number of frame relay connections to one, as you can only have one physical connection to the Wide Area Connector card.

In our scenario we connected to a remote RouteXpander/2 using a modem eliminator with a V.35 connector.

```
┌──────────────────────────────────────────────────────────────────────────┐
│                        ┌──────────────┐                                    │
│                        │     MVS      │        ▪1                          │
│                        │    TCP/IP    │        ▪2                          │
│                        └──────────────┘                                    │
│                               │  ESCON attach                              │
│                        ┌──────────────┐                                    │
│                        │   3172 MPE   │        ▪3                          │
│                        ├─────┬────┬───┤                                    │
│                        │ WAC │ TR │EN │────                                │
│                        └─────┴────┴───┘                                    │
│              9.67.46.85  │                                                 │
│                        ┌──────┐                                            │
│                        │modem │                                            │
│                        │elim. │                                            │
│                        └──────┘                                            │
│                           │           ▪4            ▪5                     │
│              9.67.46.84   │                                                │
│                        ┌───────┐   ┌────────────────┐   ┌──────┐           │
│                        │ RXR/2 │───│  token-ring    │───│ OS/2 │           │
│                        │       │   │ subnet 9.67.46.128 │ WS1  │           │
│                        └───────┘   └────────────────┘   └──────┘           │
│                        9.67.46.249                     9.67.46.150         │
└──────────────────────────────────────────────────────────────────────────┘
```
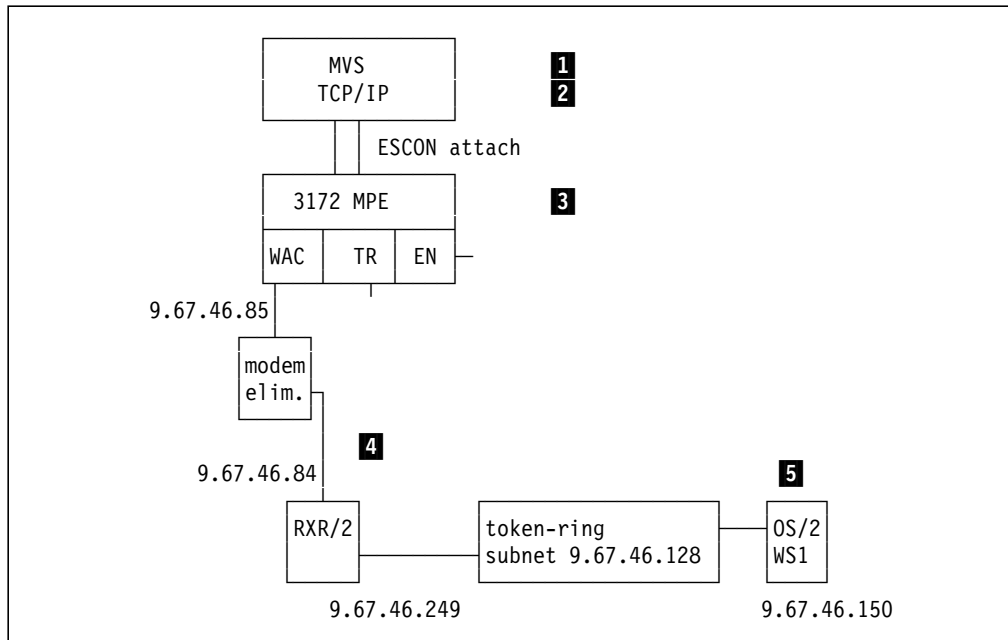
Figure 178. Scenario 3. TCP/IP from MVS to a workstation on a remote token-ring using a point-to-point line.

4.12.1 Definitions

The definitions for MVS, MVS TCP/IP, 3172, and workstation are the same as in 4.11, "MPE Scenario 2 - TCP/IP over a Frame Relay Network" on page 251. The only difference is that you will not have to define a network but only connect the 3172 and the RouteXpander/2 with modems.

4.12.2 Verification

The GSDNMA window will now only show DLCI # 32:

```
Network Management Agent for RouteXpander/2
(c) Copyright 1992 International Business Machines
All Rights Reserved.

Attempting to contact host '9.67.38.20'
host snmp port is 1025
opening port 1025 on host 9.67.38.20

Registered MIB subtree 'frame-relay' : '1.3.6.1.2.1.10.32.'
Registered MIB subtree 'rs232' : '1.3.6.1.2.1.10.33.'
Registered MIB subtree 'dot1d' : '1.3.6.1.2.1.17.'

SNA management disabled, alerts will be displayed locally.

01/11 23:11:16 FOUND    RXR/2 frame relay Protocol
01/11 23:11:16 TRAP     frame relay Status Change DLCI=32 Status=Inactive
01/11 23:11:16 FOUND    RXR/2 Source Routing Bridge
01/11 23:11:16 FOUND    IBM Wide Area Connector
01/11 23:11:16 TRAP     frame relay Status Change DLCI=32 Status=Active
```

4.13 MPE Scenario 4 - TCP/IP from 3172 LANs over a frame relay Network

The purpose of this scenario is to demonstrate TCP/IP routing from the 3172-attached token-ring and Ethernet to a workstation on a remote token-ring over a frame relay network.
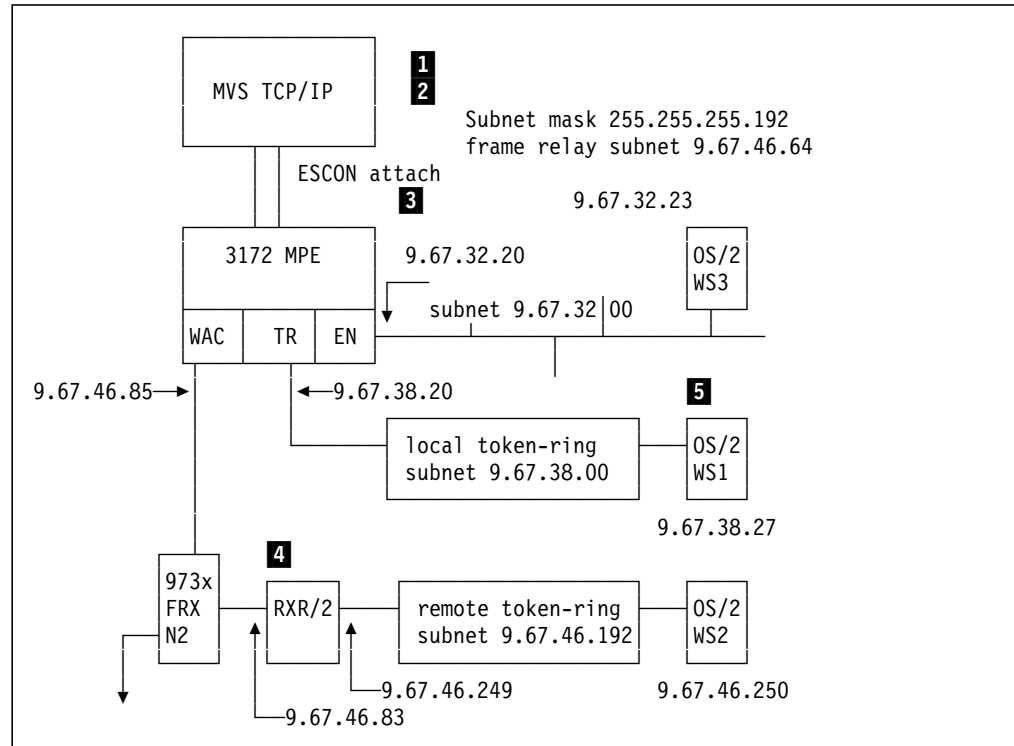
Figure 179. Scenario 4. TCP/IP from 3172-attached LANs to remote token-ring over frame relay.

4.13.1 Definitions

1 MVS definitions

See Scenario 1 definitions in 4.10.1, "Definitions" on page 247.

2 TCP/IP definitions

Definitions in TCPIP.PROFILE.TCPIP

Shown below is only a subset of the parameters in the TCPIP.PROFILE data set. The selected parameters are the ones deemed significant for this scenario.

```
DEVICE MPEDEV    CLAW 320 TCPIP  OS2TCP  NONE
  LINK   MPEIPLINK OFFLOADLINK1  1 MPEDEV
  LINK   MPETR1    OFFLOADAPIBROAD 9.67.38.20 MPEDEV  MPEIPLINK
  LINK   MPEWAC    OFFLOADAPIBROAD 9.67.46.85 MPEDEV  MPEIPLINK
  LINK   MPEEN1    OFFLOADAPIBROAD 9.67.32.20 MPEDEV  MPEIPLINK
-
GATEWAY
  9            = MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.64
  9    9.67.46.83 MPEWAC DEFAULTSIZE   0.255.255.192 0.67.46.192
  9            = MPETR1  DEFAULTSIZE   0.255.255.192 0.67.38.00
  9            = MPEN1   DEFAULTSIZE   0.255.255.192 0.67.32.00
-
DEFAULTAPPL RAKAA    ; Set the default application for all
                     ; TELNET sessions, NetView Access

START  MPEDEV
```

— Note —

The TCP/IP traffic in this scenario will be routed by the 3172 and not handled
by TCP/IP in MVS. The routes must, however, be specified in TCP/IP MVS.
The routing table used in the 3172 is downloaded from TCP/IP MVS at startup
and updated as soon as the MVS routing tables change.

---

3 3172 Offload

See Scenario 1 definitions in 4.10.1, "Definitions" on page 247.

4 RouteXpander/2 definitions

As the RouteXpander/2 now is not directly attached to both networks, we have to
add TCP/IP route statements to the 3172-attached LANs.

```
route add subnet 9.67.38.00 9.67.46.85 1
route add subnet 9.67.32.00 9.67.46.85 1
```

5 Workstation TCP/IP Definitions

Define the OS/2 IP address in WS1

```
ifconfig LAN0 9.67.38.27 netmask 255.255.255.192
```

Define the routes to WS2 and WS3 in WS1

```
route add subnet 9.67.46.192 9.67.38.20 2
route add subnet 9.67.32.00 9.67.38.20 1
```

Define the OS/2 IP address in WS2

```
ifconfig LAN0 9.67.46.250 netmask 255.255.255.192
```

Define the routes to WS1 and WS3 in WS2

```
   route add subnet 9.67.38.00 9.67.46.249 2
   route add subnet 9.67.32.00 9.67.46.249 2
```

Define the OS/2 IP address in WS3

```
   ifconfig LAN0 9.67.32.23 netmask 255.255.255.192
```

Define the routes to WS1 and WS2 in WS3

```
   route add subnet 9.67.38.00 9.67.32.20 1
   route add subnet 9.67.46.192 9.67.32.20 2
```

4.13.2 Verification

Verification of TCP/IP connectivity between WS1, WS2, and WS3 can be done with a PING, TELNET or FTP. See 4.10.2, "Verification" on page 249.

A TRACERTE command similar to the one implemented in MVS TCP/IP and described in 4.11.2, "Verification" on page 262 is also implemented in OS/2 TCP/IP. Using this command on WS1 to trace the route to WS2 gave the following screen:

```
 OS2 C:\>tracerte 9.67.46.250
 traceroute to 9.67.46.250 (9.67.46.250), 30 hops max, 38 byte packets
  0  MPETR1 (9.67.38.20)  0 ms  0 ms  0 ms
  1  MPETR1 (9.67.38.20)  31 ms  0 ms  31 ms
  2  RXR83 (9.67.46.83)  63 ms  31 ms  63 ms
  3  9.67.46.250 (9.67.46.250)  62 ms  62 ms  63 ms

 OS2 C:\>
```

4.14 MPE Scenario 5 - Bridging from Local Token-Ring over a Frame Relay Network

The purpose of this scenario is to demonstrate bridging of SNA and NetBIOS traffic from the token-ring attached to the 3172 over a frame relay network to a workstation on a remote token-ring.
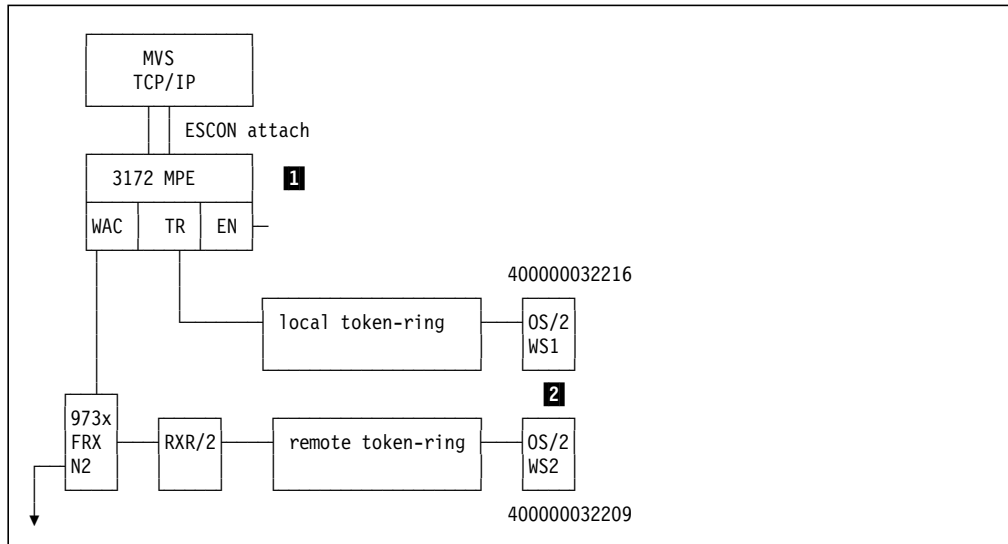
Figure 180. Scenario 5. Bridging from 3172-Attached Token-Ring to Remote Token-Ring over frame relay.

4.14.1 Definitions

1 3172 Bridge definitions

The statement RUN=C:\GSD\GSDBRMGR.EXE will start the source route bridging function between the token-ring card and the WAC card. The file C:\IBMCOM\GSDBRMGR.INI will be read at startup to initiate the bridge filters.

2 Workstation definitions

SNA definitions

Workstation WS1 APPN node name **USIBMRA.WTR32216**
Workstation WS2 APPN node name **USIBMRA.WTR32209**

We defined a peer connection between the the two workstations in Communications Manager/2. To do that follow these steps:

Step   1. Double-click on the Communications Manager/2 icon.

Step   2. Double-click on Communications Manager/2 Setup icon.

Step   3. Click on **OK**.

Step   4. Click on **Setup...**.

Step   5. Click on **OK** to accept default profile.

Step   6. With **Token-Ring or other LAN types** selected in the Workstation Connection type window, click on **CPI Communications**.

Step   7. Click on **Configure**.

Step   8. Double-click on **SNA Connections**.

Step   9. Select **Peer**.

Step 10. Click on **Create**.

Step 11. Click on **Continue** and fill out the following screen with values for the peer station:
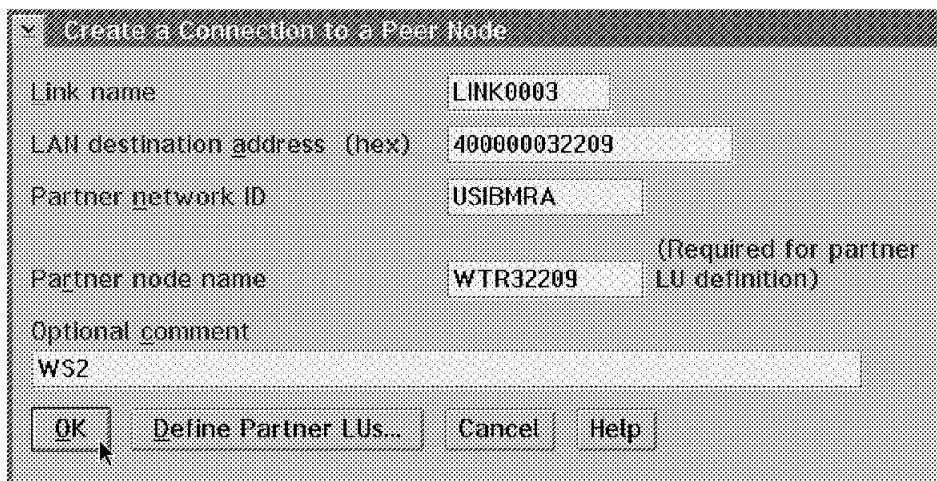
Figure 181. Define a Peer Connection.   Values configured at WS1.

Step 12. Click on **OK**.

Step 13. Exit Communication Manager Setup by closing the windows.

Step 14. Repeat the steps at WS2.

LAN Services definitions for NetBIOS test

Workstation WS1 LAN Requester name **WTR32216**

Workstation WS2 LAN Requester name **WTR32209**

4.14.2 Verification

SNA Connectivity

To test SNA connectivity we used the **Atell** and **Atelld** sample programs that are provided as part of Communications Manager/2.

We copied the C:CPICPGMS directory from CM/2 Productivity Aids Disk 1 to subdirectory C:\ZZZ\ on the workstations. The C:\ZZZ\ subdirectory was added to the PATH statement in the CONFIG.SYS file.

Atelld also had to be defined to CM/2 as a transaction program. To do that, follow these steps:

Step 1. Double-click on the Communications Manager/2 icon.

Step 2. Double-click on the Communications Manager/2 Setup icon.

Step 3. Click on **OK**.

Step 4. Click on **Setup...**.

Step 5. Click on **OK** to accept default profile.

Step 6. With **Token-ring or other LAN types** selected in the Workstation Connection type window, click on **CPI Communications**.

Step 7. Click on **Configure**.

Step 8. Double-click on **SNA Features**.

Step 9. Select **Transaction program definitions**.

Step 10. Click on **Create** and fill out the following screen.

```
┌─────────────────────────────────────────────────────────────┐
│ ⌄  Create a Transaction Program Definition                    │
├─────────────────────────────────────────────────────────────┤
│  Transaction program definition                               │
│    ☐ Service TP                                               │
│  Transaction program (TP) name        ATELLD                  │
│  OS/2 program path and file name       c:\zzz\atelld.exe      │
│  Optional comment                                             │
│                                                               │
│                                                               │
│  Optional values                                             │
│    ☐ Conversation security required                           │
│  Program parameter string                                     │
│  Icon path and file name                                      │
│                                                               │
│  ┌──────────┐  ┌────────┐  ┌──────┐                           │
│  │ Continue │  │ Cancel │  │ Help │                           │
│  └──────────┘  └────────┘  └──────┘                           │
└─────────────────────────────────────────────────────────────┘
```
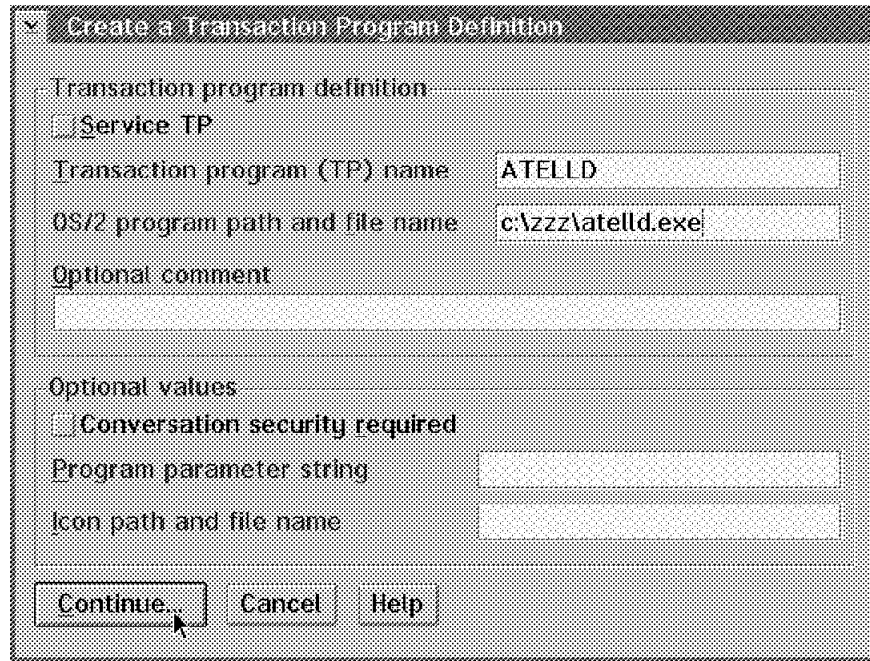
Figure 182. Define a Transaction Program. First screen.

```
┌─ Important ───────────────────────────────────────────────┐
│                                                            │
│  TP name is case sensitive and must be entered in uppercase│
│  (ATELLD).                                                 │
│                                                            │
└────────────────────────────────────────────────────────────┘
```

Step 11. Click on **Continue** and fill out the second screen

```
┌─────────────────────────────────────────────────────────────┐
│ ⌄  Create Additional TP Parameters                            │
├─────────────────────────────────────────────────────────────┤
│  Presentation type            Operation type                  │
│  ○ Presentation Manager       ○ Queued, Attach Manager started│
│  ● VIO-windowable             ○ Queued, operator started      │
│  ○ Full screen                ○ Queued, operator preloaded    │
│  ○ Background                 ● Non-queued, Attach Manager started│
│                                                               │
│  ┌────┐  ┌────────┐  ┌──────┐                                 │
│  │ OK │  │ Cancel │  │ Help │                                 │
│  └────┘  └────────┘  └──────┘                                 │
└─────────────────────────────────────────────────────────────┘
```
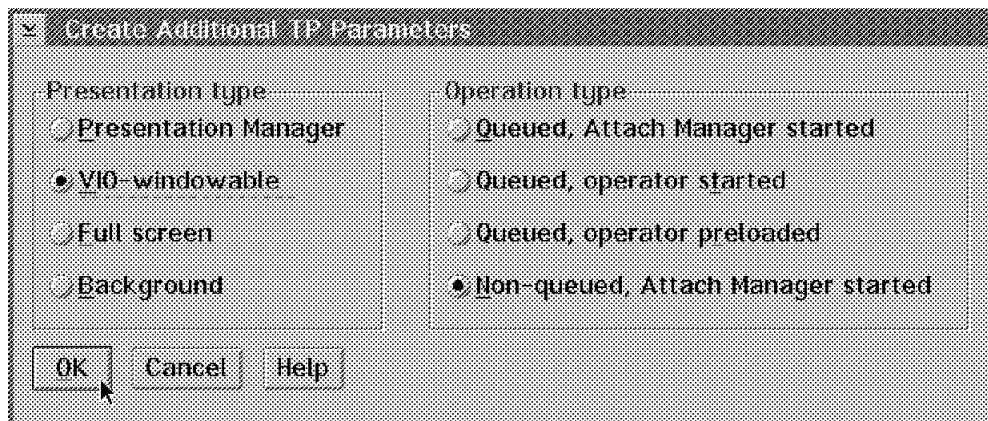
Figure 183. Define a Transaction Program. Second screen.

Step 12. Click on **OK**.

Step 13. Exit Communications Manager/2 Setup by closing the windows

The following screen shows Atell invoked from WS1:

```
OS2 C:\>atell usibmra.wtr32209 hejsan
ATELL version 2.38 - Send a message.
  by Peter J. Schwaller (pjs@ralvm6.vnet.ibm.com)

Connected to a partner running on: OS/2 or DOS (Family API)

Message successfully sent to USIBMRA.WTR32216

OS2 C:\>
```

On the WS2 the following window was displayed:

```
              ATELLD

 msg from USIBMRA.WTR32216 on Fri Jan 14 15:01:38 1994:

    hejsan

 press Enter to continue:
```

NetBIOS connectivity

LAN Messaging was used to verify NetBIOS connectivity. To send a message
using LAN Messaging follow this procedure:

 1. Double-click on the LAN Services icon.

 2. Double-click on the LAN Messaging icon.

 3. You will now be presented with a sequence of screens that lets you send a
    message to a workstation by using its LAN requester name, which is also
    used as its NetBIOS name.

 4. On the destination workstation, a window pops up with the message that was
    sent.

4.14.3 Filtering

In our test environment, the token-ring attached to the 3172 is the production
LAN. This means that it is very busy and, if no filters are applied to the bridges,
much unnecessary bridging is being performed. For most bridges this does not
affect performance, up to a limit. The limit where performance is affected is
lower for the token-ring to frame relay bridge implemented in the 3172. This is
because the frame relay side of the bridge operates at a significantly lower
speed than a normal LAN.

The GSDNMA window will display TRAP messages when your 3172 is being
overloaded with bridged traffic.

If your GSDNMA window displays messages like the ones shown below, you may
have a reason to add or modify filters.

```
01/12 09:17:32 ALERT    Bridge Transmit Buffer Pool Threshold Exceeded, 80% full
01/12 09:17:32 ALERT    Bridge Transmit Buffer Pool Depleted, Frames Lost
```

We installed the filter below to restrict the bridged traffic to certain NetBIOS
names and to certain MAC addresses. With that filter in place the warnings no
longer appeared.

This filter is only included to serve as a sample of the types of filters available and to show the syntax.

Notes

The ′*′ at the end of the NetBIOS names proved to be necessary because a value is sometimes added in the last positions of the 16-byte NetBIOS name.

After you have changed the filter file in C:\IBMCOM\GSDSRB.INI and rebooted the 3172, check C:\IBMCOM\LANTRAN.LOG for error messages. The error messages will start with ″SRB″.

```
;; Example GSDSRB.INI File
;; --Filters out NetBIOS sessions to names starting with the string
;;   WTR except the five names WTR32216, WTR33343, WTR32209, WTRDC
;;   and WTRDM (WTRDC and WTRDM are names used by our LAN server)
;;
;; --On Port #1 (token-ring), a filter stops all traffic from MAC
;;   addresses other than 400000033343 and 4000000322xx.
;;
;; --On Port #2(WAC), hop count limit is set to 6 (for frames coming
;;   from the frame relay network).
;;
;; --Note that on 3172 MPE port #1 is the Token-Ring and port #2 is WAC.
;;   The InPortList statement lists the ports in port number order.
;;
;;************** the FILTER statement *****  1
[FILTER]
    GeneralList=NBnames
    InPortList=MACfilter, HOPfilter
;;
;;************** CRITERIA LISTS **********  2
[NBnames]
    AllOf = NW, S1, S2, N1, N2, N3
[MACfilter]
    AllOf = MACone, MACtwo
;;
;;************** CRITERIA ****************  3
[NW]
    NetBiosName = ″WTR*″
[S1]
    NetBiosName != ″WTRDC*″
[S2]
    NetBiosName != ″WTRDM*″
[N1]
    NetBiosName != ″WTR32216*″
[N2]
    NetBiosName != ″WTR33343*″
[N3]
    NetBiosName != ″WTR32209*″
[MACone]
    SrcAddr != ″0x400000033343″
[MACtwo]
    SrcAddr != ″0x400000032200″
    SrcAddrMask = ″0xffffffffff00″
[HOPfilter]
    HopCountLimit = 6
```

1 **The FILTER statement**

The filter statement must begin with the label [**FILTER**]. All other statements may have any character string as label. The FILTER decides which filters are applied on the two ports of the bridge.

- GeneralList is applied to both sides (token-ring and WAC).

- InPortList points to filter for either side of the bridge.

- First position points to filter for port 1 (TOKEN RING).

- Second position points to filter for port 2 (WAC).

  Note: To apply a filter only to port 2, the keyword *empty* can be used in the first position.

On the right side of the equal sign ($'='$) you will find labels of either criteria lists (NBnames, MACfilter) or a criteria (HOPfilter).

2 The CRITERIA LIST

This list combines criteria with one of the logical operators:

- AnyOf

- AllOf

- NoneOf

- NotAllOf

3 The CRITERIA

The criteria describe what is to be filtered out with this filter. The following is a list of the available keywords and one sample statement of each type to show the syntax:

- SourceRouteType

  - SourceRouteType=STE (Spanning Tree Explorer frame)

  - SourceRouteType=ARE (All Routes Explorer frame)

  - SourceRouteType=SRF (Specifically Routed Frame)

- HopCountLimit

  - HopCountLimit = 6

- DestAddr

  - DestAddr = "0x400000033333"

- DestAddrMask - specified together with DestAddr

  - DestAddrMask = "0xffffffffffff" (default)

- SrcAddr

  - SrcAddr = "0x400000033333"

- SrcAddrMask - specified together with SrcAddr

  - SrcAddrMask = "0xffffffffffff" (default)

- NetBIOSName - max 16 characters

  - NetBIOSName = "WTR*"

- FrameData - max 64 bytes

  - FrameData = "0xAAAA030000008137"

- FrameDataOffset - specified together with FrameData

  - FrameDataOffset = 0

- FrameDataMask - specified together with FrameData

  - FrameDataMask = "0xffffffffffffffff"

> **┌─ The Compound Operators ″! and =″ ──────────**
>
> *!=* normally means *NOT EQUAL* for the comparison. However, in the specific
> case of *NetBIOSName*, != means that the frame must be a NetBIOS frame
> and the NetBIOS name must *NOT* match the specified name.

How does the filter work?

A frame *is* blocked (filtered out) if the GeneralList **or** the InPortList applied is
true. The InPortList filter can be constructed using Criteria Lists that combine
criteria with the logical keywords such as Allof, AnyOf, NoneOf or NotAllOf; it
may be a single filter or a compound filter.

Examples:

1. Workstation with MAC address 400000032216 on the token-ring sends a frame
   to NetBIOS name WTR32209.

   To be filtered out, all filters in either GeneralList (NBfilter) or in InportList for
   the token-ring (MACfilter) must be true:

   - NBnames

     – NW (true)

     – S1 (true)

     – S2 (true)

     – N1 (true)

     – N2 (true)

     – N3 (false)

   - MACfilter

     – MACone (true)

     – MACtwo (false)

   The frame is passed. One false criterion in any group is enough to inhibit
   blocking of the frame.

   If follows from this logic that MAC address 400000033343 (or any station with
   MAC address 4000000322xx, which includes the LAN Server) can send
   frames to NetBIOS names WTR32216, WTR33343, WTR32209 and the Server
   names.

   All other frames coming from the token-ring will be blocked.

2. A frame coming from the frame relay network addressed to NetBIOS name
   WTR5555. We assume that the hop count is 3.

   To be filtered out, all filters in either GeneralList (NBfilter) or in InPortList for
   the WAC card (HOPfilter) must be true:

   - NBnames

     – NW (true)

     – S1 (true)

     – S2 (true)

     – N1 (true)

– N2 (true)

          – N3 (true)

      • HOPfilter

          – HOPfilter (false)

      This frame is blocked as the GeneralList (NBnames) is true. Had it been
      addressed to, for example, NetBIOS name ZZZ32216, it would have passed,
      as NW would have been false and that makes NBnames false.

4.15 MPE Scenario 6 - Bridging from Remote LAN to SNA Host Using Frame Relay

      The purpose of this scenario is to demonstrate how SNA traffic can be bridged to
      a SNA host from a remote token-ring over a frame relay network. This involves
      using a second 3172 with ICP connected to the same local token-ring as the 3172
      MPE.
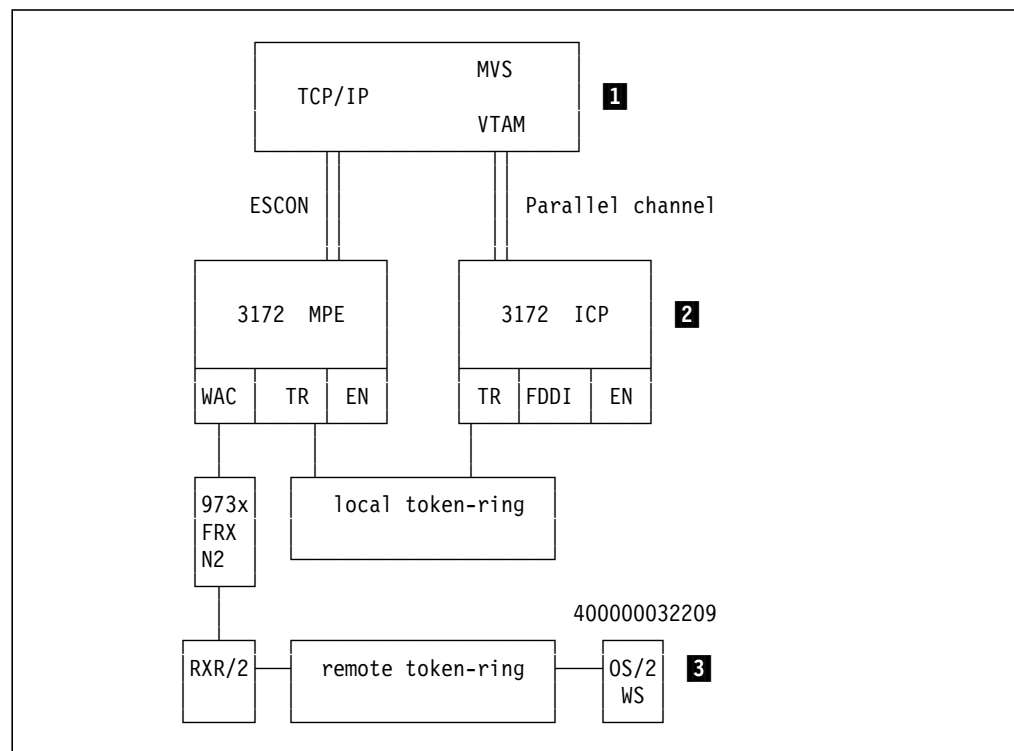
Figure 184. Scenario 7. Bridging SNA host to remote LAN using ICP and MPE

4.15.1 Definitions

      For this test we used definitions described in the ICP section of this book, see
      2.11, "Scenario 4: SNA over Token-Ring" on page 115. The workstation shown
      in Figure 65 on page 115 was physically disconnected from the local LAN and
      connected to the remote LAN. No definitions were changed in MVS, VTAM, ICP
      or the workstation.

      1 MVS and VTAM definitions

      See 2.11.1, "Host Definitions" on page 116.

2 3172 ICP definitions

See 2.11.2, "3172 Definitions" on page 118.

2 Workstation definitions

see 2.11.3, "Workstation Definitions" on page 119.

4.15.2 Verification

After moving the workstation, we were able to log on to the MVS host using 3270 emulation

Chapter 5. 3172 Network Management

This chapter describes how network managers can manage the 3172. The network managers are either SNA or SNMP managers. NetView is the IBM Enterprise Network Manager for SNA nets. The current offering for SNMP management from IBM is NetView/6000. For our purposes we will use NetView as the manager to control a 3172. We will discuss managing a 3172 using both SNA and SNMP.

Aspects of controlling the three 3172 configurations covered in this book (ICP, Offload, and MPE) will be discussed.

5.1 3172 as Seen by Network Managers

The IBM 3172 LAN Interconnect Controller can be seen as an intelligent LAN adapter for VM and MVS hosts. To manage the 3172 resources, it is important to understand where the 3172 fits in the network structure of which it is a component.

5.1.1 3172 Appearance to NetView

A 3172 with ICP may participate actively in an SNA network or a TCP/IP network or both. Offload and MPE configurations exist only in a TCP/IP network.

In an SNA environment, NetView lets you manage the nodes and the links that make up your network. The nodes can be subarea nodes (Type 5, 4, or 2) or APPN nodes (NN, EN, or LEN). The 3172 is *NOT* seen as any type of SNA node. To NetView, the 3172-attached LANs are seen as links attached directly to the MVS or VM PU Type 5. These links can be managed and monitored by NetView. Any SNA-node attached to a LAN on a 3172 can certainly be managed through the 3172, where 3172 only plays the role of a link.

However, 3172 ICP also implements a network management PU Type 2 to enable NetView to manage the 3172 as such. The 3172 and its adapters do not depend on the network management PU to be active for normal functions. This PU is merely a communication link between NetView and ICP to perform the box related functions described in 5.2, "NetView SNA Support for 3172" on page 278.

> **Note:**
>
> The 3172 Interconnect Enhancement Feature needs to be installed on the 3172 to enable the network management PU Type 2. However, no adapter needs to be enabled for SNA traffic for SNA network management to function. A 3172 with ICP running only TCP/IP over the LAN adapters can still support SNA management of the box from NetView.

5.1.2 3172 Appearance to TCP/IP Network Managers

A TCP/IP network consists of hosts and interfaces. These hosts and interfaces can be managed by a network manager program using the *Simple Network Management Protocol* provided the managed hosts run an agent program.

The 3172 is *NOT* seen as a TCP/IP host by an SNMP manager. All 3172-attached LANs are seen as interfaces to the VM or MVS host running TCP/IP and using the 3172 to access LANs.

This support is implemented differently in ICP and in Offload environments; from an SNMP manager the appearance is the same.

5.2 NetView SNA Support for 3172

The NetView support described in this section requires the following software:

- ICP with the Interconnect Enhancement Feature
- VTAM Version 3 Release 4 or later
- NetView Version 2 Release 2
  - CSCF started in NetView (task name is DSIKREM)
  - VPD started in NetView (task name is VPDTASK)

5.2.1 3172 Generic Alerts

The 3172 sends generic alerts, generated from errors that it detects, to the Hardware Monitor at the NetView operator console. Each generic alert contains:

- Notification of an actual or pending loss of service
- Available data about the loss of service, which will help with problem determination and resolution

See 5.3.3, "Alert Display Example" on page 288 and *GA27-3951, 3172 Interconnect Controller Status Codes*.

5.2.2 NetView CSCF and VPD Support

CSCF Support

Central Site Control Facility provides NetView operators with access to specific 3172 information. This information can be used to analyze the system configuration and correct problems.

To issue a command from NetView to the 3172, a CSCF session between NetView and the 3172 network management PU must be established. This session is activated using a CSCF command. When a CSCF session has been activated, a CSCF panel will show the available commands. 5.3.1, "CSCF Command Examples" on page 280 shows examples of CSCF panels displayed for the ITSO 3172 running ICP.

VPDCMD Support

The *Vital Product Data* command retrieves vital product data from the 3172. 5.3.2, "VPD Command Example" on page 288 shows an example of a VPDCMD command issued for the ITSO 3172 running ICP.

5.2.3 SNA Definitions

To enable the SSCP-PU session used for SNA management services, the following has to be defined to VTAM:

- An XCA major node defining the subchannel address dedicated for the network management interface

- A switched major node defining the PU Type 2 in 3172 ICP

The VTAM definitions used in the ITSO environment are listed in 5.3, "NetView Support for ITSO ICP Environment."

5.3 NetView Support for ITSO ICP Environment
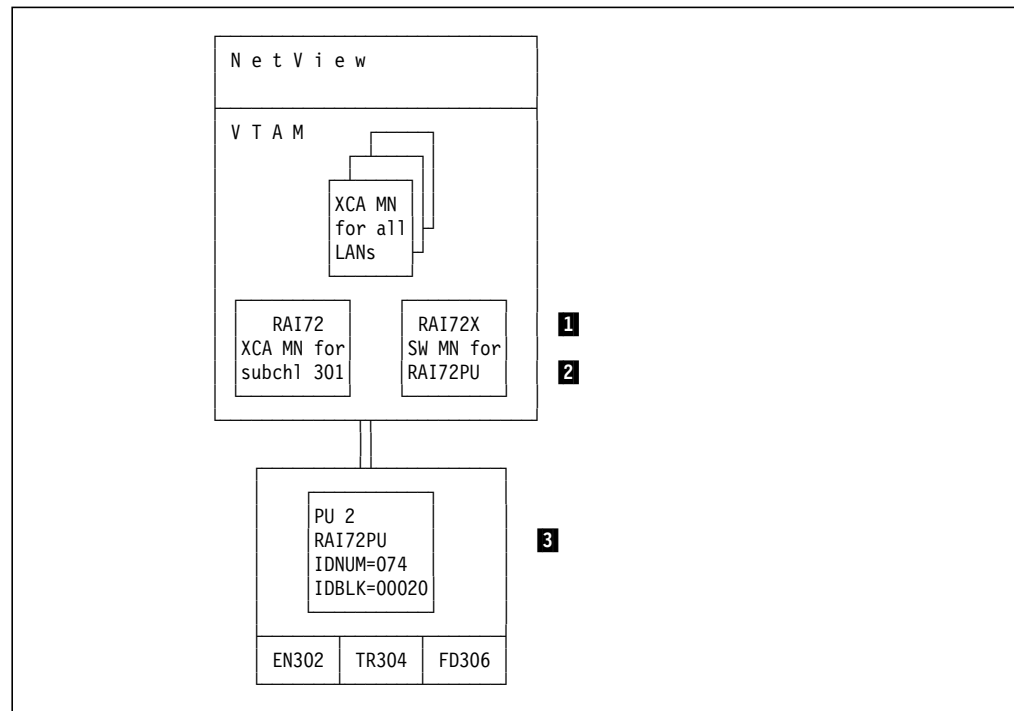
Figure 185. The ITSO 3172 ICP. SNA network management environment.

An SSCP-PU session is used to establish SNA management services communications between 3172 and NetView. To enable the SSCP-PU session a 3172 major node definition (XCA) must be provided to VTAM.

The PU Type 2 that resides in 3172 is defined in a switched major node with IDBLK value 074.

Note: The definitions used in the ITSO 3172 are listed and explained in 2.11.1, "Host Definitions" on page 116, and are only repeated here for convenience.
1 XCA definition

```
*************************************************************************
**  3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR 3172 NETWORK MANAGEMENT  **
*************************************************************************
RAI72     VBUILD TYPE=XCA          XCA FOR 3172 NETWORK MANAGEMENT
RAI72P    PORT  CUADDR=301,                                              X
                MEDIUM=BOXMGR
RAI72G    GROUP
RAI72L    LINE
          PU
```

2 Switched major node definition

```
*************************************************************************
**   3172 MODEL 3 (ICP) - 3172 SWITCHED MAJOR NODE              **
*************************************************************************
RAI72S    VBUILD MAXGRP=1,                                              X
                 MAXNO=1,                                               X
                 TYPE=SWNET
RAI72PU   PU     ADDR=01,                3172 PU                        X
                 IDBLK=074,                                                X
                 IDNUM=00020,                                              X
                 MAXDATA=265,                                              X
                 MAXOUT=2,                                                 X
                 MAXPATH=1
RAI72P1   PATH   CALL=INOUT,                                            X
                 DIALNO=9904000000000000,                                  X
                 GID=1,                                                 X
                 GRPNM=RAI72G,                                          X
                 PID=1
```

3 PU definitions
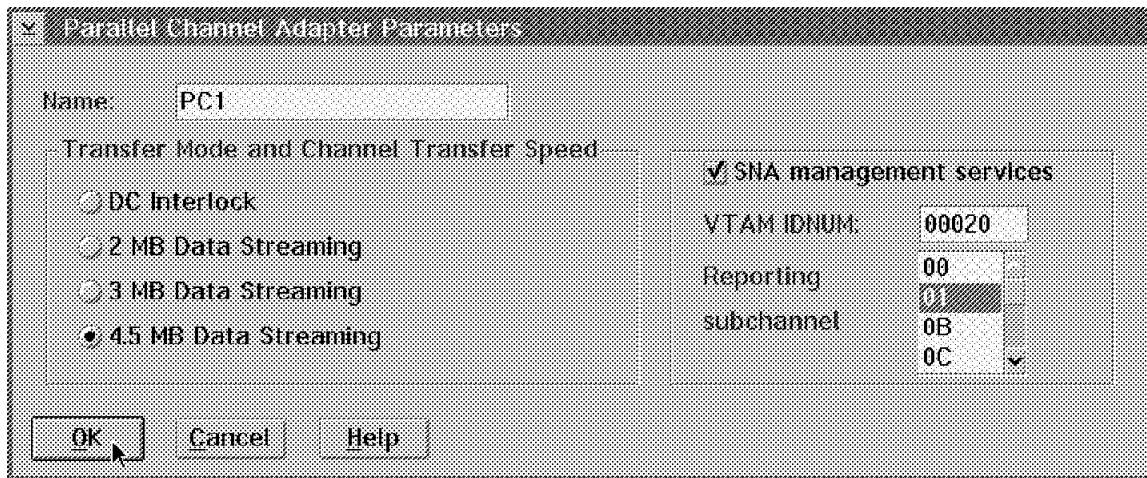
Figure 186. ICP definition of Channel Adapter. Includes subchannel and IDNUM for PU.

5.3.1 CSCF Command Examples

As a real life example of CSCF screens we have included a walk-through of the screens displayed for the ITSO 3172 running ICP.

The CSCF PU=RAI72PU command presents the following screen:

```
┌─────────────────────────────────────────────────────────────────────┐
│                                                                       │
│   CSP00101      -------- Interconnect Controller Commands -------     PU/RAI72PU │
│                                                                       │
│      Command                 Description                              │
│      ----------------        -----------------------------------------------   │
│      /QUERY                  Display profile component list           │
│      /QUERY component        Display profile for named component      │
│      /CONFIG                 Display configuration component list     │
│      /CONFIG component       Display configuration for named component│
│      /LOG                    Display Interconnect Controller log data │
│      /IPL                    Request the Interconnect Controller to be restarted │
│      /VERIFY /IPL            Confirm IPL request                      │
│                                                                       │
│      For more information about Interconnect Controller Commands,     │
│      refer to the Interconnect Controller Program User's Guide.       │
│                                                                       │
│   CMD===>/QUERY                                                       │
│   PF2= END                        PF3= RETURN              PF6= ROLL  │
└─────────────────────────────────────────────────────────────────────┘
```

QUERY Commands

Enter /QUERY and press **PF9** to get a list of the components that can be queried.

```
┌─────────────────────────────────────────────────────────────────────┐
│                                                                       │
│   CSP01301      ----------- Query Component List --------------   PU/RAI72PU │
│                                                                       │
│   Components                                                          │
│                                                                       │
│   -------------------------------------------------------------------- │
│   HARDWARE (or HW)    SOFTWARE (or SW)    EN1              TR1         │
│   PC1                 FD1                                              │
│                                                                       │
│                                                                       │
│   Enter component for QUERY: ( hw     )                               │
│                                                                       │
│   ===>                                                                │
│   PF2= END                        PF3= RETURN              PF6= ROLL  │
│   PF9= QUERY                                              PF12= RETRIEVE │
└─────────────────────────────────────────────────────────────────────┘
```

By entering the component name and pressing **PF9**, CSCF will display query
data for the component selected.

Below you will find query response screens for all components listed on the
Query Component List screen above:

HW query response:

```
┌─────────────────────────────────────────────────────────────────────┐
│                                                                       │
│   CSP00201      ------------ Hardware Profile ---------------   PU/RAI72P │
│                                                                       │
│   Name: ICP-1           Model: 000        Serial Number: 0000000      │
│                                                                       │
│   Memory Size:      8,257,536 Bytes    Disk Size:    30,392,320 Bytes │
│   Diskette Size:    1,457,664 Bytes    Disk Free:    70,199,296 Bytes │
│                                                                       │
│   Location:  ITSC Raleigh - Room BB121                                │
│   User Data: 3172 Model 3 PCA ICP 3.2                                 │
│                                                                       │
│   Adapter       Slot                                                  │
│   --------      ----                                                  │
│   EN1           2                                                     │
│   TR1           3                                                     │
│   PC1           4                                                     │
│   FD1           6                                                     │
│                                                                       │
│                                                                       │
│   ===>                                                                │
│   PF2= END                        PF3= RETURN              PF6= ROLL  │
└─────────────────────────────────────────────────────────────────────┘
```

SW query response:

```
 ┌────────────────────────────────────────────────────────────────────────────┐
 │                                                                              │
 │   CSP00301     --------------- Software Profile --------------    PU/RAO72PU  │
 │                                                                              │
 │  Common Name: 3172 Interconnect Ctlr Pgm                                     │
 │  Program: 5621425     BIOS Date: 07/31/92                                    │
 │                                                                              │
 │  DESCRIPTION                      LEVEL       PTF NUMBER                      │
 │  Interconnect Controller Pgm      03.02.00    0000000                        │
 │  Interconnect Enhancement Ftr     03.02.00    0000000                        │
 │                                                                              │
 │                                                                              │
 │  APARs                                                                       │
 │  IR24278 IR24319                                                             │
 │                                                                              │
 │                                                                              │
 │  CMD===>                                                                     │
 │  PF2= END                     PF3= RETURN                  PF6= ROLL         │
 │                                                                              │
 └────────────────────────────────────────────────────────────────────────────┘
```

EN1 query response:

```
 ┌────────────────────────────────────────────────────────────────────────────┐
 │                                                                              │
 │  CSP00601      ---------- LAN Adapter Profile --------------    PU/RAI72P     │
 │                                                                  Page 1       │
 │   Name: EN1                         Status: ONLINE                            │
 │   Type: Ethernet/802.3              Current Time: 01/17/94 13:52:34           │
 │   Slot: 2                           Last Clear:   01/17/94 11:11:04           │
 │                                                                              │
 │  Bytes Transmitted:          0   Node Address:          4000012B3172          │
 │  Bytes Received:         5,670   Universal Address:      02608C2F6714         │
 │  Frames Transmitted:         0   Multicast Addresses:    000000000000         │
 │  Frames Received:           54                           000000000000         │
 │                                                          000000000000         │
 │  Receive Errors:           107                           000000000000         │
 │  Transmit Errors:            0                           000000000000         │
 │                                                          000000000000         │
 │                                                          000000000000         │
 │                                                          000000000000         │
 │                                                                              │
 │  ===>                                                                        │
 │  PF2= END                    PF3= RETURN                    PF6= ROL          │
 │  PF8= FORWARD   PF9= CLEAR COUNTERS     PF11= REFRESH    PF12= RETRIEV        │
 │                                                                              │
 └────────────────────────────────────────────────────────────────────────────┘
```

TR1 query response:

```
 ┌────────────────────────────────────────────────────────────────────────────┐
 │                                                                              │
 │   CSP00501     -------------- LAN Adapter Profile --------------  PU/RAI72PU  │
 │                                                                  Page 1       │
 │    Name: TR1                        Status: ONLINE                            │
 │    Type: Token-Ring 16/4            Current Time: 01/17/94 13:56:50           │
 │    Slot: 3                          Last Clear:   01/17/94 11:11:11           │
 │                                                                              │
 │  Bytes Transmitted:     256,755   Node Address:             4000021B3172      │
 │  Bytes Received:     32,700,240   Universal Address:        10005AC97347      │
 │  Frames Transmitted:      2,539   Combined Functional Addresses: C00000000080 │
 │  Frames Received:       319,820                                               │
 │                                                                              │
 │  Receive Errors:            333                                               │
 │  Transmit Errors:             0                                               │
 │                                                                              │
 │                                                                              │
 │  CMD===>                                                                     │
 │  PF2= END                      PF3= RETURN                  PF6= ROLL         │
 │  PF8= FORWARD      PF9= CLEAR COUNTERS     PF11= REFRESH   PF12= RETRIEVE     │
 │                                                                              │
 └────────────────────────────────────────────────────────────────────────────┘
```

PC1 query response:

```
CSP00401       ------------ Channel Adapter Profile ------------     PU/RAI72PU
                                                                       Page  1
   Name: PC1                          Status: ONLINE
   Type: Parallel Channel             Current Time: 01/17/94 14:01:34
   Slot: 4                            Last Clear:   01/17/94 11:11:14

   Received Invalid (blocks):                0
   Transmit Failures (blocks):               0

                  Bytes           Bytes          Blocks          Blocks
Subchannel      Transmitted      Received      Transmitted      Received
   01            69,546          22,576            397             317
   02               110               0              3               0
   03                 0               0              0               0
   04           113,120               0          1,176               0
   05                 0          22,506              0              75
   06             3,674               0             84               0
   07                 0          22,425              0              75
   08             1,966             152             83               4
   09             1,938             152             83               4

CMD===>
PF2= END                        PF3= RETURN                      PF6= ROLL
PF8= FORWARD      PF9= CLEAR COUNTERS      PF11= REFRESH     PF12= RETRIEVE
```

FD1 query response:

```
CSP03501       ---------- LAN Adapter Profile --------------     PU/RAI72P
                                                                  Page 1
   Name: FD1                         Status: ONLINE
   Type: FDDI                        Current Time: 01/17/94 14:05:11
   Slot: 6 & 7                       Last Clear:   01/17/94 11:11:12

   Port Status: WRAP_A

Bytes Transmitted:        6,017        Node Address:       4000033B3172
Bytes Received:           5,265        Universal Address: 10005AB81F26
Frames Transmitted:         264        Group Addresses:    000000000000
Frames Received:            276                            000000000000
                                                           000000000000
Receive Errors:               0                            000000000000
Transmit Errors:              0                            000000000000
                                                           000000000000
                                                           000000000000
                                                           000000000000

===>
PF2= END                        PF3= RETURN                      PF6= ROLL
PF8= FORWARD   PF9= CLEAR COUNTERS      PF11= REFRESH     PF12= RETRIEVE
```

CONFIG Commands

Enter /CONFIG and press **PF9** to get a list of the components for which you can display the configuration.

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │  CSP02001     ---------- Configuration Component List ---------    PU/RAI72PU  │
 │                                                                        │
 │     Components                                                         │
 │     ------------------------------------------------------------------ │
 │     EN1              TR1              PC1              FD1              │
 │     TCPGATE                                                            │
 │                                                                        │
 │     Enter component for CONFIG: (        )                             │
 │                                                                        │
 │  CMD===>                                                               │
 │  PF2= END                   PF3= RETURN                  PF6= ROLL     │
 │  PF9= CONFIG                                             PF12= RETRIEVE │
 └──────────────────────────────────────────────────────────────────────┘
```

By entering the component name and pressing **PF9**, CSCF will display configuration data for the component selected.

Below you will find configuration response screens for all components listed on the *Configuration Component List* screen above:

EN1 configuration response:

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │  CSP02401     ------- Ethernet/802.3 Adapter Parameters -------    PU/RAI72PU  │
 │                                                                  Page 1 │
 │       Name  . . . . . . . . . . . . . :  EN1        Multicast Addresses: │
 │       Relative adapter number . . . . :  0                             │
 │       Slot number . . . . . . . . . . :  2                             │
 │       Node address  . . . . . . . . . :  4000012B3172                  │
 │       To Operator Facility/2 . . . . :  No                             │
 │       Transceiver type . . . . . . . :  BNC                            │
 │       Receive mode  . . . . . . . . . :  Specific                      │
 │                                                                        │
 │  CMD===>                                                               │
 │  PF2= END                   PF3= RETURN                  PF6= ROLL     │
 │  PF8= FORWARD                                            PF12= RETRIEVE │
 └──────────────────────────────────────────────────────────────────────┘
```

TR1 configuration response:

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │  CSP02301     ------- Token-Ring 16/4 Adapter Parameters ------    PU/RAI72PU  │
 │                                                                  Page 1 │
 │       Name  . . . . . . . . . . . . . . :  TR1                         │
 │       Relative adapter number . . . . . :  0                           │
 │       Slot number . . . . . . . . . . . :  3                           │
 │       Node address  . . . . . . . . . . :  4000021B3172                │
 │       Data rate . . . . . . . . . . . . :   4 Mb/second                │
 │       To Operator Facility/2 . . . . . :  Yes                          │
 │       Combined Functional Addresses . . :  C00000000080                │
 │                                                                        │
 │  CMD===>                                                               │
 │  PF2= END                   PF3= RETURN                  PF6= ROLL     │
 │  PF8= FORWARD                                            PF12= RETRIEVE │
 └──────────────────────────────────────────────────────────────────────┘
```

PC1 configuration response:

```
  CSP02101      ------ Parallel Channel Adapter Parameters ------      PU/RAI72PU

        Name . . . . . . . . . . . . . . . . . . . :   PC1
        Slot number  . . . . . . . . . . . . . . . :   4
        Transfer mode and channel transfer speed . . :   4.5 MB data streaming
        SNA Management Services  . . . . . . . . . . :   Enabled
          VTAM IDNum . . . . . . . . . . . . . . . . :   00020
          Reporting subchannel . . . . . . . . . . . :   01

CMD===>
PF2= END                             PF3= RETURN                    PF6= ROLL
                                     PF12= RETRIEVE
```

FD1 configuration response:

```
  CSP02701      ------------ FDDI Adapter Parameters ------------      PU/RAI72PU
                                                                       Page 1

        Name  . . . . . . . . . . . :   FD1           Group Addresses:
        Relative adapter number . . :   0
        Slot number . . . . . . . . :   6 & 7
        Node address  . . . . . . . :   4000033B3172

CMD===>
PF2= END                             PF3= RETURN                    PF6= ROLL
PF8= FORWARD                                                        PF12= RETRIEVE
```

TCPGATE configuration response:

```
  CSP02901      ------------ LAN Gateway Definition ------------      PU/RAI72PU
                                                                       Page  1
    LAN function name . . :   TCPGATE
    Channel name  . . . . :   PC1

      LAN                       Host Subchnl    Host     Block    Max
      Adapter     Adapter Type    to/from     Program    Delay   Response
      --------  ---------------  ------------  -------   -----   --------
      EN1       Ethernet/802.3     02/03       Other      10       100
      TR1       Token-Ring 16/4    04/05       Other      10       100
      FD1       FDDI               06/07       Other      10       100
      TR1       Token-Ring 16/4    08/08       VTAM       10       100
      EN1       Ethernet/802.3     09/09       VTAM       10       100
      FD1       FDDI               0A/0A       VTAM       10       100

CMD===>
PF2= END                             PF3= RETURN                    PF6=  ROLL
```

LOG Commands

Enter /LOG and press Enter to get a log selection screen:

```
CSP01401     --------- System Log Search Parameters ----------     PU/RAI72PU

           Search Parameters                    Selected Parameters
           -----------------                    -------------------

           Begin Date mm/dd/yy . . . . . . . . . . (          )
           End Date   mm/dd/yy . . . . . . . . . . (          )
           Begin Time hh;mm;ss . . . . . . . . . . (          )
           End Time   hh;mm;ss . . . . . . . . . . (          )
           Severity Range Begin (0-F) . . . . . . (   )
           Severity Range End (0-F) . . . . . . . (   )
           Name (up to 8 characters) . . . . . . . (          )
           Slot Number (00-08,FF) . . . . . . . . (    )
           Error Code xxxx . . . . . . . . . . . . (       )
           Component ID xxxx . . . . . . . . . . . (       )

      Input desired search parameter(s) then press PROCESS LOG PF Key to
      process log.

CMD===>
PF2= END                        PF3= RETURN                    PF6= ROLL
PF9= PROCESS LOG                                               PF12= RETRIEVE
```

To get a list of all logs just press Enter, with no search parameters.

```
CSP01501     ----------------- System Log -------------------     PU/RAI72PU
                                                                    Page
Search Parameters:  Date (          -          ), Time (          -
 Severity ( - ), Name (        ), Slot (  ), Error (    ), Component ID (    )

Mark     Date      Time      Name    Comp  Error  Slot  Plug  Sev  Statu
( )   01/20/94  12:08:59  TR1      1700   1801    3     0     0    01
( )   01/20/94  12:08:59  TR1      1700   1801    3     0     0    01
( x ) 01/20/94  10:35:53  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:53  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:52  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:52  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:51  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:39  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:38  SNB      E300   1B06    0     0     2    01
( )   01/20/94  10:35:38  SNB      E300   1B06    0     0     2    01

Mark a single entry with a non-blank character and press
EXTENDED DATA PF Key to view that record's extended data.

CMD===>
PF2= END                        PF3= RETURN                    PF6= ROLL
PF8= FORWARD                    PF9= EXTENDED DATA             PF12= RETRIEVE
```

Select a log and press **PF9**.

SNB log response:

```
 CSP01601      --- Interconnect Controller Extended Log Data ---     PU/RAI72PU
                                                                       Page
         Date       Time      Name    Comp  Error  Slot  Plug  Sev  Status
      01/20/94  10:35:53  SNB       E300  1B06    0     0     2    01

Error: NETBIOS name conflict exists with Controller name or companion (CTC)
   Controller name.

Action: Delete or change the duplicate name or remove duplicate paths to the
   companion (CTC).

Reporting task type: NETBIOS

Severity: Intervention required (software)

Module name: csp3ntbb.c

Module line number: 000002DE


CMD===>
PF2= END                      PF3= RETURN                      PF6= ROLL
PF8= FORWARD                                                   PF12= RETRIEVE
```

This log shows an actual problem that occurred with our 3172. Using OF/2 we
changed the *3172 name* for this 3172. This name is also used as 3172 *NetBIOS*
name for communication to OF/2. The name we chose was already being used
by another 3172 in the same LAN.

IPL Commands

This command restarts the 3172. When issued, the system will force a reset of
the microprocessor, causing a complete reload of the entire 3172 system. After
entering /IPL you are prompted to enter /VERIFY /IPL to confirm the command.

Warning:

This command causes all communication to the 3172 to be lost, including:

- Data flow

- The CSCF session

- The SSCP/PU session

- The Operator Facility/2 connection

An IPL should not be issued from NetView while the Operator Facility/2 is
sending code to the 3172.

After the 3172 IPL has finished you will have to re-establish the VTAM
connections as described in 2.6.2, "Restarting Your 3172" on page 74.

5.3.2 VPD Command Example

The *Vital Product Data* command is issued from a NetView command line and presents the following response:

```
* RAIAN    VPDCMD ALL RAI72PU
- RAIAN    DW0009I REQUEST 'ALL' ACCEPTED FOR RAI72PU  , REQID = 0001
- RAIAN    DW0100I REQID 0001 :  ORIG PU RAI72PU  CNFG PU RAI72PU  LINK RAI72L
             PU ISTPUS18
- RAIAN    DW0105I REQID 0001 :  PHY = 'ITSC Raleigh - Room BB121'
- RAIAN    DW0102I REQID 0001 :  IBM-HW M/T = 0000 MDL = 000 MFG = 00 S/N =
             0000000
- RAIAN    DW0102I REQID 0001 :  IBM-SW SPROD = '3172 Interconnect Ctlr Pgm'
             VER = 03 RLS = 02 MOD = 00 PPN = 5621425 '
- RAIAN    DW0106I REQID 0001 :  LBL = 'User Data?' UDT = '3172 Model 3 PCA
             ICP 3.2'
- RAIAN    DW0014I REQID 0001 COMPLETED
```

5.3.3 Alert Display Example

The following screen shows the NetView Hardware Monitor (NPDA) event detail display for a 3172 generic alert.

```
 N E T V I E W           SESSION DOMAIN: RAIAN    ZETTER    01/21/94 11:11:06
 NPDA-43S                        * EVENT DETAIL *                    PAGE  1 OF 1

  RAIAN        ISTPUS18   RAI72L      RAI72PU       3172ICP
               +--------+             +--------+   +--------+
  DOMAIN       |  COMC  |----LINE----|  CTRL  |---|  ICTL  |
               +--------+             +--------+   +--------+

  DATE/TIME: RECORDED - 01/20 15:06    CREATED - 01/20/94 15:10:16

  EVENT TYPE: TEMPORARY

  DESCRIPTION: SOFTWARE PROGRAM ERROR

  PROBABLE CAUSES:
     COMMUNICATIONS SUBSYSTEM


  UNIQUE ALERT IDENTIFIER: PRODUCT ID - 0000      ALERT ID - ACDBE7DB

  ENTER A (ACTION) OR DM (DETAIL MENU)

  ???
 CMD==>
```

This screen does not give us much detail about the problem that caused the alert. For more detail we have to go to the *Recommended Action* screens for the same alert:

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│  N E T V I E W           SESSION DOMAIN: RAIAN    ZETTER    01/21/94 11:04:43 │
│  NPDA-45A           * RECOMMENDED ACTION FOR SELECTED EVENT *    PAGE  1 OF 2 │
│   RAIAN       ISTPUS18   RAI72L      RAI72PU      3172ICP                  │
│             +--------+          +--------+  +--------+                     │
│   DOMAIN    | COMC   |----LINE----| CTRL  |---| ICTL   |                   │
│             +--------+          +--------+  +--------+                     │
│                                                                           │
│  USER    CAUSED - NONE                                                    │
│                                                                           │
│  INSTALL CAUSED - NONE                                                    │
│                                                                           │
│  FAILURE CAUSED - INTERCONNECT CONTROLLER PROGRAM                         │
│         ACTIONS - I145 - IF PROBLEM PERSISTS THEN DO THE FOLLOWING        │
│                   I257 - REFER TO PRODUCT DOCUMENTATION FOR ADDITIONAL     │
│                    INFORMATION                                            │
│                   I031 - DUMP CONTROL PROGRAM                             │
│                   I125 - REVIEW REMOTE DEVICE LOGS                        │
│                   I127 - CONTACT SERVICE REPRESENTATIVE FOR IBM 3172      │
│                    INTERCONNECT CTLR PGM                                  │
│                                                                           │
│  ENTER ST (MOST RECENT STATISTICS), DM (DETAIL MENU), OR D (EVENT DETAIL) │
│                                                                           │
│   ???                                                                     │
│  CMD==>                                                                   │
└─────────────────────────────────────────────────────────────────────────┘
```

There is not much more information here. The most important part on this
screen is the text PAGE 1 OF 2 in the upper right corner, which tells you that there
is one more screen. Press **PF8** to get to the second screen:

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│  N E T V I E W           SESSION DOMAIN: RAIAN    ZETTER    01/21/94 11:08:15 │
│  NPDA-45A           * RECOMMENDED ACTION FOR SELECTED EVENT *    PAGE  2 OF 2 │
│   RAIAN       ISTPUS18   RAI72L      RAI72PU      3172ICP                  │
│             +--------+          +--------+  +--------+                     │
│   DOMAIN    | COMC   |----LINE----| CTRL  |---| ICTL   |                   │
│             +--------+          +--------+  +--------+                     │
│                                                                           │
│                  I142 - REPORT THE FOLLOWING:                             │
│                         FAILING MODULE $NB                                │
│                         ERROR CODE 1B06                                   │
│                                                                           │
│                                                                           │
│  ENTER ST (MOST RECENT STATISTICS), DM (DETAIL MENU), OR D (EVENT DETAIL) │
│                                                                           │
│   ???                                                                     │
│  CMD==>                                                                   │
└─────────────────────────────────────────────────────────────────────────┘
```

Here you find the error code *1B06* that tells you what caused the alert. This alert
tells us that another node on the LAN is using a NetBIOS name that is the same
as the 3172 name. ICP uses the 3172 name as its NetBIOS name for
communications with OF/2.

For a complete list of Alerts and error codes generated by the 3172 see
GA27-3951, 3172 Interconnect Controller Status Codes.

5.4 3172 and SNMP

As described in 5.1.2, "3172 Appearance to TCP/IP Network Managers" on page 277 the TCP/IP network management support for 3172 is provided by VM or MVS TCP/IP.

To be manageable in a TCP/IP environment the IP host manages a *Management Information Base*. The MIB contains both static information, such as location of the host, and dynamically updated information, such as traffic counters. The *Simple Network Management Protocol* enables a manager to access MIB data managed by an agent process in a managed IP host.

This section will show the ITSO TCP/IP environment with 3172s running ICP, Offload and MPE attached to an MVS host. Using the SNMP manager implemented in TCP/IP MVS, with NetView as the operator interface, the appearance of the different LAN components will be demonstrated.

In a production environment you would probably use a dedicated SNMP management program like AIX SystemView NetView/6000. The examples shown here, using the NetView SNMP interface, are only intended to demonstrate the SNMP agent support implemented with MVS and VM TCP/IP.

5.4.1 Management Information Base (MIB)

The MIBs are partially defined in Internet global RFCs and partially defined in *Enterprise-Specific MIBs*. The enterprise-specific MIBs allows a component manufacturer, in this case IBM, to specify MIB values with special significance for a specific component. The enterprise-specific MIBs are normally made publicly available, encoded in the ISO defined syntax ASN.1, so that any SNMP manager process can incorporate the structure in its MIB library.

The SNMP agent supporting 3172 MIB data resides in the host TCP/IP.

SNMP defines commands to read and set MIB values. The MVS and VM SNMP agents only supports the read commands (GET and GETNEXT).

5.4.2 SNMP Traps

Traps are unsolicited messages that are sent by an SNMP agent to an SNMP network manager. An SNMP trap contains information about a significant network event. The network manager program interprets the trap information sent by the SNMP agent.

The following traps are generated by the SNMP agent in TCP/IP for MVS or VM:

- COLD_START
- AUTHENTICATION_FAILURE
- LINK_UP
- LINK_DOWN

There are no 3172 specific traps generated but failure of a 3172-attached LAN will generate *LINK_DOWN* and *LINK_UP* traps.

An SNMP alert does not normally contain enough data for a network manager to act upon. The trap will act as a trigger for the manager to inquire the agent's MIB for more specific data about the failing component.

5.5 NetView and SNMP

Together with TCP/IP in the same host NetView can act as an SNMP management program. To enable the SNMP management function in NetView the following requirements have to be met:

- The SNMPQE address space must be started. SNMPQE is part of TCP/IP 2.2.

- NetView must be customized for SNMP. The command processors and CLISTs used in NetView are shipped as part of TCP/IP 2.2.

With the SNMP support installed in NetView, the NetView operator is provided with a full screen command interface for SNMP commands. The command to invoke the full screen interface from a NetView command line is SNMPMGMT.

```
SNMPMGM1
X=======================================================================X
|                                               Page  1  of  1          |
|                                                                       |
|  TTTTTTTT      CCCCC      PPPPP       XXX     IIIIIIII      PPPPP       |
|     TT        CC   CC     PP   PP     XXX        II        PP   PP     |
|     TT        CC          PP  PP      XXX        II        PP   PP     |
|     TT        CC          PPPPP      XXX         II        PPPPP       |
|     TT        CC   CC     PP        XXX          II        PP          |
|     TT         CCCC       PP       XXX        IIIIIIII     PP          |
|                                                                       |
|      SSSS        NNN   NN     MMM      MMM      PPPPP                   |
|    SSS   SSS     NNNN  NN     MM MM MM MM      PP   PP                  |
|     SSS          NN NNN NN    MM   MMM   MM    PP   PP                  |
|      SSS         NN   NNNM    MM    M    MM    PPPPP                    |
|    SSS   SSS     NN    NNN    MM         MM    PP                       |
|      SSSS        NN    NN     MM         MM    PP                       |
|                                                                       |
|                                                                       |
|                                                                       |
|  PF 1=Help     2=Ping      3=Exit      4=Groups    5=Traps    6=Roll   |
|  PF 7=Poll Host 8=Poll Var  9=Get/Getn  10=Set                        |
X=======================================================================X
```

In 5.6.3, "ICP SNMP Support" on page 296 and 5.6.4, "Offload and MPE SNMP Support" on page 299 several examples will be shown using the SNMPMGMT interface to display 3172 SNMP variables.

5.5.1 NetView and Traps

Traps received by TCP/IP, running in the same VM or MVS system as NetView, will be converted to SNA Alerts. The NetView Hardware Monitor can be used to monitor these alerts. NetView automation can be used to automate recovery actions based on the SNMP traps. To make traps appear in NetView you must:

- Customize TCP/IP to send traps to your NetView host

- Enable NetView to receive the traps and convert them to alerts.

TCP/IP Trap Destinations

You will have to list the IP addresses to which TCP/IP shall send traps when a trap condition occurs. You can have several addresses listed and TCP/IP will send traps to all in the list. In our case, we inserted one address of the MVS host itself. This means that TCP/IP in MVS will send an alert to itself and that trap will be forwarded to NetView if NetView is enabled to receive the trap. We also inserted the address of a PS/2 running the *SNMPTRAP* daemon in OS/2 TCP/IP.

The trap destinations are entered in the data set *TCPIP.SNMPTRAP.DEST*.

```
9.67.38.20 UDP
9.67.38.27 UDP
```

Enable NetView to Receive Traps

The NetView command SNMP TRAPSON must be issued to enable alerts to be passed to NetView. The format is:

```
snmp trapson netmask ip-address
```

You can issue several trapson commands and the filters will all be active until disabled with SNMP TRAPSOFF. To enable traps exclusively from ip address 9.67.38.20, issue:

```
snmp trapson 255.255.255.255 9.67.38.20
```

Trap Source Address

Traps generated in MVS will use the first address in the HOME list as source address. In an environment with 3172 Offload or MPE as its only links, there will be no home statements. In this case TCP/IP will use the loopback address 14.0.0.0 as source IP address for traps. In such an environment it might be a good idea to define an SNALINK that does not exist, to enable you to enter a home address for traps that is more meaningful than the loopback address.

As shown in Figure 188 on page 294 the first address in our home list is 9.67.38.1. To enable traps from MVS TCP/IP we entered the NetView command:

```
snmp trapson 255.255.255.255 9.67.38.1
```

5.6 SNMP in the ITSO TCP/IP Environment

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ┌─────────────────────────────────────────────────────────────────┐    │
│  │                                                                   │    │
│  │              N e t V i e w                                        │    │
│  │                   │                                               │    │
│  │  ┌──────────┐  ┌──┴───────┐                    ┌─────────────┐   │    │
│  │  │ SNMPD    │◄─│ SNMPQE   │                   I│ SNALINK     │──►│    │
│  │  │ (agent)  │  │ (manager)│                    │ TOROA6L     │   │    │
│  │  └────┬─────┘  └──────────┘                    │─────────────│   │    │
│  │       │                                       U│ SNALINK     │──►│    │
│  │  ┌────▼─────┐              T C P / I P          │ TOROA9L     │   │    │
│  │  │  MIB     │                                   │─────────────│   │    │
│  │  │──────────│                                  C│ SNALINK     │──►│    │
│  │  └──────────┘                                   │ SNALVM20    │   │    │
│  │    │    │        │    │          │    │        V└─────────────┘   │    │
│  └────┼────┼────────┼────┼──────────┼────┼───────────────────────────┘    │
│       │    │        │    │          │    │            │    │              │
│  ┌────┴────┴─┐ ┌────┴────┴─────┐ ┌──┴────┴─────┐ ┌────┴────┴─────┐        │
│  │  3172     │ │    3172       │ │   3172      │ │    3172       │        │
│  │  Mod 1    │ │   Model 3     │ │  Model 3    │ │   Model 3     │        │
│  │  ICP      │ │    ICP        │ │   MPE       │ │   Offload     │        │
│  │───────────│ │───────┬───────┤ │──────┬──────┤ │──────┬────────┤        │
│  │  TR1      │ │EN302│TR304│FD306│ │MPETR1│MPEWAC│MPEEN1│ │OFFTR1│OFFEN1│OFFFD1│    │
│  └───────────┘ └─────────────────┘ └─────────────┘ └───────────────┘        │
└─────────────────────────────────────────────────────────────────────────┘
```
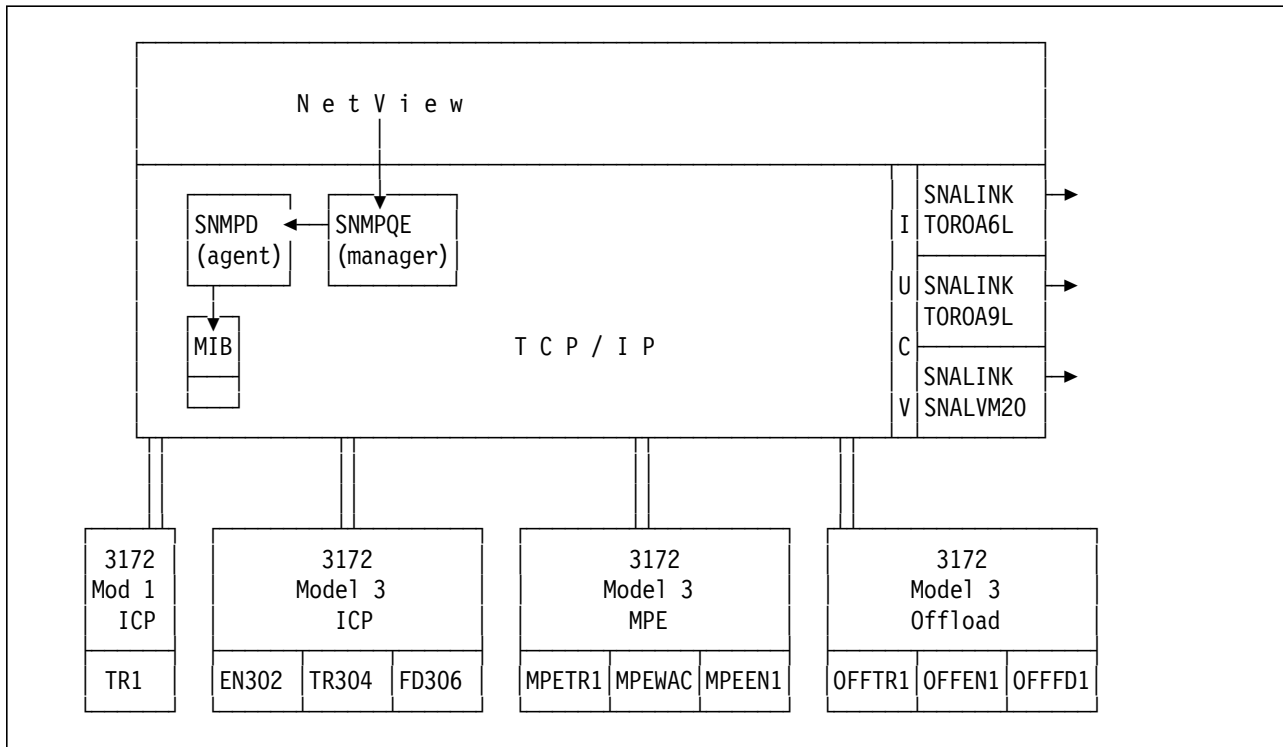
Figure 187. The ITSO TCP/IP Environment

5.6.1 TCP/IP Definitions

Enclosed below are selected statements from the TCP/IP profile data set. The selected statements define all links in this TCP/IP system and starts all but one. These definitions are included to show all the interfaces that can be managed by an SNMP manager accessing the SNMP agent process in our TCP/IP.

```
         DEVICE SNADMV20 SNAIUCV SNALINK  RAKASNAL SNALK18
         LINK   SNALMV20 IUCV       60     SNADMV20
         ;--------------------------------------------------------
         DEVICE ICPEN302 LCS        302    NETMAN   ; JF
         LINK   EN302 ETHEROR802.3  0      ICPEN302 ; ETHER.
         ;--------------------------------------------------------
         DEVICE ICPTR304 LCS        304    NETMAN
         LINK   TR304 IBMTR         0      ICPTR304 ; T/R.
         ;--------------------------------------------------------
         DEVICE ICPFD306 LCS        306    NETMAN
         LINK   FD306 FDDI          0      ICPFD306 ; FDDI
          TRANSLATE 9.67.32.202 FDDI 40008580FDDF FD306
         ;--------------------------------------------------------
         DEVICE MPEDEV    CLAW  320 TCPIP  OS2TCP NONE
         LINK   MPEIPLINK OFFLOADLINK1  1  MPEDEV
         LINK   MPETR1 OFFLOADAPIBROAD 9.67.38.20 MPEDEV  MPEIPLINK
         LINK   MPEWAC OFFLOADAPIBROAD 9.67.46.85 MPEDEV  MPEIPLINK
         LINK   MPEEN1 OFFLOADAPIBROAD 9.67.32.20 MPEDEV  MPEIPLINK
         ;--------------------------------------------------------
         DEVICE CH1TR1    LCS        EA2    NETMAN
         LINK   TR1   IBMTR          0      CH1TR1   ; T/R.
         ;--------------------------------------------------------
         DEVICE OFFDEV    CLAW       340    TCPIP  OS2TCP NONE
         LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
         LINK   OFFTR1 OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
         LINK   OFFEN1 OFFLOADAPIBROAD 9.67.32.22  OFFDEV  OFFIPLINK
         LINK   OFFFD1 OFFLOADAPIBROAD 9.67.38.200 OFFDEV  OFFIPLINK
         ;--------------------------------------------------------
         DEVICE TORA9D  SNAIUCV  SNALINK  RA9TNCS1 SNALK18A
         LINK   TORA9L  IUCV       1     TORA9D
         ;--------------------------------------------------------
         DEVICE TORA6D  SNAIUCV  SNALINK  RA6TNCS1 SNALK18B
         LINK   TORA6L  IUCV       1     TORA6D
         ; -------------------------------------------------
         HOME
             9.67.38.1     TR1       ; MAC=4000 5001 3172
             9.67.38.164   SNALMV20  ; SNALINK to TCP/IP in MVS 20
             9.69.32.135   TORA9L    ; SNALINK to NCP SA9
             9.69.32.197   TORA6L    ; SNALINK to NCP SA6
             9.67.32.21    EN302     ; MAC=4000 012B 3172
             9.67.38.21    TR304     ; MAC=4000 021B 3172
             9.67.32.201   FD306     ; MAC=4000 033B 3172
         ; -------------------------------------------------
          START CH1TR1            ; 3172-1 T/R    (MOD 1)
          START ICPTR304          ; 3172-3 T/R    (ICP)
          START ICPEN302          ; 3172-3 ETH    (ICP)
          START ICPFD306          ; 3172-3 FDDI   (ICP)
          START MPEDEV            ; 3172-3 T/R    (MPE)
          START OFFDEV            ; 3172-3 T/R    (OFF)
          START TORA9D            ; SNALINK TO NCP RA9NCP0
          START TORA6D            ; SNALINK TO NCP RA6NCSH
```

Figure 188. Excerpt from TCP/IP Profile Data Set.   Defining and starting links.

5.6.2 Interface Index Numbers and Instance Identifiers

The VM and MVS SNMP agents support MIB variables defined in RFC 1158
(MIB-II) and 3172 enterprise-specific MIB variables. The following MIB groups
are supported:

- The systems group (system)

- The interfaces group (if)

- The address translation group (at)

- The IP group (ip)

- The ICMP group (icmp)

- The TCP group (tcp)

- The UDP group (udp)

- IBM 3172 enterprise-specific

For all these groups, except the *if* and the *at* groups the values are not related to a specific interface on the host, but rather to the IP host itself. For the *if* and the *at* groups however MIB entries pertain to a specific interface. This is also true for *enterprise-specific* MIB entries.

To access MIB data from the *at* and the *if* groups it is not enough to know the IP address for the adapter. In fact, it is not even necessary to know the IP address. What you need to know is the adapter's index number on the IP host. With that the interface data can be accessed using any of the IP addresses on the host.

3172 enterprise-specific variables are accessed using either *if index* or *instance numbers* as follows:

- For all variables in the 3172 *if*-group, use if index number.

- For all others, use instance number.

Note: Variables in the if-group have names starting with *ibm3172if...*; see Figure 189 on page 296 for 3172 enterprise-specific MIB variables.

The interface index numbers and instance identifiers are allocated at TCP/IP startup. The index numbers are numbered in the order the LINK statements appear in the profile. The instance identifiers are numbered in the order of *LCS DEVICE* statements with *NETMAN* specified. From the profile depicted in Figure 188 on page 294, the adapter index numbers and instance identifiers are as follows:

LINE Name	if Index Number	Instance Number
Table 16. if Index Numbers and Instance Numbers		
SNALMV20	1	-
EN302	2	1
TR304	3	2
FD306	4	3
MPETR1	5	-
MPEWAC	6	-
MPEEN1	7	-
TR1	8	4
OFFTR1	9	-
OFFEN1	10	-
OFFFD1	11	-
TOROA9L	12	-
EN302	13	-

Note: To avoid confusion, it is probably wise to arrange your TCPIP profile so that all 3172 ICP devices with NETMAN specified are placed first. That way the *if* index numbers and the instance numbers will be the same.

5.6.3 ICP SNMP Support

To enable SNMP support for ICP, the NETMAN parameter must be coded on the DEVICE statement; see Figure 188 on page 294.

The SNMP agent in TCP/IP VM or MVS supports *3172 enterprise-specific* MIB values. The support for these MIB entries requires TCP/IP 2.2 on MVS or VM. The 3172 enterprise-specific MIB values are as follows.

```
    **    IBM 3172 Enterprise-specific variables **
    -----------------------+-----------------------+-----------+--------
    ! MIB Variable name   !    ASN.1 notation    ! Type     !   TTL
    -----------------------+-----------------------+-----------+--------
    ibm3172Descr            1.3.6.1.4.1.2.6.1.1.1.  display      900
    ibm3172Contact          1.3.6.1.4.1.2.6.1.1.2.  display      900
    ibm3172Location         1.3.6.1.4.1.2.6.1.1.3.  display      900
    ibm3172ifNumber         1.3.6.1.4.1.2.6.1.1.4.  number        1
    ibm3172ifTrapEnable     1.3.6.1.4.1.2.6.1.2.1.  number        1
    ibm3172ifInChanOctets   1.3.6.1.4.1.2.6.1.3.1.  counter       1
    ibm3172ifOutChanOctets  1.3.6.1.4.1.2.6.1.3.2.  counter       1
    ibm3172ifInChanBlocks   1.3.6.1.4.1.2.6.1.3.3.  counter       1
    ibm3172ifOutChanBlocks  1.3.6.1.4.1.2.6.1.3.4.  counter       1
    ibm3172ifInLANOctets    1.3.6.1.4.1.2.6.1.4.1.  counter       1
    ibm3172ifOutLANOctets   1.3.6.1.4.1.2.6.1.4.2.  counter       1
    ibm3172ifInLANFrames    1.3.6.1.4.1.2.6.1.4.3.  counter       1
    ibm3172ifOutLANFrames   1.3.6.1.4.1.2.6.1.4.4.  counter       1
    ibm3172ifInLANErrors    1.3.6.1.4.1.2.6.1.4.5.  counter       1
    ibm3172ifOutLANErrors   1.3.6.1.4.1.2.6.1.4.6.  counter       1
    ibm3172ifInLANDiscards  1.3.6.1.4.1.2.6.1.4.7.  counter       1
    ibm3172ifOutLANDiscards 1.3.6.1.4.1.2.6.1.4.8.  counter       1
    ibm3172ifBlkRcvOctets   1.3.6.1.4.1.2.6.1.5.1.  counter       1
    ibm3172ifBlkXmitOctets  1.3.6.1.4.1.2.6.1.5.2.  counter       1
    ibm3172ifBlkRcvFrames   1.3.6.1.4.1.2.6.1.5.3.  counter       1
    ibm3172ifBlkXmitBlocks  1.3.6.1.4.1.2.6.1.5.4.  counter       1
    ibm3172ifInBlkErrors    1.3.6.1.4.1.2.6.1.5.5.  counter       1
    ibm3172ifInBlkDiscards  1.3.6.1.4.1.2.6.1.5.6.  counter       1
    ibm3172ifDblkRcvOctets  1.3.6.1.4.1.2.6.1.6.1.  counter       1
    ibm3172ifDblkXmitOctets 1.3.6.1.4.1.2.6.1.6.2.  counter       1
    ibm3172ifDblkRcvBlocks  1.3.6.1.4.1.2.6.1.6.3.  counter       1
    ibm3172ifDblkXmitFrames 1.3.6.1.4.1.2.6.1.6.4.  counter       1
    ibm3172ifOutDblkErrors  1.3.6.1.4.1.2.6.1.6.5.  counter       1
    ibm3172ifOutDblkDiscards 1.3.6.1.4.1.2.6.1.6.6. counter       1
    ibm3172ifDeviceNumber   1.3.6.1.4.1.2.6.1.7.1.  counter       1
```

Figure 189. IBM 3172 Enterprise-Specific MIB Variables

This list is extracted from the TCPIP.MIB@DESC.DATA data set which is part of the MVS TCP/IP installation. To access the 3172 enterprise-specific MIB values from a network manager other than NetView the MIB should be installed on that manager.

> ── **ASN.1 source:** ──
>
> *GG24-3804, Overview and Examples of using AIX NetView/6000* contains ASN.1 source for the 3172 enterprise-specific MIB. It has been included here as Appendix E, "3172 Enterprise Specific MIB, ASN.1 Source" on page 449.

Examples using NetView

The following examples show displays of MIB values for the 3172 with ICP using
the SNMPMGMT command in NetView.

```
SNMPGET1
X======================================================================X
│               Get/GetNext Input Panel              Page  1  of  1   │
│                                                                      │
│ COMMAND  get                                                         │
│ HOST  9.67.38.20                                                     │
│ COMMUNITY NAME                                                       │
│ VARIABLES  ibm3172contact                                           │
│                                                                      │
│ PF 1=Help     2=Ping     3=Exit      4=Groups    5=Traps 6=Roll      │
│ PF 7=Poll Host 8=Poll Var              10=Set                        │
X======================================================================X
```

The command above gives the following response:

```
SNMPGET2
X======================================================================X
│                                                    Page  1  of  5   │
│ GET  Status for  9.67.38.20                                          │
│                                                                      │
│ variable: ibm3172contact                                            │
│    value: No such name                                              │
│                                                                      │
│ PF          8=Forw                                   12=RETURN      │
X======================================================================X
```

No such name?

Is it because 9.67.38.20 does not represent a 3172 ICP adapter? No. You can
use any IP address that gets you to MVS TCP/IP, so that is not the problem.

The problem is that *ibm3172contact* is an enterprise-specific MIB entry. As
explained in 5.6.2, "Interface Index Numbers and Instance Identifiers" on
page 294, you must access this variable using the instance number. The
instance numbers for the 3172 running ICP are 1, 2 or 3 and we can use any
of these numbers.

Command with index number:

```
SNMPGET1
X======================================================================X
│               Get/GetNext Input Panel              Page  1  of  1   │
│                                                                      │
│ COMMAND  get                                                         │
│ HOST  9.67.38.20                                                     │
│ COMMUNITY NAME                                                       │
│ VARIABLES  ibm3172contact.3                                         │
│                                                                      │
│ PF 1=Help     2=Ping     3=Exit      4=Groups    5=Traps 6=Roll      │
│ PF 7=Poll Host 8=Poll Var              10=Set                        │
X======================================================================X
```

Gives the following response:

```
SNMPGET2
X======================================================================X
│                                                Page  1  of  5  │
│  GET   Status  for  9.67.38.20                                 │
│                                                                 │
│  variable: ibm3172contact.3                                     │
│     value: 3172 Model with ICP 3.2                              │
│                                                                 │
│  PF         8=Forw                                 12=RETURN   │
X======================================================================X
```

The variable *ibm3172contact* will be the same for all three instances, as that is a value customized only once in the 3172 configuration process. Other variables, like *ibm3172ifInLANOctets* will show the actual values for the indexed adapter. See example below:

Command for the Ethernet adapter:

```
SNMPGET1
X======================================================================X
│             Get/GetNext Input Panel            Page  1  of  1  │
│                                                                 │
│  COMMAND  get                                                   │
│  HOST  9.67.38.20                                               │
│  COMMUNITY NAME                                                 │
│  VARIABLES  ibm3172ifinlanoctets.2                              │
│                                                                 │
│  PF 1=Help      2=Ping    3=Exit     4=Groups  5=Traps 6=Roll  │
│  PF 7=Poll Host 8=Poll Var           10=Set                     │
X======================================================================X
```

Response:

```
SNMPGET2
X======================================================================X
│                                                Page  1  of  5  │
│  GET   Status  for  9.67.38.20                                 │
│                                                                 │
│  variable: ibm3172ifinlanoctets.2                               │
│     value: 147022                                               │
│                                                                 │
│  PF         8=Forw                                 12=RETURN   │
X======================================================================X
```

Command for the token-ring adapter:

```
SNMPGET1
X======================================================================X
│             Get/GetNext Input Panel            Page  1  of  1  │
│                                                                 │
│  COMMAND  get                                                   │
│  HOST  9.67.38.20                                               │
│  COMMUNITY NAME                                                 │
│  VARIABLES  ibm3172ifinlanoctets.3                              │
│                                                                 │
│  PF 1=Help      2=Ping    3=Exit     4=Groups  5=Traps 6=Roll  │
│  PF 7=Poll Host 8=Poll Var           10=Set                     │
X======================================================================X
```

Response:

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │ SNMPGET2                                                               │
 │ X=====================================================================X │
 │                                                    Page  1  of  5     │
 │   GET   Status for  9.67.38.20                                        │
 │                                                                        │
 │   variable: ibm3172ifinlanoctets.3                                    │
 │      value: 5225870                                                   │
 │                                                                        │
 │   PF         8=Forw                               12=RETURN           │
 │ X=====================================================================X │
 └──────────────────────────────────────────────────────────────────────┘
```

For values from the other MIB groups the SNMP agent in TCP/IP will add values
from all the interfaces. No adapter index shall be attached to the MIB variable
name.

Command:

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │ SNMPGET1                                                               │
 │ X=====================================================================X │
 │                 Get/GetNext Input Panel             Page  1  of  1    │
 │                                                                        │
 │   COMMAND  get                                                        │
 │   HOST  9.67.38.21                                                    │
 │   COMMUNITY NAME                                                      │
 │   VARIABLES  tcpoutsegs                                               │
 │                                                                        │
 │   PF 1=Help     2=Ping    3=Exit       4=Groups   5=Traps 6=Roll      │
 │   PF 7=Poll Host 8=Poll Var            10=Set                         │
 │ X=====================================================================X │
 └──────────────────────────────────────────────────────────────────────┘
```

Response:

```
 ┌──────────────────────────────────────────────────────────────────────┐
 │ SNMPGET2                                                               │
 │ X=====================================================================X │
 │                                                    Page  1  of  5     │
 │   GET   Status for  9.67.38.21                                        │
 │                                                                        │
 │   variable: tcpoutsegs                                                │
 │      value: 884                                                       │
 │                                                                        │
 │   PF         8=Forw                               12=RETURN           │
 │ X=====================================================================X │
 └──────────────────────────────────────────────────────────────────────┘
```

This answer would have been exactly the same using any other IP address on
the host TCP/IP system.

5.6.4 Offload and MPE SNMP Support

In the Offload and MPE environments, the SNMP support is implemented by
subagents executing in the 3172 that register with the SNMP agent in VM or
MVS. Offload SNMP management is enabled during installation or
reconfiguration of the 3172 Offload product as described in 4.5.7,
"RouteXpander/2 Installation" on page 225.

In the MPE environment, a separate subagent can be enabled during installation
or reconfiguration of the RouteXpander/2 product. This subagent also registers
with the host SNMP agent. The RXR/2 subagent provides support for the
following MIBs:

- RFC 1315, MIB for Frame Relay DTEs

- RFC 1286, MIB for Bridges

- RFC 1082, MIB for RS-232-like Hardware Devices

No enterprise-specific MIBs are supported in the Offload or MPE 3172 environments.

Starting the Offload SNMP Subagent

The following window is created on the Offload and MPE 3172 if SNMP management is enabled:

```
awaiting agent at 9.67.38.20
ipAddr: 9.67.38.20, local ifIndex: 1, host ifIndex: 5
ipAddr: 9.67.46.85, local ifIndex: 2, host ifIndex: 6
ipAddr: 9.67.32.20, local ifIndex: 3, host ifIndex: 7
C:\OFFLOAD\OFFSNMP.EXE ready and awaiting queries from agent
```

host ifIndex is the adapter index number as shown in Table 16 on page 295. Looking at the index numbers, you can see that this screen is from the 3172 with MPE. On the 3172 running only Offload, the numbers would have been 9, 10 and 11.

Starting the RXR/2 SNMP Subagent in 3172 MPE

The following window is created on the 3172 with MPE at startup time:

```
Network Management Agent for RouteXpander/2
(c) Copyright 1992 International Business Machines
All Rights Reserved.

Attempting to contact host '9.67.38.20'
host snmp port is 1025
opening port 1025 on host 9.67.38.20

Registered MIB subtree 'frame-relay' : '1.3.6.1.2.1.10.32.'
Registered MIB subtree 'rs232' : '1.3.6.1.2.1.10.33.'
Registered MIB subtree 'dot1d' : '1.3.6.1.2.1.17.'

SNA management disabled, alerts will be displayed locally.

01/18 16:21:22 FOUND   RXR/2 Frame Relay Protocol
01/18 16:21:22 FOUND   IBM Wide Area Connector
```

This window also shows the MIB subtrees that this subagent takes responsibility for.

See also 4.7.4, "Reestablish Connection after a Failure" on page 240 for the manual intervention that might be required to restart the RXR/2 SNMP subagent after a failure.

Examples using NetView

What is said about MIB groups and interface numbers in 5.6.2, "Interface Index Numbers and Instance Identifiers" on page 294 is also true for the Offload and MPE environments. To access MIB variables from the *if* and the *at* groups, the variable name has to be indexed.*:* MIB variables from the other groups will be exactly the same as shown in the 3172 ICP examples in 5.6.3, "ICP SNMP Support" on page 296 as they pertain to the entire IP host.

The following examples show displays of MIB values for the 3172 with Offload and MPE using the SNMPMGMT command in NetView.

Command:

```
SNMPGET1
X====================================================================X
|                 Get/GetNext Input Panel            Page  1  of  1  |
|                                                                    |
|  COMMAND  get                                                      |
|  HOST  9.67.38.20                                                  |
|  COMMUNITY NAME                                                    |
|  VARIABLES  ifphysaddress.9                                        |
|                                                                    |
|  PF 1=Help     2=Ping    3=Exit      4=Groups    5=Traps 6=Roll    |
|  PF 7=Poll Host 8=Poll Var             10=Set                      |
X====================================================================X
```

Response:

```
SNMPGET2
X====================================================================X
|                                                    Page  1  of  5  |
|  GET  Status for  9.67.38.20                                       |
|                                                                    |
|  variable: ifphysaddress.9                                         |
|     value: 4000011C3172                                            |
|                                                                    |
|  PF          8=Forw                              12=RETURN         |
X====================================================================X
```

This command reports the physical address of the token-ring adapter on the Offload 3172 as shown above. Again, 9.67.38.20 is not the IP address of that adapter. The adapter is identified by the index number (9) and the agent can be accessed on any IP address defined on the host.

Another screen shows the speed value configured for the same token-ring adapter:

```
 ┌──────────────────────────────────────────────────────────────────────────────┐
 │ SNMPGET2                                                                       │
 │ X=============================================================================X│
 │                                                          Page  1  of  5       │
 │  GET  Status for  9.67.38.20                                                   │
 │                                                                                │
 │  variable: ifspeed.9                                                           │
 │     value: 4000000                                                             │
 │                                                                                │
 │                                                                                │
 │  PF          8=Forw                                            12=RETURN       │
 │ X=============================================================================X│
 └──────────────────────────────────────────────────────────────────────────────┘
```

Chapter 6. 3172 Backup and Restore

This chapter describes the facilities that can be used to provide backup and restore capabilities to a 3172 Model 3 operating in the ICP, Offload and MPE environments.

Because the 3172 can be configured in a variety of ways and each configuration is relatively complex, we will present the supported backup and restore utilities of the ICP platform and detail a technique developed at the ITSO as an alternative for the OS/2 backup and restore utilities which are part of the MPE, Offload and SNA/Comm offerings. This method introduces an additional software product from the IBM family of LAN software products and is called SaveUtility/2.

Almost any LAN found in use today will have some backup and recovery procedures in place. Usually these are found on a server platform and very often are tape-based. SaveUtility/2 uses the client/server model to extend the use of an archive device by providing services to workstations that otherwise would not have the convenience of such a device available to them. This includes the 3172.

In each of the three environments detailed in this book, ICP, Offload and MPE, the type of information that must be backed up and restored varies considerably. Therefore, we will cover different approaches to the task, appropriate to each situation.

6.1 Backup and Restore in the ICP Environment

In the ICP environment, the information that needs to be backed up and recovered are your 3172 hardware configuration(s) and their associated profile(s).

At any given time there is one active configuration executing on a 3172. Any other defined configurations are kept in the OF2VER3 directory on the hard disk of the operator station.

6.1.1 Configuration Backup Procedures

Using Operator Facility/2, you can perform a full or partial backup of your 3172 configurations. This means that you can back up all or some of the 3172 profiles stored on the hard disk of the operator station.

6.1.1.1 Backup Procedure Using the Operator Facility

Before you proceed any further, you must choose a drive and a directory to be used for your backup operation(s). Then use the following procedure to back up your active 3172 configuration:

Step 1. At an OS/2 prompt, create a directory on one of your fixed disks or a diskette.

For example, type md3172back to create 3172BACK as your backup directory.

Step 2. Select **Utilities** from the action bar as shown in Figure 190 on page 304.
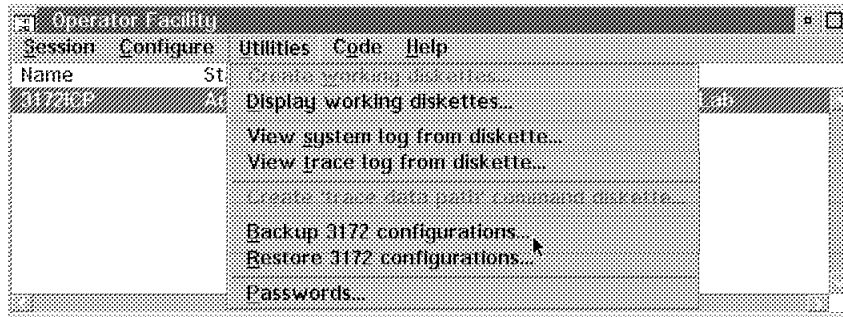
Figure 190. Back Up 3172 Configuration

Step 3. Select **Backup 3172 configurations** from the pull-down menu.

The panel shown in Figure 191 appears.
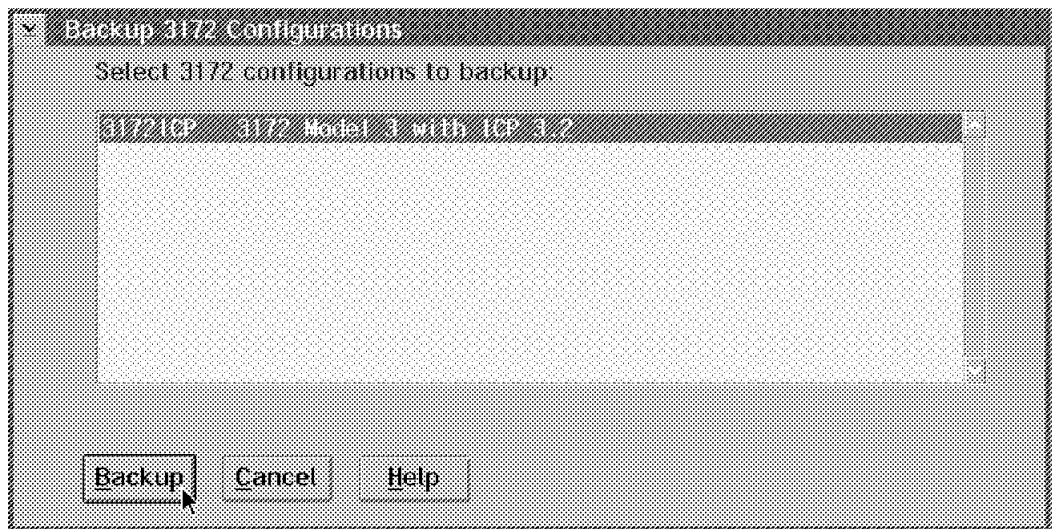
Figure 191. Select 3172 Configuration to be Backed Up

Step 4. Select the 3172 configuration that you want to back up.

The panel shown in Figure 192 on page 305 appears.
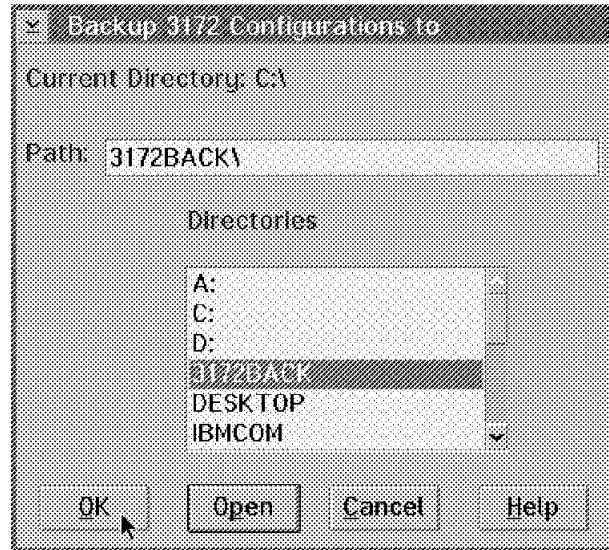
Figure 192. Select Your Backup Directory

Step 5. Select the drive of your backup directory and click on **Open**.

A list of the directories on the drive is displayed.

Step 6. Select your backup directory and click on **OK** to begin the backup operation.

A dialog window confirms the completion of the operation.

Step 7. Click on **OK** to return to the primary Operator Facility panel.

The 3172ICP configuration has been backed up to the selected directory. In our example, it is the 3172BACK directory on the C drive as shown below.

```
OS2 C:\3172back>dir

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is E60E:8814
 Directory of C:\3172back

 1-19-94   8:05p      <DIR>           0  .
 1-19-94   8:05p      <DIR>           0  ..
 1-19-94   6:03p       5376           0  3172ICP.BK1
 1-19-94   8:17p        543           0  CSPCFG.BK
 7-06-93   2:55p         18           0  CSPVER.BK
          5 file(s)       5937 bytes used
                      16194048 bytes free
```

6.1.1.2 Backup Procedure Using the Keypad

You can copy a 3172 configuration from the hard disk of your 3172 to a diskette using the procedure described in Chapter 2 of the *IBM 3172 Interconnect Controller Interconnect Controller Program Version 3.2 User's Guide (SC30-3572)*.

6.1.2 Configuration Restore Procedures

Using the Operator Facility/2 you can restore all or some of your previously backed up 3172 configuration(s). A restored configuration is copied from the specified backup directory to the OF2VER3 directory.

6.1.2.1 Restore Procedure Using the Operator Facility

Before you proceed any further, you must choose the drive and the directory of your backups. Then use the following procedure to restore your previously backed-up configuration(s):

Step   1. Select **Utilities** from the action bar as shown in Figure 193.
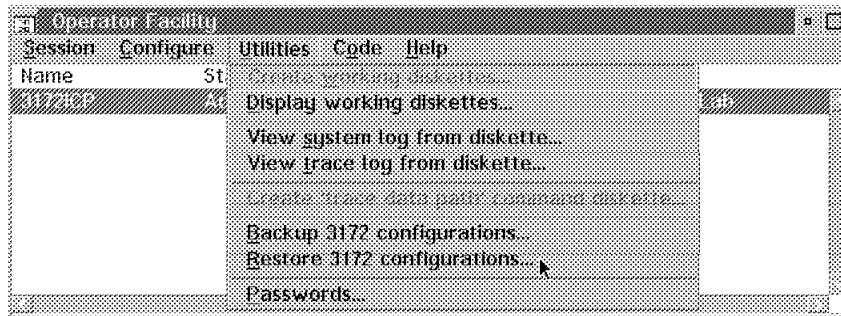
Figure 193. Restore 3172 Configurations

Step   2. Select **Restore 3172 configurations** from the pull-down menu.

The panel shown in Figure 194 appears.
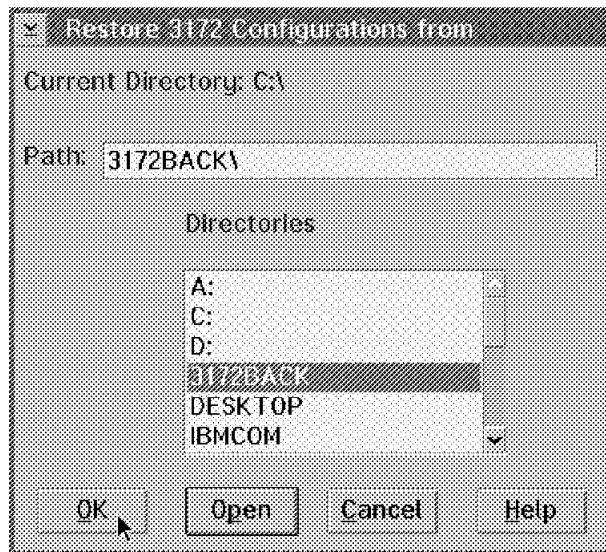
Figure 194. Select Path and Directory for Restore Operation

Step   3. Select the drive of your backup directory and click on **Open**.

A list of the directories on the drive is displayed.

Step   4. Select your backup directory and click on **OK**.

The panel shown in Figure 195 on page 307 appears.
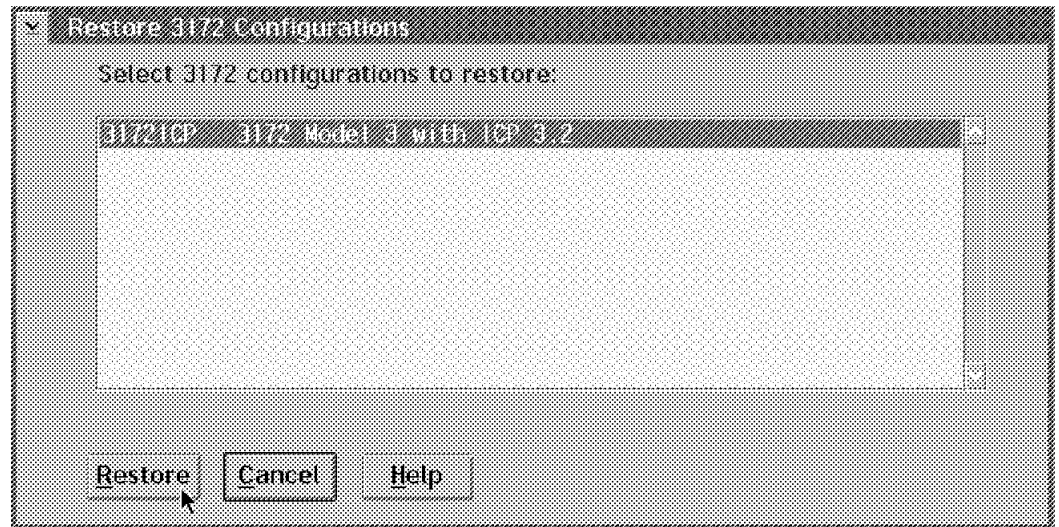
Figure 195. Select 3172 Configuration(s) to Restore

Step 5. Select the 3172 configuration(s) you want to restore. At this point, you can restore one or several 3172 configurations.

> **Tip**
>
> If you remember the name of a 3172 configuration that you deleted previously from the operator station, you can restore it from the 3172 hard disk using the Operator Facility, if that configuration is still active in the 3172.

A dialog window confirms the completion of the operation.

Step 6. Click on **OK** to return to the primary Operator Facility panel.

In our example, the 3172ICP configuration has been restored from the backup directory to the OF2VER3\CONFIG subdirectory as shown below.

```
OS2 C:\of2ver3\config>dir

 The volume label in drive C is C_DRIVE.
 The Volume Serial Number is E60E:8814
 Directory of C:\of2ver3\config

 1-19-94    5:51p    <DIR>         0  .
 1-19-94    5:51p    <DIR>         0  ..
 1-19-94    6:03p     5376         0  3172ICP.001    1
 1-19-94    7:45p      543         0  3172ICP.CTL    2
 1-19-94    9:38p      543         0  CSPCFG.BAK
 1-19-94    9:38p      543         0  CSPCFG.DAT
 8-31-93   11:28a       76         0  CSPLVL.BAK
 8-31-93   11:27a       76         0  CSPLVL.DAT
 8-04-93   10:22a     8832         0  SAMPLE1.BA1
 8-04-93   10:22a     9984         0  SAMPLE2.BA1
 8-04-93   10:22a    11520         0  SAMPLE3.BA1
       11 file(s)     37493 bytes used
                    16195072 bytes free
```

1 This file is the 3172 profile that was restored.

2 This file relates the 3172 to its associated profile(s).

6.1.2.2 Restore Procedure Using the Keypad

You can copy a 3172 configuration from a diskette to the hard disk of your 3172 using the procedure described in Chapter 2 of the *IBM 3172 Interconnect Controller Interconnect Controller Program Version 3.2 User's Guide (SC30-3572)*.

6.1.3 Operational Code Backup and Restore Considerations

You need not back up the operational code running in your 3172(s) and the OF/2 code running in your LAN-attached operator station.

Note: By operational code we mean the ICP base code and Interconnect Enhancement Feature code.

In the case where your 3172 operating environment is rendered totally unrecoverable, you must reinstall the operational code and the OF/2 code, using the product diskettes.

6.2 Backup and Restore in the OS/2 Environment

The MPE, Offload and SNA/Comm environments run on OS/2. The backup strategy for MPE, Offload and SNA/Comm utilizes the backup and restore facilities of OS/2. These in turn rely on using diskettes for a backup medium. Anyone who has ever tried to back up an OS/2 system using these tools recognizes their shortcomings. The 3172 has a SCSI disk drive. It provides the SCSI interface via a standard Micro Channel adapter. Some may be interested in using this interface with industry tape devices and software. Be aware that this is not supported and in all probability will negate FCC-certified compliance for electromagnetic radiation. For these reasons we explored the use of SaveUtility/2 as an alternative backup strategy.

SaveUtility/2 is a new tool to assist LAN administrators with the task of archiving information. It uses standard network adapters and drivers. It will work with FTP, IPX and NetBIOS. The attractiveness of SaveUtility/2 for our purposes lay in the fact that no further testing is necessary to obtain and/or maintain FCC compliance. Each 3172 running Offload requires at least one LAN adapter. This may be shared by multiple protocols using an NDIS protocol stack that is standard IBM supported software supplied with the Offload feature.

Please note that even though this solution is predicated exclusively on IBM software products, at this time 3172 product development has not endorsed this as a supported methodology for the saving and restoring of data in a 3172 configured for Offload. This is only the result of informal testing done at the ITSO in an attempt to find a better solution to the task at hand. With that aside, we found SaveUtility/2 to be a viable backup and restore facility.

SaveUtility/2 uses the client/server model to process interactive and batch backup and restore requests. In the Offload environment, we set up a Subscriber (client) function on the 3172 and an Archiver (server) function at another LAN station. An Archiver handles backup and restore requests from Subscribers. The Archiver backs up files to and restores them from a variety of mass storage devices such as host DASD and SCSI tape drives. It uses the available space on its fixed disk as a staging area to facilitate data transfers between the Subscriber station and the archive device.

We will discuss two possible implementations. They are presented only as two alternatives and are not meant to be considered as the only available options. The choices we made were to:

- Back up and restore using a workstation-attached Tape Drive

- Back up and restore using host DASD via FTP

The installation and customization of SaveUtility/2 and its required tape drive support utilities (either Sytos Plus** or Novaback**) are not within the scope of this book. We assume that you will use the product documentation to complete the necessary installation tasks. Some of these tasks are listed below:

- Connect tape drive to SCSI adapter on Archiver station.

- Install and customize Sytos Plus device driver on Archiver station.

- Install SaveUtility/2 and customize profiles on Archiver station.

- Install SaveUtility/2 and customize profiles on 3172.

Note: The tape drive must be directly attached to the Archiver station.

6.2.1 Backup and Restore Using a Tape Drive

This strategy has certain hardware and software requirements, some of which are basic and others that will vary depending on the storage device and device driver that you choose to use.

We used an IBM 7208 Model 1 tape drive and Sytos Plus tape utilities, but any similar device with supported software can be used in conjunction with this solution. This particular drive does not support the QFA (Quick File Access) feature of Sytos and therefore we found it limited for a production environment. There are faster devices that can be used. We used this equipment because it was readily available to us. Novaback is another software package supported by SaveUtility/2 and may work equally as well or better in your environment. The requirements for our test environment which depended on the 7208 tape drive can be summarized as follows:

- Hardware

    - Hard drive on SaveUtility/2 Archiver station formatted for HPFS (to support potential long file names)

    - SCSI adapter at Archiver station

    - Tape drive SCSI-attached to Archiver station

    - Tape(s) suitable for selected tape drive

    - NetBIOS protocol configured for LAN adapter at Subscriber (3172) and Archiver stations.

- Software

    - Operating System/2 installed at Subscriber (3172) and Archiver stations

    - SaveUtility/2 installed at Subscriber (3172) and Archiver stations

    - Sytos Plus device driver installed at Archiver station to operate tape drive.

The Subscriber and Archiver use NetBIOS to exchange files. The Archiver uses the Sytos Plus tape utilities to store and fetch files to/from the tape drive. Figure 196 on page 310 illustrates this approach.

```
┌────────────────────────────────────────────────────────────────────────┐
│  ▌1▐                          ▌2▐                                        │
│                                                                          │
│  ┌──────────────────┐        ┌──────────────────┐                       │
│  │                  │        │                  │     ▌3▐                │
│  │  3172 Model 3    │        │  PS/2 station    │                       │
│  │                  │ NetBIOS│                  │    ┌──────────────┐    │
│  │  SaveUtility/2   │───────▶│  SaveUtility/2   │    │              │    │
│  │   Subscriber     │◀───────│   Archiver       │    │  IBM 7208    │    │
│  │                  │        │                  │    │  Model 1     │    │
│  │  Offload TCP/IP  │        │  Sytos Plus      │◀─SCSI─▶│  Tape Drive  │    │
│  │                  │        │  V1.35           │    │              │    │
│  └──────────────────┘        └──────────────────┘    └──────────────┘    │
│                                                                          │
└────────────────────────────────────────────────────────────────────────┘
```
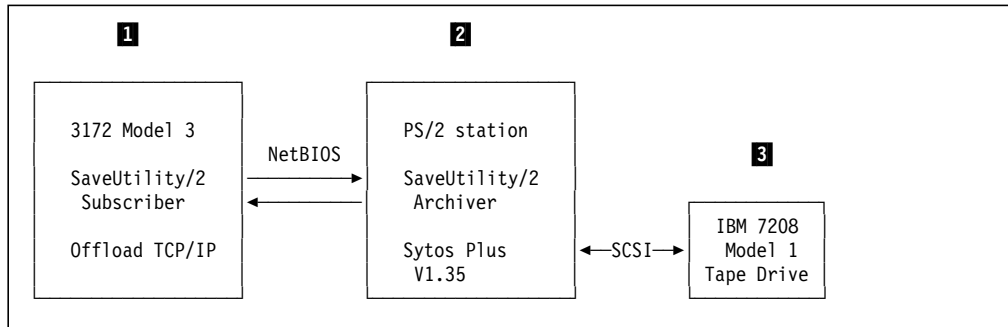
Figure 196. Backup and Restore Using Tape Drive

The backup sequence is summarized as follows:

▌1▐ The Subscriber station uses SaveUtility/2 to start the backup operation.
The Subscriber station is the 3172 in the Offload environment. SaveUtility/2
sends the files to the Archiver station using the NetBIOS protocol.

▌2▐ SaveUtility/2 at the Archiver station receives and copies the files to the
staging area on its hard disk. Then SaveUtility/2 uses the Sytos Plus tape
utilities to send the files to the tape drive through the SCSI interface.

▌3▐ The files are archived to tape for later retrieval.

The restore sequence is summarized as follows:

▌1▐ The Subscriber station uses SaveUtility/2 to create a pair of OS/2 restore
boot diskettes in advance of actual need, anticipating a catastrophic outage
requiring remedial action. When the Subscriber needs to have a file
restored it uses NetBIOS to inform the Archiver that it is ready to receive
restored files.

▌2▐ Another OS/2 Subscriber station uses SaveUtility/2 to request a full restore
on behalf of the 3172. SaveUtility/2 at the Archiver station receives the
restore request. It uses the Sytos Plus tape utilities to retrieve the required
files from the tape drive. It copies the restored files to its staging area and
sends them to the 3172 using NetBIOS protocol.

Note: The Archiver station can issue this request on behalf of the 3172 as
well.

▌3▐ The SCSI-attached tape drive is the file repository for backup and restore
operations.

6.2.1.1 Backup Procedures Using Tape Drive

Using the SaveUtility/2 Subscriber function, you can start three types of backup
from your 3172:

 • Full

 • Incremental

 • Progressive

We will concern ourselves only with the full backup option here. Use the
following procedure to start a full backup of your 3172 hard disk:

Step   1. Ensure that the SaveUtility/2 Librarian and Append Volume programs
are active at the Archiver station before you proceed to the next step.

If they are not, go to the Archiver station and start them now.

Step   2. Go to your 3172 and open the SaveUtility/2 folder.

This folder is created at the 3172 desktop when you install SaveUtility/2.

```
┌──────────────────────────────────────────────────────────────────────┐
│ ▪ ▓▓▓▓Backup/Restore 3172C - Icon View▓▓▓▓                    ▪ ▪ □ │
├──────────────────────────────────────────────────────────────────────┤
│                                                                        │
│   ⟳         ⟳          ⟳          ⟳          ⟳          ⊟            │
│                                                                        │
│  Backup     Backup      Backup      Restore     Restore   Create OS/2 2.x│
│  (Full)   (Incremental) (Progressive) (Interactive) (Wait)  Boot Diskettes│
│                                                                        │
│                                                              ▓▓▓▓▓▓ >  │
└──────────────────────────────────────────────────────────────────────┘
```

Figure 197. Starting a Full Backup

Step   3. Double-click on the **Backup (Full)** icon to start the backup.

The Subscriber and Archiver stations synchronize by exchanging levels, profiles
and clock information as shown below:

```
0606 SaveUtility/2 Backup started at 08:45:53 on 27 Jan 1994.
0617 Getting file SU2CUS.CMD from Librarian LIB8565B.
0617 Getting file SU2BUILD.CMD from Librarian LIB8565B.
0618 SaveUtility/2 Subscriber code level 1.10 is current.
0660 System clock is being synchronized to Librarian.
     The time and date have been set to 08:46:09  Thursday  Jan 27,  1994
0621 Requesting remote pruning of backup log.
0617 Getting file 3172C.PRO from Librarian LIB8565B.
```

The actual backup operation proceeds and its progress is indicated in the
manner shown below:

```
                Backing up subscriber 3172C at 08:46:25 on 27 Jan 1994


    │ Librarian name.... LIB8565B     │ Archiver name..... A8565B       │
    │ Profile name...... 3172C.PRO    │ Backup type....... FULL         │
    │ Event log name.... 3172C.EVT    │ Deadline time..... NONE         │
0635 Starting file transmission to Archiver.
     Usable remote disk space is 198,349,920 Bytes  A8565B01
         1%                            50%                        100%

        │>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  │

     At line item 853 of 890 (95%)   Files 850    Bytes  35126774




                                                              30:1398
```

6.2.1.2 Restore Procedures Using Tape Drive

Using the SaveUtility/2 Subscriber function, you can request two types of restore from your 3172:

- Full
- Partial

We will concern ourselves only with the full restore option. To effect a full restore from a previous full backup, SaveUtility/2 uses a pair of OS/2 boot diskettes.

```
┌─ Important ────────────────────────────────────────────────────────┐
│                                                                     │
│  To ensure a prompt and smooth recovery in case of a hard disk or other  │
│  disastrous 3172 failure, we recommend that you prepare the OS/2 boot    │
│  diskettes as soon as you install your 3172, establish the Offload environment │
│  and install SaveUtility/2.  Note that you must re-create these diskettes │
│  whenever your 3172 configuration changes.                          │
│                                                                     │
└─────────────────────────────────────────────────────────────────────┘
```

Creating Your OS/2 Boot Diskettes

Follow this procedure to create the OS/2 boot diskettes used to restore your Offload environment:

Step 1. At an OS/2 workstation, use **diskcopy** to copy the original *OS/2 Installation diskette* and *OS/2 Diskette 1* to a pair of formatted diskettes.

> **Note:** Do not use the original OS/2 installation diskettes because the contents are altered in a subsequent step of this procedure.

Step 2. Ensure that the SaveUtility/2 Librarian and Append Volume programs are active at the Archiver station before you proceed to the next step.

> If they are not, go to the Archiver station and start them now.

Step 3. At an Archiver station, not using the Token-Ring 16/4 Busmaster Adapter, select the **Create OS/2 2.x Boot Diskettes** program from the SaveUtility/2 folder to create the OS/2 boot diskettes.
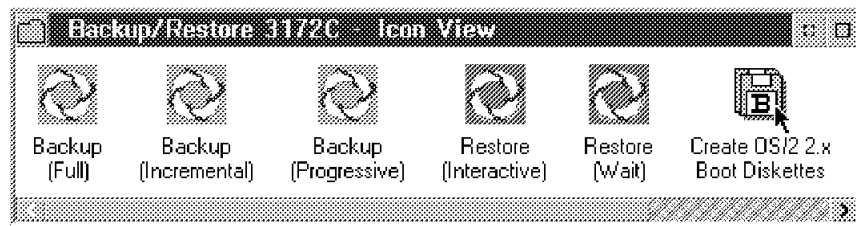
Figure 198. Creating Your OS/2 Boot Diskettes

> The program prompts you for the diskettes. The contents of the OS/2 diskettes are modified by this program. They are referred to as *OS/2 boot diskette 0* and *OS/2 boot diskette 1* respectively from here on.

> The only token-ring adapter supported by the Offload environment is the **Token-Ring 16/4 Busmaster Adapter**. SaveUtility/2 does not create OS/2 boot diskettes for this adapter. To use your OS/2 boot diskettes with this adapter, customize *OS/2 boot diskette 1* manually:

Step   4. Copy the file \IBMCOM\MACS\IBMTRBM.OS2 to the diskette.

Step   5. Copy the file \IBMCOM\MACS\IBMTRBM.NIF to the diskette.

Step   6. Change the path to A:\ for IBMTRBM.OS2, NETBEUI.OS2 and NETBIOS.OS2 in the \IBMCOM\MACS\IBMTRBM.NIF file.

Step   7. Copy the file \IBMCOM\PROTOCOL\NETBEUI.OS2 to the diskette.

Step   8. Copy the file \IBMCOM\PROTOCOL\NETBEUI.NIF to the diskette.

Step   9. Copy the file \IBMCOM\MACS\MONT400.BIN to the diskette.

Step 10. Copy the file \IBMCOM\MACS\WRTRAM.BIN to the diskette.

Step 11. Copy the file \IBMCOM\LT4.MSG to the diskette.

Step 12. Copy the file \IBMCOM\LT4H.MSG to the diskette.

Step 13. Replace ″DEVICE=\IBMTOK.OS2″ with ″DEVICE=\IBMTRBM.OS2″ in the CONFIG.SYS file.

Step 14. Modify the PROTOCOL.INI file:

   a. In the [IBMLXCFG] section, replace line ″IBMTOK_nif = IBMTOK.nif″ with ″IBMTRBM_nif = IBMTRBM.nif″.

   b. In the [NETBEUI_nif] section, change ″Bindings = IBMTOK_nif″ to ″Bindings = IBMTRBM_nif″.

   c. Remove the section called [IBMTOK_nif].

   d. Add the following section:

   [IBMTRBM_nif]

```
      DriverName = IBMTRBM$
      MaxTransmits = 31
      MinRcvBuffs = 20
      SizWorkBuf = 2048
```

   Note: Refer to B.4, "3172 Offload Restore" on page 409 for the modified files:

   • CONFIG.SYS

   • PROTOCOL.INI

   • IBMTRBM.NIF

   • NETBEUI.NIF

Step 15. Store your OS/2 boot diskettes in a safe place to be used in case of a disastrous 3172 failure.

Recovering Your 3172 Using the OS/2 Boot Diskettes

Let us suppose that the 3172 hard disk is damaged beyond repair and that a full backup was taken previously. We request a complete restore to re-establish the Offload environment as it was recorded by the last full backup. Within the context of this procedure, the 3172 is the Subscriber station to be restored.

Use the following procedure to effect a full restore of your 3172 hard disk:

Step   1. Ensure that the SaveUtility/2 Librarian and Append Volume programs are active at the Archiver station before you proceed to the next step.

   If they are not, go to the Archiver station and start them now.

Step 2. Go to the 3172 to be restored, insert *OS/2 boot diskette 0* in the diskette drive and press Ctrl-Alt-Del to restart the machine.

Step 3. When the blue IBM logo panel appears, remove *OS/2 boot diskette 0* and insert *OS/2 boot diskette 1* and press Enter.

Step 4. When prompted, remove *OS/2 boot diskette 1*, re-insert *OS/2 boot diskette 0* and press Enter.

You are then prompted to enter the name of the Subscriber station.

Step 5. Type the name that identifies your 3172 to SaveUtility/2.

We identified our 3172 as **3172C**.

A menu is presented with options necessary to set up your 3172 before the restoration procedure starts, such as partitioning and so on. This step might involve partitioning the fixed disk, in which case your 3172 must be restarted and you must step through this procedure from step 2 again.

Note: If you do restart your 3172, this menu will not be presented on the second pass through this procedure.

A process options menu is presented. Option 5 restores the most recent version of all your backed up files. Option 4 allows you to select a backup from which to restore files. The selection is made from SaveUtility/2 at the Subscriber (3172) station. We will discuss only option 5 here.

Step 6. Select option 5 (**Request a SaveUtility/2 full system restore, then Receive files from SaveUtility/2**).

The Subscriber is now placed in **listen mode** waiting for files from the Restorer (running at the Archiver station).

Step 7. When the restore completes, remove *OS/2 boot diskette 0* from the diskette drive and press Ctrl-Alt-Del to restart the machine.

At this point the Offload environment is re-established on the 3172.

6.2.2 Backup and Restore Using Host DASD

This approach will work only with an MVS host running TCP/IP. It will not work with a VM host because the long file names used by SaveUtility/2 (up to 35 characters) are not supported by the CMS file system.

Furthermore, you must consider this approach only if you have more than one 3172 so that an alternate path to the host exists, in case of an adapter or software failure.

This strategy requires the following hardware and software:

- Hardware

  − Host DASD for a full backup of your 3172 hard disk files

  − TCP/IP protocol configured for LAN adapter at Subscriber (3172) and Archiver stations

  − NetBIOS protocol configured for LAN adapter at Subscriber (3172) and Archiver stations.

- Software

  − Operating System/2 installed at Subscriber (3172) and Archiver stations

- SaveUtility/2 installed at Subscriber (3172) and Archiver stations

  - TCP/IP and FTP installed at Subscriber (3172) and Archiver stations.

  - TCP/IP and FTP installed at host system

The Subscriber and Archiver exchange files using NetBIOS protocol. The Archiver and the host exchange files using FTP protocol. Files on the 3172 hard disk are backed up through the Archiver station and the 3172 to host DASD and restored in similar fashion. Figure 199 illustrates this approach.
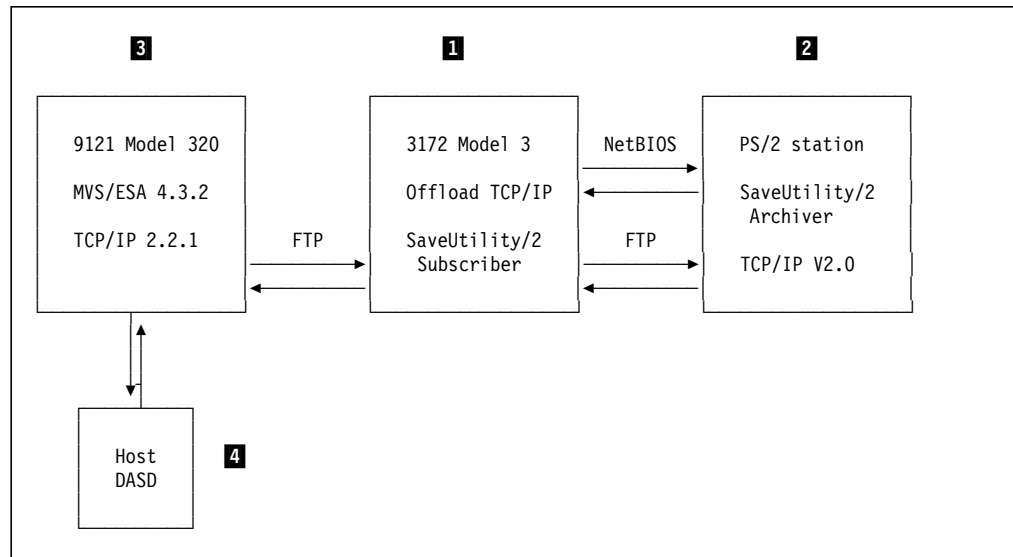
Figure 199. Backup and Restore Using Host DASD

The backup sequence is summarized as follows:

1 The Subscriber station uses SaveUtility/2 to start the backup operation. The Subscriber station is the 3172 in the Offload environment. SaveUtility/2 sends the files to the Archiver station using the NetBIOS protocol.

2 SaveUtility/2 at the Archiver station receives and copies the files to the staging area on its hard disk. Then the Archiver establishes an FTP session with the MVS host through the 3172 interface and sends the files.

3 TCP/IP at the host writes the files to TSO data sets on DASD.

4 Host DASD is the repository of the backed up 3172 files.

The restore sequence is summarized as follows:

1 The Subscriber station uses SaveUtility/2 to create a pair of OS/2 restore boot diskettes and uses NetBIOS to inform the Archiver that it is ready to receive restored files.

2 Another OS/2 Subscriber station uses SaveUtility/2 to request a full restore on behalf of the 3172. SaveUtility/2 at the Archiver station receives the restore request. It opens an FTP session with the host and issues a series of GET operations to copy the required files to its staging area. It then sends them to the 3172 using NetBIOS protocol.

Note: Normally, the Subscriber function is installed at the Archiver station. The Archiver station can issue this request on behalf of the 3172.

3 FTP receives commands from the Archiver station and retrieves the required files from the backup TSO data sets. It sends the files to the Archiver station through another socket (session).

6.2.2.1 Backup Procedures Using Host DASD
The procedures described in 6.2.1.1, "Backup Procedures Using Tape Drive" on page 310 can be used to back up files to DASD owned by a TCP/IP host.

6.2.2.2 Restore Procedures Using Host DASD
The procedures described in 6.2.1.2, "Restore Procedures Using Tape Drive" on page 312 can be used to restore files from DASD owned by a TCP/IP host.

6.3 Backup and Restore in the MPE Environment

The backup and restore considerations for the MPE and Offload environments are identical because both run on the OS/2 platform. The procedures described for the Offload environment apply equally to the MPE environment, with one important difference. The procedure used to create the OS/2 boot diskettes differs between these two 3172 environments.

Follow this procedure to create the OS/2 boot diskettes used to restore your MPE environment:

Step   1. At the Archiver station, use **diskcopy** to copy the original *OS/2 Installation diskette* and *OS/2 Diskette 1* to a pair of formatted diskettes.

   Note: Do not use the original OS/2 installation diskettes because the contents are altered in a subsequent step of this procedure.

Step   2. Ensure that the SaveUtility/2 Librarian and Append Volume programs are active at the Archiver station before you proceed to the next step.

   If they are not, go to the Archiver station and start them now.

Step   3. Select the **Create OS/2 2.x Boot Diskettes** program from the SaveUtility/2 folder as shown in Figure 198 on page 312 to create the OS/2 boot diskettes.

   The program prompts you for the diskettes. The contents of the OS/2 diskettes are modified by this program. They are referred to as *OS/2 boot diskette 0* and *OS/2 boot diskette 1* respectively from here on.

Step   4. Store your OS/2 boot diskettes in a safe place to be used in case of a disastrous 3172 failure.

Chapter 7. 3172 Model 3 High-Availability

Today, many available systems and their components have typical failure rates of once in a hundred years or better. This does not mean, however, that failure will happen *after* the hundredth year; it could happen anytime. A prudent systems architect would therefore weigh the cost of having additional systems and/or components to improve availability of the system, guarding the business from the cost of an expensive outage.

This chapter describes the considerations a systems designer must take when incorporating high-availability with the 3172. It will show several configurations which provide different types and levels of availability for the different operating environments.

7.1 High-Availability Design Considerations

One way of ensuring high availability is to eliminate potential configurations where there is a single point of failure. The failure of any single component should not prevent connectivity between two points in the network. This is often accomplished through the use of a backup path which requires duplication of certain components. It is important, therefore, to know which of these components to duplicate. The cost of buying two components may be hard to justify, especially if one is only a standby in anticipation of a failure.

Another consideration of note is what, if any, host intervention is required for the backup path to become operational. Certain configurations will require extensive, little, or no manual intervention for the backup configurations to take effect. Configurations requiring extensive intervention will not be as attractive or acceptable, especially if they will require prolonged time to execute.

Finally, configurations where downstream workstation reconfiguration is required will also be either unattractive or unacceptable, especially if there are hundreds or even thousands of workstations and if these workstations are scattered over a wide geographic area.

For more information about 3172 Availability, see ″3172 Availability and Backup″ in Chapter 2, ″Determining Your System Requirements,″ of the *IBM 3172 Interconnect Controller Program Version 3 Planning Guide*. Take note that the discussion on TCP/IP in the ICP realm will also apply to Offload.

7.1.1 Points of Failure

Any point-to-point connection usually traverses several distinct components. For example, a simple file server-to-client connection passes from the server and its network interface card, through a cable, possibly through a concentrator, another piece of cable, and then through the workstation network interface card and the workstation itself. In this example, we have already identified seven potential points of failure. High-availability design will attempt to duplicate components such that any point of failure can be bypassed. Alternate connections from any point to any other point can be established.

To illustrate a good LAN-to-host gateway high-availability design, we try to eliminate points of failure in order to end up with a network design that is flexible, easily maintained and quickly reconfigured.

Let us start with the simplest configuration: a single host, single channel connection, single 3172, single 3172 LAN adapter, single workstation adapter, and a single workstation.

The configuration shown in Figure 200 illustrates our base setup. The possible points and reasons of failure are as follows:

```
┌─────────────────────────────────┐
│                                 │
│   ┌──────────────────┐  ■1      │
│   │      Host        │          │
│   ├──────────────────┤          │
│   │   Channel Card   │          │
│   └──────────────────┘          │
│   Channel      ■2               │
│   Attachment                    │
│                        ┌──────────────────┐  ■7  │
│                        │   Workstation    │      │
│   ┌──────────────────┐  ■3      ├──────────────────┤  │
│   │ Channel Adapter  │          │      LAN         │  ■8│
│   ├──────────────────┤    * * * * *   │    Adapter       │  │
│   │                  │  ■4    *      *  └──────────────────┘  │
│   │   3172 Model 3   │      *  LAN   *          │
│   ├──────────────────┤  ■5  *   ■6   *          │
│   │      LAN         │       *      *           │
│   │    Adapter       │────────* * * * *          │
│   └──────────────────┘                          │
└─────────────────────────────────┘
```
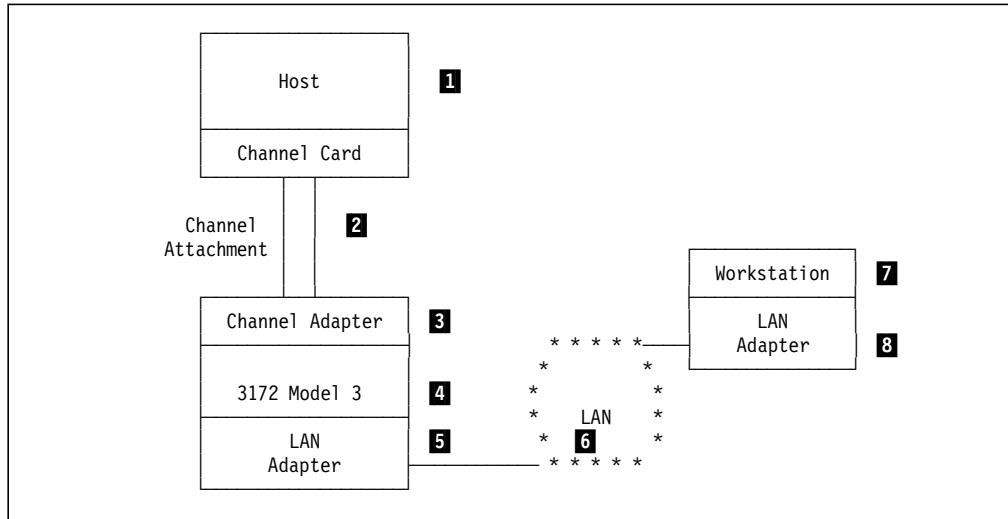
Figure 200. Points of Failure

■1   Host -- application or hardware failure

■2   Channel card/cable -- card failure or cable break

■3   3172 channel adapter -- card or connector failure

■4   3172 -- disk, cooling, or power supply failure, or planar damage

■5   3172 LAN adapter -- card or connector failure

■6   Local Area Network -- network connectivity failure

■7   Workstation -- disk, cooling, or power supply failure or planar damage

■8   Workstation LAN adapter -- card or connector failure

We will limit our discussions to failures for components ■2 to ■5 . Failure of components ■1 , ■6 , ■7 , and ■8 are outside the scope of this book. Similarly, LAN media failure will not be discussed. We will also limit our examples to a few representative configurations which can be further expanded to provide for more flexibility.

Channel Card/Cable and 3172 Channel Adapter: S/390 channel cards and cables are the least likely to fail. They are also seldom duplicated since they are fairly expensive. It will not be difficult, though, to duplicate this component, albeit with some limitations.

ICP will allow the use of two parallel channel adapters. You may configure these so that one can be an active backup of the other. In this setup, one adapter will take the load of the other in addition to its own load if the partner adapter fails. You can also configure the two such that one of the adapters is a passive backup. This means that the backup adapter is never used until the active adapter fails. Choose which setup to use depending on your load and availability requirements.

The use of Offload, meanwhile, limits you to only one parallel channel adapter. This means that you cannot have a backup adapter in a single 3172. The only way to have a backup channel path is to have another 3172 (which will be discussed below).

Similarly, as far as ESCON channels are concerned, you are also limited to only one ESCON path to the host. As with PCA, the only way to have a backup ESCON channel path is to have another 3172.

3172: The 3172 Model 3 has been designed with reliability as one of its most important features. It has excellent power and cooling subsystems as well as attachment harnesses. Nevertheless, it would still be prudent to include a second 3172 as backup if the requirement for availability deems it necessary. A redundant 3172 can also provide the further benefits of additional throughput and load sharing. Examples will be provided in the sample configurations below.

3172 LAN Adapter: The 3172 LAN adapter suite is the component most usually duplicated because of the relatively low cost, flexibility, and the least favorable reliability rate among the aforementioned components. Like the 3172 as a whole, multiple LAN adapters can provide the additional benefit of increased throughput.

7.1.2 Host Intervention and Recovery Considerations

The ideal high-availability scenario is one where minimal operator intervention is required to activate backup paths and where a failure would be non-disruptive to the users and sessions. Protocols which provide excellent error recovery and flow control such as SNA, as well as subsystems which detect problems and automatically perform recovery operations accomplish this.

Providing a means for an operator to quickly disable the problematic component and activate a backup path would be a fairly good compromise. Although reconnection would sometimes be necessary, it would not be as inconvenient to the users, as the transfer to the backup path would just take a few seconds. This compromise, however, may still be unacceptable for real-time or online transaction processing applications.

7.1.3 Workstation Reconfiguration

As stated earlier, a network design where reconfiguration must take place at the workstation level would be unattractive and unacceptable. Networks might, and usually do, consist of hundreds of scattered workstations. Although products to remotely reconfigure workstations are starting to appear in the market, the number of workstations to reconfigure can be staggering and the time it would take to complete reconfiguration would defeat the purpose of providing availability. It is also possible that, in the time it takes to complete a reconfiguration, the source of the availability problem may have been found and resolved. Lastly, it would be inconvenient for users (and sometimes unacceptable to them) to reconfigure their workstations themselves.

7.1.4 Returning to the Original Configuration

Just like activating a backup configuration, returning one to its original setup should be as easy, although not necessarily as urgent. The steps are usually the reverse of the steps of activating the backup configuration.

Returning to the original configuration should be easily performed without the risk of bringing the network down again. If the duplicate components were performing load-sharing, then the sooner any congestion that may be happening at the component which carried the extra load can be alleviated the better.

Finally, a network that is already at a backup configuration may not be able to handle another failure, especially if the failing component *is* a backup component currently acting as a primary component because of a previous, still unresolved failure. This is another reason why returning a network to its original configuration quickly is important.

7.1.5 Physical Swapping

A final option that can be considered is the actual physical swapping of the failed component with a waiting backup. This is disruptive but, for some components, the speed at which they can be replaced make them an attractive option when cost is of concern.

7.2 Scenario 1 - SNA, Single 3172, Multiple Token-Ring LAN Adapters

The following section describes the conditions, requirements and setup considerations that are applicable when implementing a high-availability configuration for a single 3172 as an SNA gateway. Take note that this scenario is applicable only when using the 3172 with the IBM 3172 Interconnect Controller Program.

```
                        ┌─────────────────┐
                        │     MVS/ESA     │
                        │       TSO       │
                        │      VTAM       │
                        │                 │
                        └─────────────────┘

                        ┌─────────────────┐
                        │  3172 Model 3   │
                        │   ICP V3R2      │
                        ├────────┬────────┤
        PCA             │  309   │  30A   │
        RAN             │   0    │   1    │
        LAA             │  TR0   │  TR1   │
                        └────────┴────────┘

                        ┌──────┐  ┌──────┐
                        │  TR  │  │  TR  │
                        │segment  │segment
                        │ 582  │  │ 580  │
                        └──────┘  └──────┘

                         ┌──┐      ┌──┐
                         │ B│      │ B│       PCA -- Parallel Channel Adapter,
                         │ 3│      │ 2│                subchannel address
                         └──┘      └──┘       RAN -- relative adapter number
                                              B   -- source routing brigde
                                              LAA -- locally administered address
                                                     TR0=TR1=4000 021B 3172
                                                     TRA=4000 000A 8565
                                                     TRB=4000 000B 8565
                    ┌─────────────┐
                    │ token ring  │        ┌─────────┐   PS/2 with CM/2
                    │    LAN      │ LAA  │ work-   │   LU dynamically defined
                    │  user ring  │      │ station │
                    │             │ TRA  │   W1    │
                    └─────────────┘        └─────────┘

                      LAA │ TRB
                    ┌─────────────┐
                    │    work     │   PS/2 with CM/2
                    │  station    │   LU=RAI72TL1
                    │    W2       │
                    └─────────────┘
```
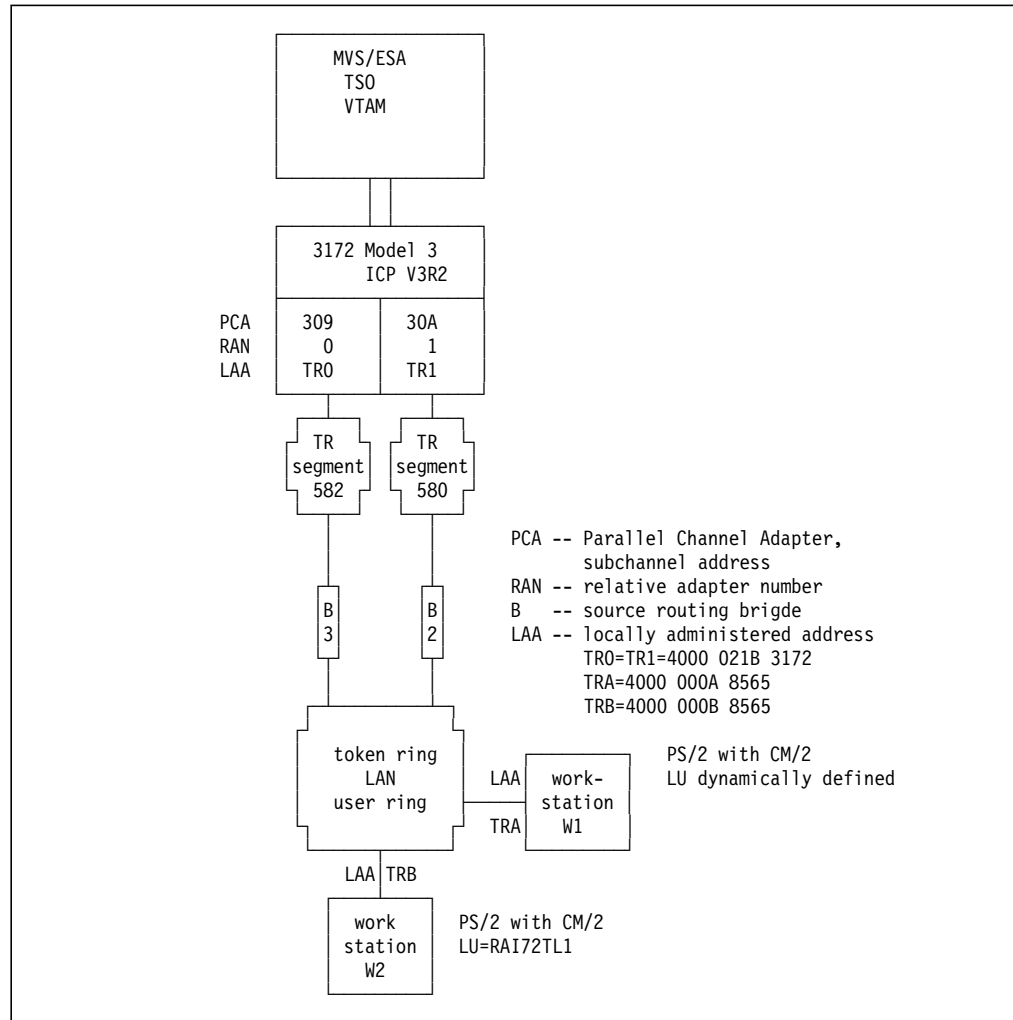
Figure 201. Scenario 1 -- SNA with Single 3172 with Multiple LAN Adapters

7.2.1 Normal Operation Considerations

The configuration in Figure 201 shows one 3172 attached to two apex rings while
the user ring is bridged to these two rings. The locally administered address
(LAA or MAC address) is duplicated in the adapter pair. Both adapters can be
active with this configuration offering bridge, apex ring, and 3172 LAN adapter
backup.

Redundancy is provided by two token-ring adapters and each token-ring LAN
adapter is attached to a different token-ring LAN segment.

1 When you take a look at the system log and display the channel units 300 to
30F, the channels allocated for the SNA traffic should be online (O) and after
activation of the XCA major node, their status is active (A).

```
D U,,,300
IEE450I 11.40.49 UNIT STATUS 245
UNIT TYPE STATUS  VOLSER VOLSTATE   UNIT TYPE STATUS  VOLSER VOLSTATE
300  CTC  OFFLINE                   301  CTC  O
302  CTC  O                         303  CTC  O
304  CTC  O                         305  CTC  O
306  CTC  O                         307  CTC  O
308  CTC  O                         309  CTC  A  1
30A  CTC  A  1                      30B  CTC  OFFLINE
30C  CTC  OFFLINE                   30D  CTC  OFFLINE
30E  CTC  OFFLINE                   30F  CTC  OFFLINE
```

Using NetView NLDM, the following information can be displayed concerning the SSCP-PU session and the LU-LU session.

```
NLDM.CON                    SESSION CONFIGURATION DATA              PAGE   1
-------------- PRIMARY --------------+-------------- SECONDARY --------------
NAME RAIAT03   SA 00000012 EL 0083   |   NAME WA856502  SA 00000012 EL 05CD
-------------------------------------+---------------------------------------
DOMAIN RAIAN      PCID USIBMRA.RAI.F86FE16491791A38        DOMAIN RAIAN
              2 +------------+                 +------------+
RAI             | CP/SSCP    | ---      ---    | CP/SSCP    | RAI
ISTPUS18(0000)  | SUBAREA PU |                 | SUBAREA PU | ISTPUS18(0000)
              +------+------+   SUBA TP 00    +------+------+
                     |         VR 00                 |
              1 +------+------+  ER 00        +------+------+ 3
RAIAT03 (0083) |    LU      |   RER 00        |    LINK    | L0309000
              +------------+                 +------+------+
                                                    |
                                             +------+------+ 4
                              LOGMODE D4C32XX3 |    PU      | WA8565  (01F6)
                                             +------+------+
                              SADJ CP TRAA8565        |
                                             +------+------+ 5
                                             |    LU      | WA856502(05CD)
                                             +------------+
```

1 The TSO LU with which the workstation (W1) LU **5** is in session.

2 The SSCP-PU of VTAM in subarea 18 is ISTPUS18 and has a session with the **4** downstream PU of the workstation.

3 The generated link name LINK contains the information of the subchannel used by this SSCP-PU session. Subchannel 309 is used, which means token-ring adapter TR0 is used.

4 The PU indicates the last 5 hexadecimal digits of the XID value as you defined them in the Communications Manager/2 of the PS/2 workstation.

When you take a look at the MVS system log, the following information can be displayed, related to the workstation LU.

```
D NET,ID=WA856502,E
IST097I DISPLAY ACCEPTED
IST075I NAME = USIBMRA.WA856502, TYPE = LOGICAL UNIT 420
IST486I STATUS= ACT/S---X-, DESIRED STATE= ACTIV
IST977I MDLTAB=***NA*** ASLTAB=***NA***
IST861I MODETAB=ISTINCLM USSTAB=US327X LOGTAB=***NA***
IST934I DLOGMOD=D4C32XX3 USS LANGTAB=***NA***
IST597I CAPABILITY-PLU INHIBITED,SLU ENABLED  ,SESSION LIMIT 00000001
IST136I SWITCHED SNA MAJOR NODE = ISTDSWMN  6
IST081I LINE NAME = L0309000, LINE GROUP = RAITRG0, MAJNOD = RAI72TR0  7
IST135I PHYSICAL UNIT = WA8565
IST082I DEVTYPE = LU
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST171I ACTIVE SESSIONS = 0000000001, SESSION REQUESTS = 0000000000
IST206I SESSIONS:
IST634I NAME      STATUS        SID          SEND RECV VR TP NETID
IST635I RAIAT03  ACTIV-P    F86FE16491791A38 0001 0003       USIBMRA
IST314I END

D NET,ID=RAI72TL1,E
IST097I DISPLAY ACCEPTED
IST075I NAME = USIBMRA.RAI72TL1, TYPE = LOGICAL UNIT 661
IST486I STATUS= ACT/S, DESIRED STATE= ACTIV
IST977I MDLTAB=***NA*** ASLTAB=***NA***
IST861I MODETAB=AMODETAB USSTAB=US327X LOGTAB=***NA***
IST934I DLOGMOD=M2SDLCNQ USS LANGTAB=***NA***
IST597I CAPABILITY-PLU INHIBITED,SLU ENABLED  ,SESSION LIMIT 00000001
IST136I SWITCHED SNA MAJOR NODE = RAI72TRS  8
IST081I LINE NAME = L030A0F4, LINE GROUP = RAITRG1, MAJNOD = RAI72TR1  9
IST135I PHYSICAL UNIT = RAI72TP1
IST082I DEVTYPE = LU , CONTROLLING LU = RAIAT
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST171I ACTIVE SESSIONS = 0000000001, SESSION REQUESTS = 0000000000
IST206I SESSIONS:
IST634I NAME      STATUS        SID          SEND RECV VR TP NETID
IST635I RAIAT02  ACTIV-P    F86FE164935A4495 0000 0002       USIBMRA
IST314I END
```

6 The workstation LU of W1 is dynamically defined using VTAM's standard switched major node ISTDSWMN.

7 The line is defined in the major node *RAI72TR0* as shown in 7.2.4.2, "VTAM Definitions" on page 327. The workstation W1's session goes through token-ring adapter 0 (TR0).

8 If dialing out from VTAM is required, then you have to specify the dial information per downstream PU in a switched major node (RAI72TRS) as shown in 7.2.4.2, "VTAM Definitions" on page 327. We used this definition for the workstation W2. This switched major node also contains the static LU definition (LU=RAI72TL1). You cannot use dynamic LU definitions.

9 The session of workstation W2, with TSO LU RAIAT02, goes through token-ring adapter 1 (TR1).

```
D NET,ID=RAI72TR0,E
IST097I DISPLAY ACCEPTED
IST075I NAME = RAI72TR0, TYPE = XCA MAJOR NODE 117
IST486I STATUS= ACTIV, DESIRED STATE= ACTIV
IST1021I MEDIUM=RING,ADAPNO= 0,CUA=0309,SNA SAP= 4    1
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST170I LINES:
IST232I L0309000, ACTIV
IST232I L0309001, ACTIV
              .      .
              .      .
IST232I L03090F3, ACTIV
IST232I L03090F4, ACTIV
IST314I END
```

1 A display of the XCA major node for token-ring adapter 0 (TR0) shows that:

- The XCA major node and all its 245 DSPUs are active.
- This XCA major node concerns token-ring adapter TR0.
- This token-ring adapter is using Channel Unit Address 0309
- The token-ring adapter uses Data Link SAP x′04′, the recommended DLSAP for SNA traffic (TCP/IP uses DLSAP x′AA′).

7.2.2 Failure of the Token-Ring Adapter

A failing token-ring adapter TR0 will result in a message in the ICP log and the display of the 3172 will indicate that a LAN adapter is failing. An alert is sent to NetView and the message is logged in the MVS system log as shown on the next panel.

```
IST259I  INOP RECEIVED FOR L0309001 CODE = 02
IST619I  ID = L0309001 FAILED - RECOVERY IN PROGRESS
IST129I  UNRECOVERABLE OR FORCED ERROR ON NODE L0309001 - VARY INACT
SCHED
IST105I  L0309001 NODE NOW INACTIVE       1
IST259I  INOP RECEIVED FOR L0309000 CODE = 02
IST619I  ID = L0309000 FAILED - RECOVERY IN PROGRESS
IST129I  UNRECOVERABLE OR FORCED ERROR ON NODE L0309000 - VARY INACT
SCHED
IST590I  CONNECTION TERMINATED  FOR PU WA8565    ON LINE L0309000  1
IST105I  WA8565   NODE NOW INACTIVE
IST105I  L0309000 NODE NOW INACTIVE
IST871I  RESOURCE WA856502 DELETED                                2
IST871I  RESOURCE WA856503 DELETED
IST871I  RESOURCE WA856504 DELETED
IST871I  RESOURCE WA856505 DELETED
IST871I  RESOURCE WA8565    DELETED
CNM039I AN IMPORTANT MESSAGE HAS BEEN LOGGED - PLEASE BROWSE THE NETVIEW
 LOG
```

1 All 245 DSPUs defined on the link go down and for each a message is created in the log. Only L0309001 and L0309000 are shown.

2 The four workstation LU sessions associated with L0309000 are lost.

When the token-ring TR0 fails, the SSCP-PU session between the workstation and VTAM in the host will be re-established over the remaining token-ring adapter (TR1). The LLC MAC frames will contain different token-ring routing information pointing to the functioning token-ring LAN adapter. The following message in the MVS system log for this session re-establishment appears:

```
  IST590I  CONNECTION ESTABLISHED FOR PU WA8565   ON LINE L030A0F4
```

Note that the SSCP-PU session now flows over the other subchannel (030A).

When you display the DSPU information on line L030A0F4, you see that the PU and its four LUs are now ACTIV on this line.

```
D NET,ID=L030A0F4,E
IST097I DISPLAY ACCEPTED
IST075I NAME = L030A0F4, TYPE = LINE 683
IST486I STATUS= ACTIV, DESIRED STATE= ACTIV
IST087I TYPE = SWITCHED DIAL-INOUT, CONTROL = SDLC
IST936I ANSWER MODE = ENABLED
IST134I GROUP = RAITRG1, MAJOR NODE = RAI72TR1
IST084I NETWORK NODES:
IST089I WA8565   TYPE = PHYSICAL UNIT    , ACTIV---X-
IST089I WA856502 TYPE = LOGICAL UNIT     , ACTIV---X-
IST089I WA856503 TYPE = LOGICAL UNIT     , ACTIV---X-
IST089I WA856504 TYPE = LOGICAL UNIT     , ACTIV---X-
IST089I WA856505 TYPE = LOGICAL UNIT     , ACTIV---X-
IST314I END
```

The NLDM shows the message of the failing LU-LU session and the re-activated SSCP-PU session.

```
NLDM.SESS                                                    PAGE 1
                           SESSION LIST
NAME: WA856502                                      DOMAIN:
--------------------------------------------------------------------------
    ***** PRIMARY *****  **** SECONDARY ****
 SEL#   NAME   TYPE DOM    NAME   TYPE  DOM   START TIME      END TIME
 ( 1) RAI     SSCP RAIAN  WA856502 LU   RAIAN 02/25 16:16:08 *** ACTIV ****
 ( 2) RAIAT03 LU   RAIAN  WA856502 LU   RAIAN 02/25 15:52:32 02/25 16:15:04
                                              REASON CODE 08 SENSE 80200007
 ( 3) RAI     SSCP RAIAN  WA856502 LU   RAIAN 02/25 15:14:49 02/25 16:15:04
 ( 4) RAIAT03 LU   RAIAN  WA856502 LU   RAIAN 01/07 17:06:01 01/07 17:11:18
 ( 5) RAI     SSCP RAIAN  WA856502 LU   RAIAN 12/23 12:17:47 12/23 12:25:52
```

```
SENSE DATA:
   CATEGORY - (80) Session reset:  The LU-LU session identified in the
   MODIFIER - (20) UNBIND is being deactivated because of a reset
     BYTE 2 - (00) condition.
     BYTE 3 - (07)
                An LU requested termination.
```

Interpretation of the sense code: we pulled the lobe cable from the token-ring adapter in the 3172.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ NLDM.CON                   SESSION CONFIGURATION DATA              PAGE   1 │
│ -------------- PRIMARY --------------+-------------- SECONDARY ------------- │
│ NAME RAI        SA 00000012  EL 0001 │ NAME WA856502  SA 00000012  EL 05D1   │
│ -------------------------------------+------------------------------------- │
│ DOMAIN RAIAN      PCID USIBMRA.RAI.F86FE16491791A47           DOMAIN RAIAN   │
│               +-------------+                      +-------------+          │
│ RAI           │    SSCP     │ ---        ---       │    SSCP     │  RAI       │
│ ISTPUS18(0000)│ SUBAREA PU  │                      │ SUBAREA PU  │ ISTPUS18(0000)│
│               +-------------+                      +------+------+          │
│                                                           │                 │
│                                                    +------+------+          │
│ ▐1▌                                                │    LINK     │  L030A0F4 │
│                                                    +------+------+          │
│                                                           │                 │
│                                    SUBACOS ISTVTCOS +------+------+          │
│                                    LOGMODE N/A      │     PU      │ WA8565  (05C8)│
│                                                    +------+------+          │
│                                                           │                 │
│                                                    +------+------+          │
│                                                    │     LU      │ WA856502(05D1)│
│                                                    +-------------+          │
└─────────────────────────────────────────────────────────────────────────┘
```

▐1▌ The LU-LU sessions between the workstation and TSO have gone. The user has to log on again to the application.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ D NET,ID=RAI72TR0,E                                                        │
│ IST097I DISPLAY ACCEPTED                                                   │
│ IST075I NAME = RAI72TR0, TYPE = XCA MAJOR NODE 657                          │
│ IST486I STATUS= ACTIV, DESIRED STATE= ACTIV                                │
│ IST1021I MEDIUM=RING,ADAPNO= 0,CUA=0309,SNA SAP= 4                          │
│ IST654I I/O TRACE = OFF, BUFFER TRACE = OFF                                 │
│ IST170I LINES:                                                             │
│ IST232I L0309000, IINOP                              ▐2▌                    │
│ IST232I L0309001, IINOP                                                    │
│                     .       .                                              │
│                     .       .                                              │
│ IST232I L03090F3, IINOP                                                    │
│ IST232I L03090F4, IINOP                                                    │
│ IST314I END                                                                │
└─────────────────────────────────────────────────────────────────────────┘
```

▐2▌ Note that all DSPUs have gone IINOP. Although the XCA node is ACTIV, you will have to re-activate the XCA node to bring the DSPUs from IINOP to ACTIV state.

Note: When planning for backup, take note that each LAN adapter can handle a maximum of 255 PU sessions. With 4 LAN adapters, therefore, you can have a maximum of 1020 PU sessions during normal operations but for each failing LAN adapter, this total will be reduced by 255 sessions.

7.2.3 Recovery from Failing Token-Ring LAN Adapter

When the card has to be replaced, recovery requires manual intervention. The cards in the IBM 3172 are not hot-pluggable, which means that the recovery scenario is as follows:

1. Vary the channels to the IBM 3172 offline.

2. Power off the IBM 3172.

3. Replace the token-ring adapter.

4. Power on the IBM 3172.

5. Vary the channels online.

Note: The XCA node remains active; however the DSPUs go IINOP. After the channels are varied online and the XCA major node is activated, the DSPUs will change from IINOP to ACTIV. SNA traffic can be accepted after ICP is loaded at power on of the IBM 3172.

If the failing component is the local lobe into the token-ring LAN, then recovery is the simple replacement of the token-ring cable. You do not need to reactivate the channel or the 3172. You should re-activate the XCA major node. The SNA sessions taken over by the backup token-ring adapter will remain running via that adapter. There is no "giveback" procedure.

7.2.4 Definition Considerations

There are four areas where definitions should be reviewed. These are:

1. The host definitions as described in 7.2.4.1, "HOST Definitions."
2. The VTAM definitions as described in 7.2.4.2, "VTAM Definitions."
3. The 3172 definitions as described in 7.2.4.3, "3172 Definitions" on page 329.
4. The workstation definitions as described in 7.2.4.4, "Workstation Definitions" on page 330.

7.2.4.1 HOST Definitions

The IOCP, VM/ESA HCPRIO and MVS/ESA IODEVICE macro definitions do not really change. Each token-ring adapter requires a subchannel for VTAM sessions.

7.2.4.2 VTAM Definitions

The VTAM definitions are shown below.

Although not used in our scenario, the XCA major node for network management is shown.

```
************************************************************
**  ICP 3172 - XCA major node for 3172 network management **
************************************************************
**
RAI72X   VBUILD TYPE=XCA
**
RAI72P   PORT  CUADDR=301,MEDIUM=BOXMGR
**
RAI72G   GROUP
**
RAI72L   LINE
**
RAI72P   PU
**
```

Figure 202. XCA Major Node RAI72X for Network Management

In VTAM, you will have to define two XCA major nodes, one for each token-ring adapter.

VTAMLST member **RAI72TR0**, containing the XCA major node definition for TR0:

```
     ************************************************************************
     ** 3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR TOKEN RING ADAPTER 0    **
     ************************************************************************
     **
     RAI72TR0 VBUILD TYPE=XCA        XCA FOR 3172 TOKEN RING LAN
     **
     RAITRP0  PORT ADAPNO=0,                                            X
                   CUADDR=309,                                          X
                   MEDIUM=RING,                                         X
                   SAPADDR=4,                                           X
                   TIMER=60     ▌1▐
     **
     RAITRG0  GROUP DIAL=YES,                                           X
                   ANSWER=ON,                                           X
                   AUTOGEN=(245,L,P),                                   X
                   CALL=INOUT,                                          X
                   ISTATUS=ACTIVE
```

Figure 203. XCA Major Node RAI72TR0 for TR0

VTAMLST member **RAI72TR1**, containing the XCA major node definition for TR1:

```
     ************************************************************************
     ** 3172 MODEL 3 (ICP) - XCA MAJOR NODE FOR TOKEN RING ADAPTER 1     **
     ************************************************************************
     **
     RAI72TR1 VBUILD TYPE=XCA        XCA FOR 3172 TOKEN RING LAN
     **
     RAITRP1  PORT ADAPNO=1,                                            X
                   CUADDR=30A,                                          X
                   MEDIUM=RING,                                         X
                   SAPADDR=4,                                           X
                   TIMER=60
     **
     RAITRG1  GROUP DIAL=YES,                                           X
                   ANSWER=ON,                                           X
                   AUTOGEN=(245,L,P),                                   X
                   CALL=INOUT,                                          X
                   ISTATUS=ACTIVE
```

Figure 204. XCA Major Node RAI72TR1 for TR1

VTAMLST member **RAI72S**:

```
     **************************************************************
     **  ICP 3172 - Switched major node for network management  **
     **************************************************************
     **
     RAI72S   VBUILD MAXGRP=1,MAXNO=1,TYPE=SWNET
     **
     RAI72PU  PU    ADDR=01,IDBLK=074,IDNUM=00020,        X
                    MAXDATA=265,MAXOUT=2,MAXPATH=1
     **
     RAI72P1  PATH  CALL=INOUT,DIALNO=9904000000000000,   X
                    GID=1,GRPNM=RA72G,PID=1
     **
```

Figure 205. Switched Major Node RAI72S for Network Managment

When you use HOST-initiated sessions, you must define the switched major
node. This switched major node should contain two PATH statements each
pointing to a different token-ring adapter, but both using the same MAC address
for **each** downstream PU. If you use only workstation-initiated sessions, you do
not need to code the PATH statements and, better, you do not need to code the
switched major 2odes when you use the dynamic LU assignment by VTAM.

```
************************************************************
**  ICP 3172 - Token-ring LAN switched major node        **
************************************************************
**
RAI72TRS VBUILD MAXGRP=2,MAXNO=2,TYPE=SWNET
**
RAI72TP1 PU    ADDR=01,DLOGMOD=M2SDLCNQ,              X
               IDBLK=05D,IDNUM=32209,                 X
               ISTATUS=ACTIVE,LOGAPPL=RAIAT, 2        X
               MAXDATA=2057,MAXOUT=2,                 X
               MAXPATH=2,MODETAB=AMODETAB,            X
               PUTYPE=2,USSTAB=US327X
**
RAI2TH1 PATH  CALL=INOUT,                             X
               DIALNO=11044000000B8565, 2             X
               GID=1,GRPNM=RAITRG0,PID=1
**
RAI72TH2 PATH  CALL=INOUT,                            X
               DIALNO=11044000000B8565, 3             X
               GID=2,GRPNM=RAITRG1,PID=2
**
RAI72TL1 LU    LOCADDR=2
**
RAI72TL2 LU    LOCADDR=0,DLOGMOD=DSIL6MOD
```

Figure 206. Switched Major Node RAI72TRS for Dial Out

2 When we used the switched major node definitions as defined above, VTAM automatically brought up the session between the DSPU on the adapter with LAA 4000 000B 8565 as defined in the DIALNO and TSO (applid=RAIAT), due to the LOGAPPL statement.

3 When the lobe cable fails, the second token-ring adapter takes over the session and the call out is automatically placed over that adapter. The user only experiences a "long response time" of 60 seconds, which can be controlled with the TIMER statement (**1**) in the XCA PORT macro.

In the system log, you will see the following message:

```
IST590I  CONNECTOUT ESTABLISHED FOR PU RAI72TP1 ON LINE L030A000
LOGON
IST590I  CONNECTIN  ESTABLISHED FOR PU WB8565   ON LINE L030A0F4
```

The other workstation, not defined in the switched major node, will obtain its SSCP-PU session but not its LU-LU session.

The use of the LOGAPPL statement depends on user requirements.

7.2.4.3 3172 Definitions

We defined the two token-ring adapters with the same **locally administered addresses** (4000 021B 3172). Both adapters use a different VTAM subchannel address (309 for TR0 and 30A for TR1).

Note: We recommend that you accept the default IEEE 802.2 (LLC) parameters and functional address of C00000000080 for the first token-ring LAN adapter. This is the NetBIOS functional address used by the Operator Facility/2. Set the functional address of the second token-ring adapter to 000000000000.

```
┌─── Note ───────────────────────────────────────────────────────┐
│                                                                 │
│   We could use the same subchannel address for the two token-ring adapters │
│   but for performance reasons, we chose different addresses.    │
│                                                                 │
└─────────────────────────────────────────────────────────────────┘
```

7.2.4.4 Workstation Definitions

SNA workstations using OS/2 Communications Manager/2 do not require special definitions for this setup.

For a description of SNA workstation definitions, refer to 2.11.3.1, "Configuring Your Token-Ring LAN Adapter for SNA" on page 120.

7.3 Scenario 2 - SNA, Dual 3172, Multiple Token-Ring LAN Adapters

The following section describes the conditions, requirements, and setup considerations that are applicable when implementing a high-availability configuration for two 3172s acting as SNA gateways. Take note that this scenario is applicable only when using the 3172 with the IBM 3172 Interconnect Controller Program.
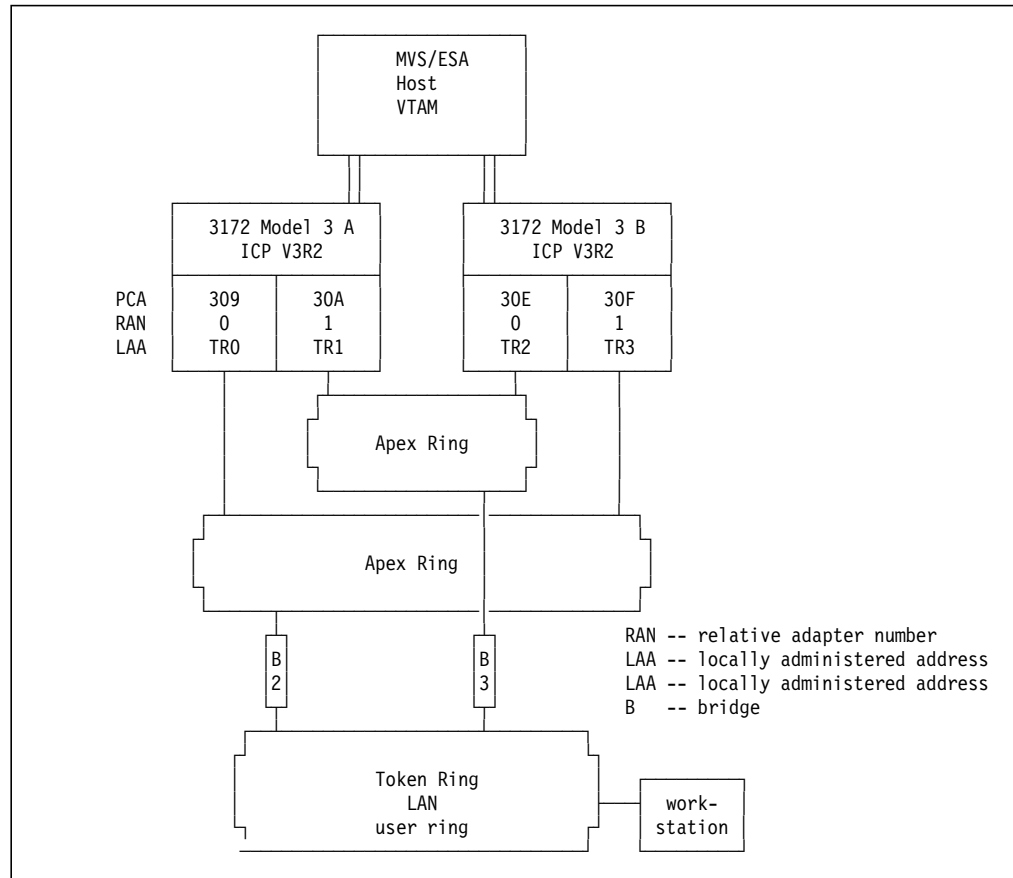
Figure 207. Scenario 2 -- SNA with Multiple 3172s with Multiple LAN Adapters

The configuration in Figure 207 shows two 3172s attached to two apex rings while the user ring is bridged to these two rings. The locally administered addresses (LAAs or MAC addresses) are duplicated in the second 3172 (MAC of TR0 = MAC of TR2, MAC of TR1 = MAC of TR3). All adapters can be active with this configuration offering bridge, apex ring, 3172 channel, 3172 LAN adapter, and 3172 controller backup.

This scenario provides backup for the token-ring adapters and their lobe attachments, for one of the 3172 systems and for one of the channel attachments.

When the failing component is either the channel attachment of 3172 A or 3172 A itself, then workstations that had sessions with host applications via 3172 A will lose these sessions. The SSCP-PU sessions will be re-established over the partner apex ring via 3172 B. Users will have to log on again to their applications.

This backup procedure and the giveback procedure after repair of the 3172 or the channel attachment are identical to the backup scenario of one 3172 with two

token-ring adapters as described in 7.2, "Scenario 1 - SNA, Single 3172, Multiple Token-Ring LAN Adapters" on page 320.

Remember:

When planning for backup, take note that each LAN adapter can handle a maximum of 255 PU sessions. With 4 LAN adapters therefore, you can have a maximum of 1020 PU sessions during normal operation. For each failing LAN adapter, this total will be reduced by 255 sessions.

7.4 Scenario 3 - TCP/IP, Single 3172, Multiple Token-Ring LAN Adapters

The following section describes the conditions, requirements, and setup considerations that are applicable when implementing a high-availability configuration for a single 3172 as a TCP/IP gateway.

```
                         ┌─────────────────┐
                         │   MVS/ESA       │
                         │   NVAS          │
                         │   TELNET        │
                         │   TCP/IP        │
                         │ TR0:IP=9.67.38.21│
                         │ TR1:IP=9.67.38.21│
                         └─────────────────┘
                                │ │
                         ┌─────────────────┐
                         │ 3172 Model 3    │
                         │ ICP V3R2        │
              PCA        ├────────┬────────┤
              RAN        │ 304-305│ 306-307│
              LAA        │   0    │   1    │
                         │  TR0   │  TR1   │
                         └────────┴────────┘
                           ┌────┐  ┌────┐
                           │ TR │  │ TR │
                           │seg-│  │seg-│
                           │ment│  │ment│
                           │582 │  │580 │
                           └────┘  └────┘      PCA -- Parallel Channel Adapter,
                                                       subchannel address
                             ┌┐    ┌┐         RAN -- relative adapter number
                             │B│   │B│
                             │3│   │2│        LAA -- locally administered address
                             └┘    └┘                TR0=4000 021B 3172
                                                      TR1=4000 021B 3172
work    Net1:  9.67.32.10                             TRA=4000 000A 8565
station 9.67.32                                       TRB=4000 0007 6000
  W3             ┌────────┐  TR LAN         B   -- Source Routing Bridge
                 │Router  │  Segment BB2            PS/2 with TCP/IP V2 for OS/2
                 │IP=     │  IP Network    ┌──────┐ IP=9.67.38.23
IP=9.67.32.23    │9.67.   │  9.67.38.0     │work- │
                 │38.10   │       LAA-TRA  │station│
                 └────────┘                │ W1   │
                                           └──────┘
                    9.24 104.81  LAA-TRB
Work                                ┌──────┐
station Net2                        │work  │ RS/6000 running AIX V3R4
  W4    9.24.104                    │station│ IP=9.67.38.75
                                    │ W2   │
IP=9.24.104.17                      └──────┘
```

Figure 208. Scenario 3 -- TCP/IP with Single 3172 with Multiple LAN Adapters

The configuration in Figure 208 shows one 3172 attached to a user ring through multiple LAN adapters and two apex rings.

The locally administered addresses (LAAs or MAC addresses) are the same for the two adapters. The IP subnetmask is 255.255.255.0.

This setup offers 3172 LAN adapter and token-ring lobe attachment backup.

Note: We chose again to use two separate token-ring segments for our token-ring adapters, so that both adapters can insert into their rings simultaneously and both can be active with this configuration.

Note also that we used the same IP address for TR0 and TR1 in MVS.

7.4.1 Normal Operation Considerations

The workstations directly attached to the 9.67.38 network maintain an ARP cache with the following information regarding the MVS Token-Ring attachments:

```
OS2 C:\>arp -a
          ARP table contents:

interface      hardware address        IP address    minutes since
                                                        last use
    0           4000021B3172           9.67.38.21      1
```

What is not shown, but also maintained in this ARP cache is the source routing information, which reveals at the link layer information detailing which bridges and segments are to be taken. On another workstation (an RS/6000) we were able to display this information with the arp -a command:

```
<rs60007># arp -a
  mvs18.itso.ral.ibm.com (9.67.38.21 ) at 40:0:2:1B:31:72 (token-ring)
  rt=6a0:5823:bb20
```

The routing information field tells everything about the MAC layer route the frames will use to get from 9.67.38.75 (the RS/6000) to 9.67.38.21:


```
6a0: Routing control field

0000 0110  1010 0000
                        ──►not used
                      ──►largest frame bits (byte 1, bit 1 to 3): information field of
                            largest frame is 2052 bytes (b'010')
                   ──►direction bit (byte 1, bit 0): read route designator fields from
                        right to left: destination (MVS18) is in segment 582.
                ──►length of routing information field (byte 0, bit 3 to 7): length
                      is 6 octets.
             ──►broadcast indicator (byte 0, bit 0 to 2): non-broadcast frame,
                  use route designator fields.

5823:bb20 : Route designator fields
    -582 is destination segment number
    -3   is bridge number
    -bb2 is origin segment
    -0   is end of route
```

Figure 209. Token-Ring Routing Information Field

The workstations, attached to other networks, maintain a route to the 9.67.38.0 network, in order to reach the MVS18 system. The routing table for W4 contains the following entries:

```
OS2 C:\>netstat -r

   destination          router     refcnt      use flags    snmp  intrf
                                                             metric
      default        9.24.104.1        0       1363    U       -1  lan0
    9.67.32.0       9.24.104.81        0          5    U       -1  lan0
   9.24.104.0       9.24.104.17        0     683095    U       -1  lan0
    9.67.38.0       9.24.104.81        0        275    U       -1  lan0
```

To reach the 9.67.38 network, route the IP traffic to the router's IP address 9.24.104.81. It is important to understand that the ARP cache of the workstations and routers only contains IP addresses of systems attached to the same broadcast network.

```
OS2 C:\>arp -a
         ARP table contents:

interface     hardware address        IP address    minutes since
                                                       last use
    0          10005ac92ceb           9.24.104.70    1
    0          400000033355           9.24.104.81    0
```

Figure 210. Partial ARP Cache of Workstation W4

It is the router attached to the 9.67.38 network that has the IP address and MAC address of MVS18 in its ARP cache.

An entry in the ARP cache is built when an IP datagram has to be sent to that destination on the same broadcast network. An ARP cache entry is deleted after it has not been used, or not successfully been used, for a number of minutes. This is a customizable parameter in MVS.

We decided to use static routing. Read 7.6.4, "Considerations when Using the Routing Information Protocol" on page 346 for dynamic routing considerations when RIP is the routing protocol.

1 The system log after activation of TCP/IP shows the two subchannel address pairs active and busy.

```
D U,,,300
IEE450I 22.02.41 UNIT STATUS 768
UNIT TYPE STATUS  VOLSER VOLSTATE   UNIT TYPE STATUS  VOLSER VOLSTATE
300  CTC  OFFLINE                   301  CTC  O
302  CTC  O                         303  CTC  O
304  CTC  A-BSY 1                   305  CTC  A 1
306  CTC  A-BSY 1                   307  CTC  A 1
308  CTC  O                         309  CTC  A
30A  CTC  A                         30B  CTC  OFFLINE
30C  CTC  OFFLINE                   30D  CTC  OFFLINE
30E  CTC  OFFLINE                   30F  CTC  OFFLINE
```

The following screen is an excerpt from the TCP/IP profile used to start this configuration. The important profile statements are:

OBEY: defines the user that can issue OBEYFILE commands.

DEVICE: defines the device that controls one or more links and relates them to a subchannel address pair.

LINK: defines the LAN adapters and relates them to a device.

HOME: defines the IP address of each link.

GATEWAY: defines the routes to networks and hosts and indicates which link should be used to reach them.

START/STOP: starts and stop the devices.

```
;      ALLOW USE OF OBEYFILE COMMAND FOR FOLLOWING USERS:
;      ===================================================
OBEY
  RESIDENT                         ; USER RESIDENT CAN ISSUE OBEY COMMANDS,
ENDOBEY
;
; HARDWARE DEFINITIONS:
; ====================
;
;    *************************************************************
;    *            3172 Model 3 attachments: ICP box             *
;    *************************************************************
;          ------------------------------
;          |          TCPIP18           |
;          | IP addr: 9.67.32.21  = EN302 |
;          | IP addr: 9.67.38.21  = TR304 |
;          | IP addr: 9.67.38.21  = TR306 |
;          ------------------------------
;                || CHU subaddress 302-303 -->EN302 (TCPIP18)
;                || CHU subaddress 304-305 -->TR304 (TCPIP18)
;                || CHU subaddress 306-307 -->TR306 (TCPIP18)
;          -----------------------
; ChAd nbr |         300         |
; Slot nbr |         #4          |
;          |     3172 Model 3    |
;          |       ICP V3.2      |
; Dev to   |  EN302 TR304 TR306  |
; chan     |  302   304   306    |
; Rel adp  |  0     0     1      |
; number   |                     |
; Slot     |  2     3     7      |
;          -----------------------
; MACs:    |     |     | 4000 021B 3172
;                |       4000 021B 3172
;                   4000 012B 3172
;    =========================
;   | Token Ring DEFINITIONS: |
;    =========================
; Link TR304 is Token ring on network 9.67.38.21 using device ICPTR304
; Link TR306 is Token ring on network 9.67.38.21 using device ICPTR306
; Device ICPTR304 is a Lan Channel Station using subchannels 304-305
; Device ICPTR306 is a Lan Channel Station using subchannels 306-307
;
  DEVICE ICPTR304 LCS            304   NETMAN
  LINK   TR304 IBMTR            0    ICPTR304
;
  DEVICE ICPTR306 LCS            306   NETMAN
  LINK   TR306 IBMTR            1    ICPTR306 ;
HOME
; Local host's Internet addresses
; *************************************************************
; * 3172 Model 3 for 3172 residency  ICP                     *
; *************************************************************
    9.67.38.21     TR304        ; MAC=4000 021B 3172
    9.67.38.21     TR306        ; MAC=4000 021B 3172
;
GATEWAY                                                           1
; *************************************************************
  9.67.38.75   = TR304   DEFAULTSIZE   HOST ; TKR     RS60007
  9.67.38.24   = TR304   DEFAULTSIZE   HOST ; TKR     PS/2 A8565
  9.67.38.23   = TR306   DEFAULTSIZE   HOST ; TKR     PS/2 B8565
; *************************************************************
; *   Three host routes to IP hosts in the same IP network   *
; *   IP traffic for 9.67.38.75 is directed over TR304        *
; *   IP traffic for 9.67.38.24 is directed over TR304        *
; *   IP traffic for 9.67.38.23 is directed over TR306        *
; *************************************************************
  9    =         TR304   DEFAULTSIZE  0.255.255.0   0.67.38.0
  9  9.67.38.10 TR304   DEFAULTSIZE  0.255.255.0   0.67.32.0
  9  9.67.38.10 TR306   DEFAULTSIZE  0.255.255.0   0.24.104.0
; *************************************************************
; *   One network route to direct attached network 9.67.38   *
; *   Two network routes to the networks 9.67.32 and 9.24.104 *
; *   IP traffic for 9.67.32 is directed over TR304           *
; *   IP traffic for 9.24.104 is directed over TR306          *
; *************************************************************
; ----------------------------------------------------
  START ICPTR304           ; 3172-3 T/R    (ICP)
  START ICPTR306           ; 3172-3 T/R    (ICP)
```

Notes:

1. To some extent, load sharing can be achieved for **outbound** IP traffic. In the TCP/IP GATEWAY statement, you may direct part of the IP traffic for certain nets and hosts over adapter 0 and another part over adapter 1. There is little control over the flow of **inbound** IP traffic. The adapter through which inbound IP traffic will flow depends on the ARP resolution of the workstation. The adapter's all-routes-broadcast response that reaches the workstation first will be the adapter of choice for all IP traffic from that workstation until the workstation's ARP table is flushed.

2. MVS TCP/IP uses the **IP address of the link** as the home IP address to which it wants responses sent, when it constructs IP datagrams for hosts on the network **directly attached to that link** .

   MVS TCP/IP uses the **first IP address in the home list** to indicate the home IP address to which it wants responses sent, when it constructs IP datagrams for hosts on non-adjacent networks.

   The PRIMARY INTERFACE parameter in the TCP/IP profile can be used to insert an IP address of another link for all IP datagrams sent to hosts on **non-adjacent** networks (as shown in Figure 208 on page 333: NET1 and NET2). The result of this definition is that all responses from remote network hosts will be sent to the specified IP address. The remote hosts need only to be aware of one MVS TCP/IP IP address and a route to get there. As we use the same IP address for both token-ring LAN links, this definition doesn't give us any further control over the flow of inbound traffic.

3. The routing information of the GATEWAY statement is read sequentially. This means that you cannot point to two links (TR304 and TR306) when you define a route to a specific host or network; only the last entry to this host or network is retained. Thus, you **always** have to issue an OBEYFILE command to change the routing when one of the links goes down.

4. The three host definitions shown, direct outbound traffic explicitly over the indicated links. Other hosts in these IP subnetworks will be directed over the link TR304 as indicated in the network routing statement. This provides you with a means to **distribute outbound host traffic** statically over the interfaces.

5. The three network routing statements direct outbound traffic to the defined networks over the indicated links. This provides you with a means to **distribute outbound network traffic** statically over the interfaces.

Once the TCP/IP stack is loaded, you can display the status of the defined links with the NETSTAT DEVLINKS command.

```
===> netstat devlinks

TCPNET267I MVS TCP/IP Netstat V2R2.1
TCPNET245I
TCPNET246I Device ICPTR304          Type: LCS          Status: Ready
TCPNET252I Queue size: 0            Address: 0304
TCPNET120I    Link TR304            Type: IBMTR        Net number: 0
TCPNET245I
TCPNET246I Device ICPTR306          Type: LCS          Status: Ready
TCPNET252I Queue size: 0            Address: 0306
TCPNET120I    Link TR306            Type: IBMTR        Net number: 1
***
```

The NETSTAT GATE command shows the routing information that TCP/IP in MVS maintains:

```
===> netstat gate


NetAddress      FirstHop        Link      Pkt Sz  Subnet Mask   Subnet
----------      --------        ------    ------  -----------   -------
9.0.0.0         9.67.38.10      TR306     Default 0.255.255.0   0.24.10
9.0.0.0         9.67.38.10      TR304     Default 0.255.255.0   0.67.32
9.0.0.0         <direct>        TR304     Default 0.255.255.0   0.67.38
9.67.38.23      <direct>        TR306     Default HOST
9.67.38.24      <direct>        TR304     Default HOST
9.67.38.75      <direct>        TR304     Default HOST
***
```

7.4.2 Failure of the Token-Ring LAN Adapter

We simulated a lobe cable failure for TR0. This caused the following message in the system log.

```
TCPPKT089E Device ICPTR304: LAN task net type 2 adapter number 0 has
died
```

A user at a workstation using TN3270, for instance, will note that keystrokes remain unanswered.

7.4.3 Recovery from Failing Token-Ring LAN Adapter

Before diagnosing the failure of the token-ring LAN attachment, you can switch over to the backup token-ring adapter.

To switch over to the backup token-ring adapter, issue the following OBEYFILE command:

```
ENTER TSO COMMAND, CLIST, OR REXX EXEC BELOW:

===> OBEYFILE 'tcpip.itsc.obey(backup)'

TCPOBE001I MVS TCP/IP OBEYFILE
TCPOBE009I Requesting TCPIP to accept 'TCPIP.ITSC.OBEY(BACKUP)'
TCPOBE007I File 'TCPIP.ITSC.OBEY(BACKUP)' has been read and obeyed
***
```

This OBEYFILE command stops the failing token-ring LAN adapter and switches routes to the token-ring LAN adapter that is still operational.

This is the content of our OBEYFILE:

```
  ARPAGE 1                      ; Set ARP table entry timeout to 1 minute
  STOP  ICPTR304                ; 3172-3 T/R     (ICP)
;
GATEWAY
; ******************************************************************
  9.67.38.75   = TR306  DEFAULTSIZE   HOST ; TKR      RS60007
  9.67.38.23   = TR306  DEFAULTSIZE   HOST ; TKR      PS/2 B8565
  9.67.38.24   = TR306  DEFAULTSIZE   HOST ; TKR      PS/2 A8565
  9            = TR306  DEFAULTSIZE   0.255.255.0 0.67.38.0  ; Local net
  9  9.67.38.10  TR306  DEFAULTSIZE   0.255.255.0 0.67.32.0  ; Enet
  9  9.67.38.10  TR306  DEFAULTSIZE   0.255.255.0 0.24.104.0 ; MPN
```

Although the MAC addresses of TR304 and TR306 are the same, the ARP tables
maintained by the workstations and routers connected to the 9.67.38.0 network
do not yet contain the correct token-ring routing information. Users of these
systems now need to change the ARP cache entries. They can achieve this in
one of two ways:

1. Wait until the ARP cache entry times out. When an entry is not used for a
   specific time, or when the transmission to the IP address in that ARP cache
   entry is unsuccessful for a specific time, the entry will be deleted. In MVS
   TCP/IP you can set this timeout (default is five minutes). In OS/2 TCP/IP, this
   value is fixed at twenty minutes. In AIX RS/6000 TCP/IP, the default timeout
   value is 20 minutes. This timeout value can be changed to, for instance 3
   minutes, with the command:

   ```
   <rs60007e># no -o arpt_killc=3
   ```

2. You can also ask the users of workstations and routers directly attached to
   the 9.67.38.0 network to flush their ARP tables if you do not want to wait for
   the ARP cache entry to time out.

After you issue the OBEYFILE command in MVS and after the workstation and
routers in the 9.67.38.0 network have deleted their ARP entry, you can issue a
ping to all the systems in the network to create correct ARP cache entries in
MVS and in the systems on the 9.67.38.0 network.

Note: Some implementations will overwrite their ARP cache entry for an IP host
if they receive from that host an IP datagram with different MAC layer
information. If your workstations and routers behave like this, you might
issue a broadcast ping to these direct attached systems to trigger the
ARP cache update. OS/2 TCP/IP and AIX RS/6000 TCP/IP
implementations behave like this.

You cannot flush the ARP cache in MVS; however, you can set the timeout
temporarily to a low value (1 minute) in the same OBEYFILE as shown above.

In the system log, a few messages appear when the OBEYFILE command is
issued. The reason for the "dropping packet" message is that TCP/IP has
received an ARP request, but cannot respond. This is because the adapter card
ICPTR306 has not yet reported its 48-bit MAC address. After initialization of the
adapter this message will disappear.

```
TCPPC3082E PCCA3 shutting down:
TCPPKT038E Device ICPTR306: Dropping packet for link TR306 -- don't know
 home hardware address
TCPPKT038E Device ICPTR306: Dropping packet for link TR306 -- don't know
 home hardware address
TCPPKT038E Device ICPTR306: Dropping packet for link TR306 -- don't know
 home hardware address
TCPPKT038E Device ICPTR306: Dropping packet for link TR306 -- don't know
 home hardware address
```

IP traffic will flow through the active token-ring adapter. When TCP/IP is restarted or another OBEYFILE command is issued that re-activates the first token-ring adapter and redefines the routes, both adapters will share the traffic again. The following OBEYFILE does this:

```
  START ICPTR304            ; 3172-3 T/R     (ICP)
;
GATEWAY
; ****************************************************************
  9.67.38.75   = TR304   DEFAULTSIZE   HOST ; TKR      RS60007
  9.67.38.23   = TR304   DEFAULTSIZE   HOST ; TKR      PS/2 B8565
  9.67.38.24   = TR306   DEFAULTSIZE   HOST ; TKR      PS/2 A8565
  9            = TR304   DEFAULTSIZE   0.255.255.0  0.67.38.00  ; Local Net
  9  9.67.38.10  TR304   DEFAULTSIZE   0.255.255.0  0.67.32.00  ; Enet
  9  9.67.38.10  TR306   DEFAULTSIZE   0.255.255.0  0.24.104.00 ; MPN
;
```

Our scenario is built around a lobe cable failure. If your diagnosis indicates a failing token-ring adapter, then recovery requires manual intervention. The card has to be replaced. The adapters in the IBM 3172 are not hot-pluggable, which means that the recovery sequence is as follows:

1. Vary the channels to the IBM 3172 offline.

2. Power off the IBM 3172.

3. Replace the token-ring LAN adapter.

4. Power on the IBM 3172.

5. Vary the channels online.

7.4.4 Definition Considerations

7.4.4.1 Host Definitions
The IOCP, VM/ESA HCPRIO and MVS/ESA IODEVICE macro definitions do not change.

7.4.4.2 3172 Definitions
We defined the two token-ring adapters with the *same* locally administered MAC address.

7.4.4.3 Workstation Definitions

TCP/IP workstations do not require special definitions.

For a description of the TCP/IP workstation definitions, refer to 2.11.3.1, "Configuring Your Token-Ring LAN Adapter for SNA" on page 120.

7.5 Scenario 4 - TCP/IP, Dual 3172, Multiple Token-Ring LAN Adapters

The following section describes the conditions, requirements and setup considerations that are applicable when implementing a high-availability configuration for two 3172s acting as TCP/IP gateways.

The configuration in Figure 211 on page 342 shows two 3172s attached to the user ring through multiple LAN adapters and four apex rings. This configuration provides the following backup capabilities:

1. Channel adapters and link
2. 3172 system
3. Token-ring adapters
4. Token-ring lobe cables and apex segments
5. Token-ring bridges.

The locally administered addresses (LAAs or MAC addresses) can be the same for all the adapters on the 3172s. All adapters can then still insert into the ring simultaneously. We chose to use different MAC addresses for the token-ring adapters in one 3172. As we have seen in the previous section, the duplication of MAC addresses doesn't offer a significant advantage. You still need to update the ARP cache of workstations and routers when a token-ring adapter goes down, to change the token-ring routing information, even when the MAC address and IP address remain the same.

```
┌─────────────────────────────────────────────────────────────────────────┐
│                          ┌──────────────────────────┐                     │
│                          │         MVS/ESA          │                     │
│                          │          NVAS            │                     │
│                          │         TELNET           │                     │
│                          │         TCP/IP           │                     │
│                          │    TR0 IP=9.67.38.21     │                     │
│                          │    TR1 IP=9.67.38.22     │                     │
│                          │    TR2 IP=9.67.38.21     │  RAN -- relative adapter number   │
│                          │    TR3 IP=9.67.38.22     │  LAA -- locally-administered address │
│                          └──────────────────────────┘                     │
│                                                                           │
│              ┌──────────────────────┐   ┌──────────────────────┐          │
│              │  3172 Model 3   A     │   │  3172 Model 3   B     │          │
│              │      ICP V3.2         │   │      ICP V3.2         │          │
│       PCA    │ 304-305 │ 308-309     │   │ 306-307 │ 310-311     │          │
│       RAN    │   0     │   1         │   │   0     │   1         │  TR0=4000 021A 3172  │
│       LAA    │  TR0    │  TR1        │   │  TR2    │  TR3        │  TR1=4000 022A 3172  │
│              └─────────┴──────────── ┘   └─────────┴──────────── ┘  TR2=4000 021A 3172  │
│                 ┌────┐   ┌────┐           ┌────┐   ┌────┐         TR3=4000 022A 3172  │
│                 │ TR │   │ TR │           │ TR │   │ TR │                   │
│                 │segm│   │segm│           │segm│   │segm│                   │
│                 │ent │   │ent │           │ent │   │ent │                   │
│                 │BB1 │   │BB2 │           │580 │   │581 │                   │
│                 └────┘   └────┘           └────┘   └────┘                   │
│                  ┌─┐     ┌─┐               ┌─┐     ┌─┐                      │
│                  │B│     │B│               │B│     │B│                      │
│                  │1│     │2│               │3│     │4│                      │
│                  └─┘     └─┘               └─┘     └─┘                      │
│                                                                           │
│   ┌──────┐  ┌────────┐         ┌───────────┐                              │
│   │ work │  │ Net1:  │         │  TR Seg-3 │                              │
│   │statio│──│9.67.32 │         │  Net0:    │                              │
│   │n  W3 │  │        │         │  9.67.38  │                              │
│   └──────┘  └────────┘ ┌──────┐│  TR-LAN   │              ┌──────┐  PS/2 with TCP/IP V2 │
│                        │Router││           │ LAA-TR1      │work- │  for OS/2            │
│   IP=9.67.32.23        └──────┘│           │──────────────│statio│  IP=9.67.38.23       │
│                                │           │              │n  W1 │                      │
│                                │           │ LAA-TR2      └──────┘                      │
│                        ┌──────┐│           │                                            │
│   ┌──────┐             │Router││           │                                            │
│   │ Work │  ┌────────┐ └──────┘└───────────┘                                            │
│   │statio│──│ Net2   │         ┌──────┐  RS/6000 with AIX V3.2.4                         │
│   │n  W4 │  │9.24.104│         │ work │  IP=9.67.38.75                                   │
│   └──────┘  └────────┘         │statio│                                                 │
│                                │n  W2 │                                                 │
│   IP=9.24.104.17               └──────┘                                                 │
└───────────────────────────────────────────────────────────────────────────┘
```

Figure 211. Scenario 4 -- TCP/IP with Multiple 3172s with Multiple LAN Adapters

You can allocate a separate IP address to each link in TCP/IP MVS. In that case,
the workstation user needs to be aware of the other addresses in case the
token-ring adapter used, fails.

You might want to allocate one identical IP address to all four links. This gives
you some outbound load balancing capabilities as mentioned in the previous
section. It also takes away the need to know more than one IP address by the
end users. Some delay may be introduced during the backup procedure as ARP
caches need to be refreshed, although sessions (like telnet) may continue where
they were interrupted if alternate route discovery stays within the application
inactivity timeout limits.

We allocated the same IP address twice. One time on each 3172 as shown in
Figure 211. This give some more control on inbound IP traffic. Other
considerations are:

1. Although you can assign one IP address to two different links, a takeover of
   one token-ring adapter by the second one still requires an update of the ARP

cache in the workstations and routers, due to the change in token-ring MAC layer routing information.

2. In the unlikely case that at one point in time both token-ring adapters belonging to one IP address fail, the workstation users will have to access the MVS system using the second IP address and, therefore, network recovery will not be totally transparent to them.

The host definition in the TCP/IP profile will be similar to the single 3172 scenario with some minor changes according to the configuration shown in Figure 211 on page 342 (take note of the IP and subchannel address assignments).

```
; ****************************************************************
; * HARDWARE DEFINITIONS:                                        *
; ****************************************************************
;
  DEVICE ICPTR304  LCS           304    NETMAN
  LINK   TR304  IBMTR        0      ICPTR304
;
  DEVICE ICPTR306  LCS           306    NETMAN
  LINK   TR306  IBMTR        1      ICPTR306
;
  DEVICE ICPTR308  LCS           308    NETMAN
  LINK   TR308  IBMTR        1      ICPTR308
;
  DEVICE ICPTR310  LCS           310    NETMAN
  LINK   TR310  IBMTR        1      ICPTR310 ;
HOME
;
; ****************************************************************
; * 3172 Model 3 for 3172 residency  ICP                        *
; ****************************************************************
     9.67.38.21     TR304      ; MAC=4000 021A 3172
     9.67.38.21     TR306      ; MAC=4000 021A 3172
     9.67.38.22     TR308      ; MAC=4000 022A 3172
     9.67.38.22     TR310      ; MAC=4000 022A 3172
;
GATEWAY
; ****************************************************************
  9.67.38.75   = TR304   DEFAULTSIZE   HOST ; TKR     RS60007
  9.67.38.24   = TR306   DEFAULTSIZE   HOST ; TKR     PS/2 A8565
  9.67.38.23   = TR308   DEFAULTSIZE   HOST ; TKR     PS/2 B8565
  9            = TR304   DEFAULTSIZE   0.255.255.0   0.67.38.0
  9  9.67.38.10 TR304   DEFAULTSIZE   0.255.255.0   0.24.104.0
  9  9.67.38.10 TR308   DEFAULTSIZE   0.255.255.0   0.67.32.0
  9  9.67.38.10 TR306   DEFAULTSIZE   0.255.255.0   0.67.46.0
;
; --------------------------------------------------
  START ICPTR304            ; 3172-3 T/R    (ICP)
  START ICPTR306            ; 3172-3 T/R    (ICP)
  START ICPTR308            ; 3172-3 T/R    (ICP)
  START ICPTR310            ; 3172-3 T/R    (ICP)
```

The backup procedure and the giveback procedure after the repair of the 3172 or the channel attachment are identical to the backup scenario of one 3172 with two token-ring adapters as described in 7.4, "Scenario 3 - TCP/IP, Single 3172, Multiple Token-Ring LAN Adapters" on page 333.

7.6 Scenario 5 - TCP/IP, Single 3172, Multiple Ethernet LAN Adapters

The following section describes the conditions, requirements and setup considerations that are applicable when implementing a high-availability configuration for a single 3172 acting as a TCP/IP gateway on an Ethernet LAN.
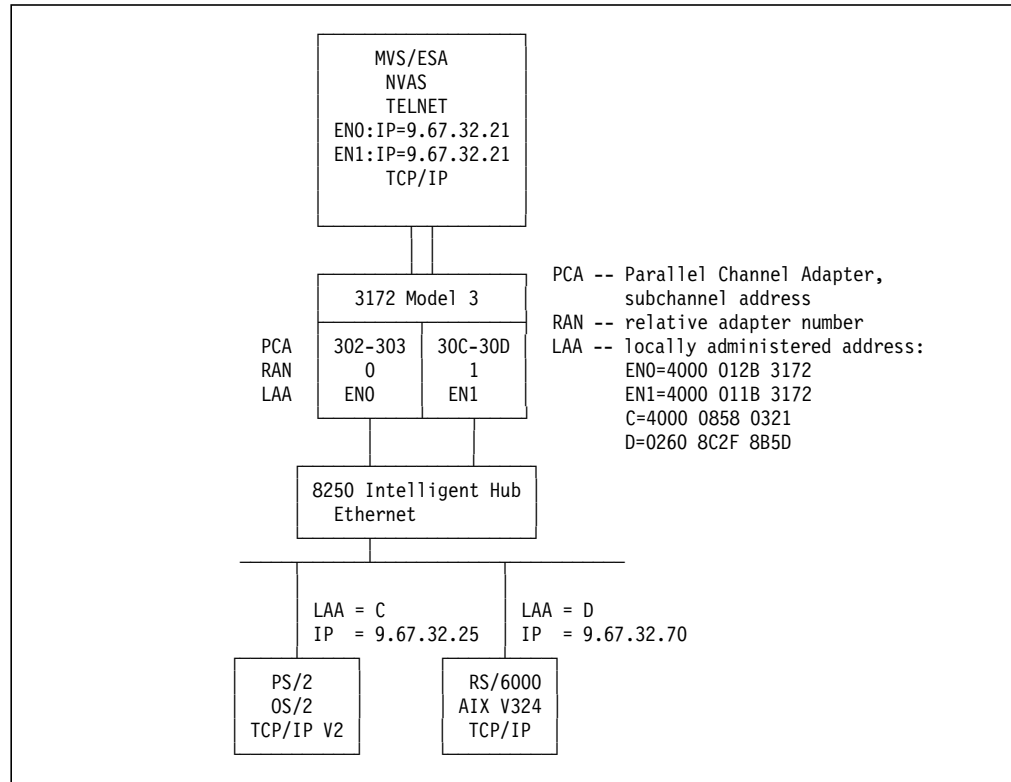
Figure 212. Scenario 5 -- TCP/IP with Single 3172 with Multiple Ethernet LAN Adapters

The configuration in Figure 212 shows one 3172 attached to the Ethernet LAN through multiple adapters. The locally-administered addresses (LAAs or MAC addresses) are different for the two Ethernet adapters EN0 and EN1. Both adapters can insert into the Ethernet segment simultaneously, and both can be active with this configuration. The 8250 Intelligent Hub is inserted to build a star-shaped network. All the segments connected to the hub take part in the single Ethernet LAN.

The 3172 Ethernet devices EN0 and EN1 have different MAC addresses, but have the same IP address in TCP/IP for MVS.

With static routing statements, the outbound traffic is spread over the two adapters.

This setup offers 3172 LAN adapter backup.

7.6.1 Normal Operation Considerations

Under normal operation, the two Ethernet adapters can share the outbound traffic.

The inbound traffic will be spread over the two Ethernet adapters, based on the ARP resolution obtained by other systems on the Ethernet LAN. It is possible for

inbound IP traffic from the PS/2 to arrive through adapter EN1 and outbound traffic for the PS/2 to be routed back through adapter EN0.

7.6.2 Failure and Recovery of the Ethernet LAN Adapter

Pulling the terminator of an Ethernet LAN segment results in the following message in the MVS system log:

```
TCPPKT089E Device ICPEN302: LAN task net type 1 adapter number 0 has
died
```

The 3172 writes a message to the ICP log.

Part of the 3172 user community can no longer be reached. Users experience no response from the host when they use telnet. The TCP/IP routing table in MVS points to a defective Ethernet adapter segment.

The MVS operator has to issue an OBEYFILE command to stop the defective Ethernet LAN adapter and to activate the other routes. This is exactly the same procedure as described in 7.4.3, "Recovery from Failing Token-Ring LAN Adapter" on page 338.

Note: You may want to ping all the networks that are affected by the re-routing. This will result in an update of the ARP cache of the TCP/IP systems attached to these networks. If you do not do this, the users of these systems will have to flush their ARP cache.

7.6.3 Definition Considerations

7.6.3.1 Host Definitions

We used the same IP address and a different MAC address for the two Ethernet LAN adapters of the 3172. You may also consider the use of only one active Ethernet adapter at a time. In this case the backup adapter may have the same MAC address as the active adapter. Here, the IBM 8250 intelligent hub can be a useful control device.

Upon failure of the active adapter, the operator issues an OBEYFILE command that stops the failing adapter, then defines and starts the backup adapter on the same IP address. On the 8250, a command is issued that detaches the segment with the failing adapter and then attaches the segment to the backup Ethernet LAN adapter. This command can be issued from the 8250 console, Intelligent Hub Management Product/6000 or an SNMP manager in the network, such as NetView/6000.

7.6.3.2 3172 Definitions

No special 3172 ICP definitions are required to make this backup scenario work.

7.6.3.3 Workstation Definitions

No special workstation LAPS or TCP/IP definitions are required to make this backup scenario work.

7.6.4 Considerations when Using the Routing Information Protocol

When you use RIP or Routing Information Protocol, consider that:

- MVS TCP/IP's RouteD recognizes one link per IP network. A second link into the same network (like in Figure 208 on page 333, TR0 and TR1) will not be recognized and its existence will not be distributed to other RouteD processes. Even if the first link fails, the second link will not be recognized.

- RIP requires a uniform subnetmask in all the networks that are connected together and that use RIP to exchange routing information.

- RIP cannot be used with networks where any path goes through more then 15 gateways (maximum hopcount).

- RIP cannot adapt to changes in network load.

- RIP cannot discriminate between network speeds.

- Point to point links cannot be managed by RouteD, unless a RouteD server is running on the host on the other end of the link. If the other host is not running RouteD, the RouteD server will not receive updates over that link, and will assume the link is down.

- RIP updates to routing table entries are normally broadcast to neighbor gateways every 30 seconds. If no broadcast received within 180 seconds from a neighbor, all routes using that link to the neighbor will be marked unreachable. If you reduce these time values, it will generate more routing information network traffic. If you extend that time, recoveries from failures can become unacceptably long.

- MVS TCP/IP's RouteD provides you with the means to dynamically maintain network routes **and** static host and network routes. The static host and network route information is maintained in the ETC.GATEWAYS file. The static route information is of local significance only. This routing information is not forwarded to other RIP routers. Using static route information allows you to better balance the network traffic load over the token-ring LAN adapters. Unfortunately the static route definitions of RouteD do not allow you to specify a linkname (for example: ICPTR306). The IP address is to be used. Hence load balancing of outbound traffic over multiple adapters into one network is not possible.

RIP and SNALINK or a CTC between two MVS TCP/IP installations can be a solution to automate the backup and recovery of a failing 3172 connection. The scenario in Figure 213 on page 347 shows a possible setup of a network that provides backup for:

1. Channel cable

2. Channel adapter in 3172

3. Token-ring adapter

4. Token-ring lobe cable

In all TCP/IP routers in this network, RIP is running. Under normal circumstances, the routing tables will be built by the RouteD processes as shown in column 2 of Table 17 on page 348.

Upon failure of token-ring adapter TR0 of the 3172, the RIP router in MVS18 will discover that the link is no longer available and it will update its routing tables accordingly. The other RIP routers will also update their tables as a result of that.

When all routers have updated their tables, the routing entries will be as shown in column 3 of Table 17 on page 348.

Note that this process is automatic and that the **non-adjacent workstations** (like WS2) do not have to be aware of any duplication in the network. The directly attached workstations like WS1 still need to know backup IP addresses (in this case 9.67.52.1 for MVS18 and 9.67.52.2 for MVS20).
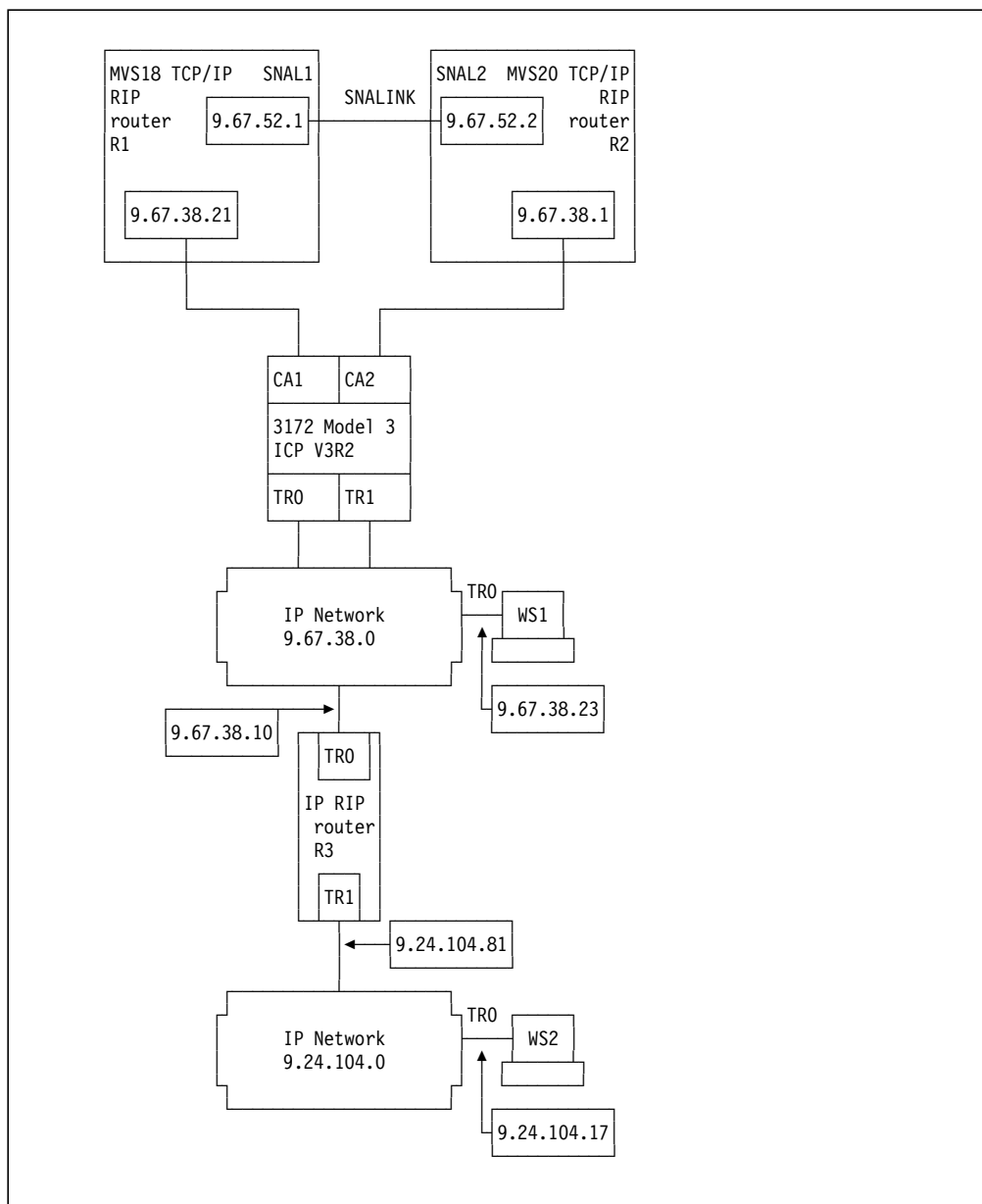
Figure 213. Using a SNALINK and RIP to Provide a Backup Route

Note: Instead of SNALINK, a CTC or any other IP link could be used, as long as RIP routing updates can be sent across that link.

The routing tables maintained by the routers and workstations before and after failure of TR0 in the 3172, or its network attachment, or the channel to MVS18, is shown in the table Table 17 on page 348.

Table 17. RIP Routing Tables Maintained by the RouteD Processes		
Routing table entry for Network: **1**	Points to before failure of TR0	Points to after failure of TR0
RIP router in MVS18		
9.67.38.0	9.67.38.21-TR0	9.67.52.2-SNAL1
9.67.52.0	9.67.52.1-SNAL1	9.67.52.1-SNAL1
9.24.104.0	9.67.38.10-TR0	9.67.52.2-SNAL1
RIP router in MVS20		
9.67.38.0	9.67.38.1-TR1	9.67.38.1-TR1
9.67.52.0	9.67.52.2-SNAL2	9.67.52.2-SNAL2
9.24.104.0	9.67.38.10-TR1	9.67.38.10-TR1
RIP router in PS/2 router		
9.67.38.0	9.67.38.10-TR0	9.67.38.10-TR0
9.67.52.0	9.67.38.21-TR0	9.67.38.1-TR0
9.24.104.0	9.24.104.81-TR1	9.24.104.81-TR1
Routing table in WS1		
9.67.38.0 **2**	9.67.38.23-TR0	9.67.38.23-TR0
9.67.52.0 **3**	9.67.38.1-TR0	9.67.38.1-TR0
9.24.104.0	9.67.38.10-TR0	9.67.38.10-TR0
Routing table in WS2		
9.67.38.0	9.24.104.81-TR0	9.24.104.81-TR0
9.67.52.0	9.24.104.81-TR0	9.24.104.81-TR0
9.24.104.0	9.24.104.17-TR0	9.24.104.17-TR0

1 You should read the table columns as follows: To reach network X in column one use the IP address Y and the link that attaches to the network to which that IP address belongs, as mentioned in column two or three.

2 The first routing entry in the routing table of WS1 points to its own network. In case TR0 is up, WS1 can use 9.67.38.21 to reach TCP/IP applications in MVS18.

3 The second routing entry in the routing table of WS1 points to network 9.67.52.0. In case TR0 is down, WS1 can use 9.67.52.1 to reach TCP/IP applications in MVS18 via MVS20. In case TR1 fails, WS1 can still access MVS20 through its 9.67.52.2 interface via MVS18.

7.6.5 Considerations when Using Offload

All the sockets are in the IBM 3172 Interconnect Controller. That means that when the IBM 3172 Interconnect Controller fails, all the user sessions fail. They cannot be taken over by a backup 3172.

It is not possible to use the OBEYFILE command to change the IP address of the adapter in the IBM 3172 Interconnect Controller. You will have to issue the changes through the OS/2 TCP/IP configurator and you will have to restart TCP/IP in the host with a new profile.

Load balancing through multiple interfaces connected to the same subnetwork is not possible. Each adapter in the 3172 should connect to a different IP subnetwork.

You can use the PRIMARY INTERFACE statement to force responses from non-adjacent hosts to the IP address of the 3172 offload system. Be aware that

when you use the IP address of the 3172 as the PRIMARY INTERFACE, responses received via other links into MVS (like an SNALINK) will be routed through MVS over the channel to the 3172 offload system and then back up through the channel again to the MVS host application.

7.6.6 Considerations when Using a Domain Name Server

The solution to all the routing issues discussed in this section might well be the Domain Name Server (DNS).

A client on the network will use the name of the MVS system as it is registered in the DNS to build a connection for a TCP/IP application like telnet or FTP. The MVS TCP/IP system is registered in the DNS with multiple IP addresses under that name. The DNS returns to the client the list of IP addresses under which the MVS TCP/IP system can be reached. It is the responsibility of the client to step through this list in order to build a successful connection with the MVS TCP/IP application. Doing so, the failure of a token-ring adapter in the 3172 becomes invisible to the end user.

Appendix A. Blank Worksheets

This appendix contains configuration worksheets for the three 3172 operating environments covered in this book:

- Interconnect Controller Program

- Offload of TCP/IP

- Multiprotocol Extensions (MPE)

Make copies of the worksheets relevant to your environment and enter the configuration parameters. This information is needed for the IBM 3172 Interconnect Controller Model 3 configuration.

A.1 Worksheets for 3172 Interconnect Controller Program

IBM 3172 Profile Worksheet

Date: _____ / _____ / _____   **Signature:** _____

IBM 3172 System Information ───

System name given to this IBM 3172: _____

IBM 3172 Profile name: _____

Type of IBM 3172:

☐ 3172-2 LAN Gateway
☐ 3172-3 LAN Gateway

Interconnect Enhancement Feature:

☐ Yes
☐ No

Operator Facility LAN adapter:

☐ Relative adapter 0
☐ Relative adapter 1
☐ No LAN connection

User data: _____

Location: _____

Figure 214. IBM 3172 System Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Parallel Channel Adapter Information ─────────────────────────────

Channel adapter name: _____

Slot number: _____

Transfer mode and
channel transfer speed:

☐ DC Interlock
☐ 2 Mb data streaming
☐ 3 Mb data streaming
☐ 4.5 Mb data streaming

SNA management services:

☐ Yes
☐ No

VTAM IDNUM: _____

Reporting subchannel: _____

Figure 215. Parallel Channel Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

ESCON Channel Adapter Information ——————————————————————————

Channel adapter name: _____

Slot number: _____

SNA Management Services: ☐ Yes
                           ☐ No

VTAM IDNUM: _____

Logical Path Information

Link Address: _____

CU Logical Address: _____

Device Address: _____

Figure 216. ESCON Channel Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Token-Ring 16/4 Adapter Information ————————————————————————————

Adapter name: _____   Relative adapter number: _____

Slot number: _____

Node address: _____

Data rate:

    ☐ 4 Mbps
    ☐ 16 Mbps

IEEE 802.2 (LLC) parameters:

    Response timer (T1) _____

    Acknowledgement timer (T2) _____

    Inactivity timer (Ti) _____

To Operator Facility:

    ☐ Yes
    ☐ No

Combined Functional Addresses

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Figure 217. Token-Ring 16/4 Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ ⁄_____ ⁄_____   **Signature:** _____

Ethernet/802.3 Adapter Information ──────────────────────────────

Adapter name: _____   Relative adapter number: _____

Slot number: _____

Node address: _____

Transceiver type:

☐ DIX
☐ BNC

Receive mode:

☐ S
☐ P

IEEE 802.2 (LLC) parameters:

Response timer (T1) _____

Acknowledgement timer (T2) _____

Inactivity timer (Ti) _____

To Operator Facility:

☐ Yes
☐ No

Multicast addresses:

Address 1: _____   Address 2: _____

Address 3: _____   Address 4: _____

Address 5: _____   Address 6: _____

Address 7: _____   Address 8: _____

Figure 218. Ethernet/802.3 Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Model 2 FDDI Adapter Information ————————————————————————

Adapter name: _____   Relative adapter number: _____

Slot number: _____

Node address: _____

IEEE 802.2 (LLC) parameters:

    Response timer (T1)   _____

    Acknowledgement timer (T2)   _____

    Inactivity timer (Ti)   _____

Group addresses:

    Address 1: _____   Address 2: _____

    Address 3: _____   Address 4: _____

    Address 5: _____   Address 6: _____

    Address 7: _____   Address 8: _____

Figure 219. Model 2 FDDI Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

Model 3 FDDI Adapter Information ————————————————————————

Adapter name: _____   Relative adapter number: _____

Slot number: _____

Node address: _____

PMF password: _____

IEEE 802.2 (LLC) parameters:

    Response timer (T1)   _____

    Acknowledgement timer (T2)   _____

    Inactivity timer (Ti)   _____

Group addresses:

    Address 1: _____   Address 2: _____

    Address 3: _____   Address 4: _____

    Address 5: _____   Address 6: _____

    Address 7: _____   Address 8: _____

Figure 220. Model 3 FDDI Adapter Information

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   **Signature:** _____

IBM 3172 Parallel Channel Definition Parameters ────────────────────

LAN function name: _____

Channel adapter name: _____

LAN adapter	Host program	Subchannels	Block delay time	Maximum response length
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Figure 221. IBM 3172 Parallel Channel Definition Parameters

IBM 3172 Profile Worksheet (continued)

Date: _____ / _____ / _____   Signature: _____

IBM 3172 ESCON Definition Parameters ──────────────────────────────

LAN function name: _____

Channel adapter name: _____

		Logical Path				Maximum
LAN adapter	Host program	Link address	CU Logical address	Device address	Block delay time	response length
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

Figure 222. IBM 3172 ESCON Definition Parameters

A.2 Worksheets for 3172 Offload of TCP/IP

```
                          3172 OFFLOAD ADAPTERS
                          =====================

Slot         Adapter              IP              Subnet      Logical LAN Local-admin
No            Type             Address             Mask       Adapter No.   Address
---- ----------------------- -------------------- -------------------- ----------- -----------

  1   ......................

  2   ...................... .................... .................... LAN ....... ...........

  3   ...................... .................... .................... LAN ....... ...........

  4   ...................... .................... .................... LAN ....... ...........

  5     XGA Adapter

  6   ...................... .................... .................... LAN ....... ...........

  7   ...................... .................... .................... LAN ....... ...........

  8     Fixed Disk Adapter


                          HOST ATTACHMENT DATA
                          ====================

      Adapter    Base Subchannel      Parallel Channel          ESCON
       Type          Address        Data Transfer Speed     Director Path
      -------    ---------------    -------------------     -------------

       PCA       ...............    ...................         N/A

      ESCON      ...............           N/A               ............
```

A.3 Worksheet for 3172 MPE

```
                          LAN ADAPTERS
                          ============                   TR/FR
Adapter              IP address      Subnet mask    Slot  Speed  MAC addr
-------              ----------      -----------    ----  -----  -----------

TR Primary   (req)   .............   ..............   .....  ....  ............

TR alternate (opt)   .............   ..............   .....  ....  ............

Ethernet     (opt)   .............   ..............   .....        ............

Ethernet     (opt)   .............   ..............   .....        ............

WAC          (req)   .............   ..............   .....  ....  ............

FDDI         (opt)   .............   ..............   .....        ............

                   WAC LMI TYPE   (select 2 or 3)
                   ============
For LMI Revision 1 select 2     For LMI ANSI T1.617 select 3

                      HOST ATTACHMENT
                      ===============              ESCON     PCA Chl
       Adapter        IP address    Base subchl addr  dir path or  Speed
       -------        ----------    ----------------  -------     -------

       PCA / ESCON    .............  ..............     .....      ......

                   RING NUMBER AND BRIDGE NUMBER
                   ============================

       Frame Relay ring number   .....................

       Token Ring ring number    .....................

       Bridge Number             .....................

               NETVIEW DISTRIBUTION MANAGER/2 NAMES
               ====================================

       LDU Distributor name (server) ....................

       LDU Receiver name (client)    ....................

               LAN LOGICAL ADAPTER NUMBERS
               ===========================
       LAN Adapter #  Adapter type (select one for each adapter number)
       -------------
       Adapter  0     TRN   -     -     -     -     -
       Adapter  1     WAC   -     -     -     -     -
       Adapter  2     TRN   ETH   FDDI  PCA   ESC   -
       Adapter  3     TRN   ETH   FDDI  PCA   ESC   None
       Adapter  4     PCA   ESC   None  -     -     -
```

Appendix B. ITSO Test Environment Configuration Details

This appendix contains system configuration files discussed in environments described by this book:

- TCP/IP MVS
- 3172 Offload
- 3172 MPE
- 3172 Offload restore

The files are only included as examples of a configuration that worked in our environment.

SNA definitions are listed within various points of the book, including Chapters 1 and 2.

The MVS TCP/IP profile is a snapshot of how it looked at one particular moment. What was activated and especially the gateway statements changed constantly to adapt to different testing scenarios. Some statements are left in the profile as comments to show alternatives that were used.

For the Offload and the MPE environments the **GETSETUP** command was used. GETSETUP is installed with the Offload feature and is used to collect the Offload configuration information of your 3172. The information consists of output from OS/2 and TCP/IP display commands plus a selection of configuration files.

The 3172 Offload Restore part lists significant files customized as described in 6.2, "Backup and Restore in the OS/2 Environment" on page 308.

B.1 MVS TCP/IP PROFILE Data Set

```
; ------------------------------------------------------------------*
;                                                                    *
;     ITSC-Raleigh:  TCP/IP MVS V2 System  *RAIANJE*                 *
;     ---------------------------------------------                  *
;                                                                    *
;   - MVS/ESA 4.1 - MVS18 / SA18                                     *
;                                                                    *
;   - Name of TCPIP Configuration File = TCPIP.ITSC.RAIANJE.TCPIP    *
;                                                                    *
; --------------------------------------------------- 93/11/27 ----*
; ****************************************************************
; * BUFFER DEFINITIONS:                                         *
; ****************************************************************
;
;                                        | size   | default | max      |
;                                        | (byte) | nbr     | nbr      |
;                                        | ====== | ======= | ======== |
ACBPOOLSIZE                 1000     ; |   96   |  1000   |          |
CCBPOOLSIZE                 300      ; | 1184   |   150   |   750    |
RCBPOOLSIZE                 50       ; |  228   |    50   |    VS    |
SKCBPOOLSIZE                256      ; |  781   |   256   |          |
IPROUTEPOOLSIZE             300      ; |  128   |   600   |    VS    |
ADDRESSTRANSLATIONPOOLSIZE  1500     ; |  153   |  1500   |    VS    |
; DATABUFFERPOOLSIZE         50 8192  ; | 8192   |   160   |    VS    |
;
; **   statement for Offload testing   -- EGL  9Dec93 --
DATABUFFERPOOLSIZE          150 28672 ; | 8192   |   160   |    VS    |
;
; SMALLDATABUFFERPOOLSIZE   1000     ; | 2048   |     0   |    VS    |
;
; **   statement for Offload testing   -- EGL  9Dec93 --
SMALLDATABUFFERPOOLSIZE     1200     ; | 2048   |     0   |    VS    |
;
TINYDATABUFFERPOOLSIZE      500      ; |  256   |     0   |    VS    |
ENVELOPEPOOLSIZE            750      ; | 2048   |   750   |          |
LARGEENVELOPEPOOLSIZE       50       ; | 8192   |    50   |    VS    |
SCBPOOLSIZE                 256      ; |  228   |   256   |   2000   |
TCBPOOLSIZE                 256      ; | 1055   |   256   |   2000   |
UCBPOOLSIZE                 100      ; |  245   |   100   |    200   |
;
;
; Note: VS=Limited by the amount of available Virtual Storage
;
; ****************************************************************
; * TRACE  DEFINITIONS: (NEEDS TO BE CUSTOMIZED)               *
; ****************************************************************
;
NOTRACE
;
; ****************************************************************
; * SYSTEM ADMINISTRATION:                                     *
; ****************************************************************
;
;
;    ************************************************************
;    * INFORM FOLLOWING USERS ABOUT SERIOUS RUN-TIME CONDITIONS *
;    ************************************************************
INFORM
```

```
         FONVILL
ENDINFORM
;
;    *****************************************************************
;    * ALLOW USE OF OBEYFILE COMMAND FOR FOLLOWING USERS:           *
;    *****************************************************************
;
OBEY
; STCTCP1                    ; Real RACF User Id's of SNMPQE SNMPD
  ROUTED18                   ; Dummy RACF ID for ROUTED
  SNMPQE                     ; Dummy RACF ID for SNMPQE
  SNMPD18                    ; Dummy RACF ID for SNMPD
  NCPROU18                   ; Dummy RACF ID for NCPROUTE
  FONVILL                    ; USER FONVILL CAN ISSUE OBEY COMMANDS,
  STUSER                     ; User on which NCPROUTE is running
;                            ; USING 'OBEYFILE DSNNAME' COMMAND
  ZETTER                     ; Olle Zetterlund
  LAPITAN                    ; Edwin Lapitan
  SOUTSOS                    ; Stelios
ENDOBEY
;    *****************************************************************
;    * PROBLEMS? CALL YOUR SYSTEM CONTACT: SNMP OBJECT SYSCONTACT   *
;    *****************************************************************
SYSCONTACT
  Sam Walton  555-1212
ENDSYSCONTACT
;    *****************************************************************
;    * KNOW WHERE YOUR SYSTEM IS RUNNING: SNMP OBJECT SYSLOCATION   *
;    *****************************************************************
SYSLOCATION
  MVS18 ITSO RALEIGH
ENDSYSLOCATION
;
;  ***************************************************************
;  * TELNET DEFINITIONS:                                        *
;  ***************************************************************
;
INTERNALCLIENTPARMS
  TIMEMARK 600       ; SET TELNET TIMEOUT TO 10 MINUTES
  SMFINIT  171       ; SMF RECORD TYPE 171 IS USED FOR LOGN RECORDS
  SMFTERM  171       ; SMF RECORD TYPE 171 IS USED FOR LOGF RECORDS
ENDINTERNALCLIENTPARMS
;  ***************************************************************
;  * HARDWARE DEFINITIONS:                                      *
;  ***************************************************************
;  ***************************************************************
;  *            SNALINK Connection to TCPIP20                   *
;  *         LU0 SNALINK between TCPIP18 and TCPIP20            *
;  ***************************************************************
;
;
;      ==================           ==================
;      | TCPIP18        |           | TCPIP20        |
;      | SNALK18        |           | SNALK20        |
;      | IP=9.67.38.164 |           | IP=9.67.38.170 |
;      |                |           |                |
;      | RAIASNAL       |           | RAKASNAL       |
;      |----------------|           |----------------|
;               |                LU0          |
;               |-----------------------------|
```

```
;                              SNALMV20
;
  DEVICE SNADMV20 SNAIUCV SNALINK  RAKASNAL SNALK18
  LINK    SNALMV20 IUCV        60    SNADMV20
;
; ****************************************************************
; *            3172 Model 3 attachments: ICP box               *
; ****************************************************************
;
;          ===================================
;          |                                 |
;          |        TCPIP18                  |
;          | IP addr: 9.67.32.21  = EN302    |
;          | IP addr: 9.67.38.21  = TR304    |
;          | IP addr: 9.67.32.201 = FD306    |
;          ---------------------------------
;                   || CHU subaddress 302-303 ==>EN302 (TCPIP18)
;                   || CHU subaddress 304-305 ==>TR304 (TCPIP18)
;                   || CHU subaddress 306-307 ==>FD306 (TCPIP18)
;                   ||
;          ----------------------
; CA nbr  |        300          |
; Slot nr |        #4           |
;         |      3172 Model 3   |
;         |       ICP V3.2      |
; Dev to  | EN302   TR304  FD306 |
; chan    | 302     304    306   |
; Rel adp | 0       0      0      |
; number  |                     |
; Slot    | 2       3      6-7   |
;         ----------------------
; MACs:     |      |      |
;           |      |          4000 033B 3172
;           |          4000 021B 3172
;               4000 012B 3172
;
; ****************************************************************
; * Ethernet DEFINITIONS:                                       *
; ****************************************************************
;
;  Link EN302 is Ethernet or 802.3 on network 9.67.32.21 using
;  device ICPEN302.
;  Device ICPEN302 is a LAN Channel Station using subchannels 302-303
;  and supports the 3172 MIB variables, owned by TCPIP18.
;
  DEVICE ICPEN302  LCS          302    NETMAN
  LINK   EN302  ETHEROR802.3  0    ICPEN302
;
;
; ****************************************************************
; * Token Ring DEFINITIONS:                                     *
; ****************************************************************
;  Link TR304 is Token ring on network 9.67.38.21 using device ICPTR304
;  MAC address is in non-canonical format. Allroute broadcast is used.
;  Device ICPTR304 is a LAN Channel Station using subchannels 304-305
;  and supports the 3172 MIB variables.
;
  DEVICE ICPTR304  LCS          304    NETMAN
  LINK   TR304  IBMTR         0    ICPTR304
;
```

```
; ****************************************************************
; * FDDI  DEFINITIONS:                                           *
; ****************************************************************
;  Link FD306 is FDDI ring on network 9.67.32.201 using device ICPFD306
;  Allroute broadcast is used.
;  Device ICPFD306 is a LAN Channel Station using subchannels 306-307
;  and supports the 3172 MIB variables.
;
   DEVICE ICPFD306  LCS             306   NETMAN
   LINK   FD306  FDDI        0    ICPFD306
   TRANSLATE 9.67.32.202 FDDI 40008580FDDF FD306
;
; ****************************************************************
; *           3172 Model 3 attachments: MPE box                 *
; ****************************************************************
;          ================================
;          |                              |
;          |                              |
;          |          TCPIP18             |
;          | IP addr: 9.67.38.20  = MPETR1|
;          | IP addr: 9.67.32.20  = MPEEN1|
;          | IP addr: 9.67.32.160 = MPEWAC|
;          --------------------------------
;                ||      subaddress 320-33F
;                ||      ESCO CPHID 18
;          +----+----+-------------------+
;          !    ! E1 !                   ! 9032
;          !    +----+     ESCON         !
;          !              DIRECTOR       !
;          !    +----+                   !
;          !    ! E4 !                   !
;          +----+----+-------------------+
;               ||
;               ||
;               ||
;          -----------------------
; ESCON  |        320            |
; slot   |        1-2            |
;        |     3172 Model 3      |
;        |        MPE            |
; Dev to |MPEWAC MPETR1 MPEEN1   |
; Rel adp|  0      0      0      |
; number |                      |
; Slot   |  4      7      6      |
;        -----------------------
; MACs:     |      |      |
;           |      |      4000 012A 3172
;           |      4000 011A 3172
;           4000 014A 3172
;
; ****************************************************************
; * Device and link definitions for 3172 A   - MPE             *
; ****************************************************************
;
   DEVICE MPEDEV    CLAW 320  TCPIP  OS2TCP  NONE
   LINK   MPEIPLINK OFFLOADLINK1  1  MPEDEV
   LINK   MPETR1  OFFLOADAPIBROAD 9.67.38.20  MPEDEV  MPEIPLINK
   LINK   MPEWAC  OFFLOADAPIBROAD 9.67.46.85 MPEDEV  MPEIPLINK
   LINK   MPEEN1  OFFLOADAPIBROAD 9.67.32.20  MPEDEV  MPEIPLINK
;
```

```
;
; ****************************************************************
; *           3172 Model 1 attachment:                         *
; ****************************************************************
;        ==============================
;        |                            |
;        |       TCPIP20 and TCPIP18  |
;        | IP addr: 9.67.32.1   = EN1 |
;        | IP addr: 9.67.32.65  = EN2 |
;        | IP addr: 9.67.38.1   = TR1 |
;        | IP addr: 9.67.38.65  = TR2 |
;        ------------------------------
;              || || CHU subaddress EA0-EA1 ==>EN1 (TCPIP18)
;              || || CHU subaddress EC0-EC1 ==>EN2 (TCPIP20)
;              || || CHU subaddress EA2-EA3 ==>TR1 (TCPIP18)
;              || || CHU subaddress EC2-EC3 ==>TR2 (TCPIP20)
;              || ||
;     -----------------------
; CA nbr |       EA0 EC0      |
; Slot nr|       #1  #4       |
;        |     3172 Model 1   |
;        |      ICP V2.1      |
; Dev to | EN1   EN2   TR1  TR2 |
; chan   | EA0   EC0   EA2  EC2 |
; Rel adp| 0     1     0    1   |
; number |                     |
; Slot   | 2     3     6    7   |
;        -----------------------
; MACs:    |     |     |    |
;          |     |     |    4000 5002 3172
;          |     |     4000 5001 3172
;          |     4000 6002 3172
;        4000 6001 3172
;
; ****************************************************************
; * Tokenring DEFINITIONS:                                      *
; ****************************************************************
;  Link TR1 is Token ring on network 9.67.38.0 using device CH1TR1.
;  MAC address is in Non canonical format. Allroute broadcast is used.
;  Device CH1TR1 is a LAN Channel Station using subaddress EA2-EA3 and
;  supports the 3172 MIB variables. TR2 is linked to TCPIP20, look in
;  TCPIP.ITSC.RALVSMV6.PROFILE for its definitions.
;
  DEVICE CH1TR1  LCS          EA2    NETMAN
  LINK   TR1  IBMTR          0    CH1TR1  ; T/R.   IN SLOT #6
;
; ****************************************************************
; *          3172 Model 3 attachments: OFFLOAD      box        *
; ****************************************************************
;       ================================
;       |                              |
;       |          TCPIP18             |
;       | IP addr: 9.67.38.22  = OFFTR1|
;       | IP addr: 9.67.32.22  = OFFEN1|
;       | IP addr: 9.67.32.200 = OFFFD1|
;       | IP addr: 9.67.32.162 = OFFWAC| <-- for MPE / FDDI tests
;       --------------------------------
;     subch addr || 340-35f
;    ESCON ChPID || 18
```

```
;        +----+----+----+
;    9032 !    ! E1 !    !
;         !    +----+    !
;    ESCON !             !
; Director !    +----+   !
;         !    ! E8 !    !
;        +----+----+----+
;            ||
;            ||
;  ----------------------+
; ESCON |     340      300 |
; slot  |     1-2      4   |
;       |    3172 Model 3  |
;       |      OFFLOAD     |
; Dev to |OFFEN1 OFFTR1 OFFFD1 |
; Rel adp|  0     0     0   |
; number |                  |
; Slot   |  4/3  3/2   6 & 7 |
;  ----------------------+
; MACs:   |     |      |
;         |     |      4000 013C 3172
;         |     4000 011C 3172
;         4000 012C 3172
;
;
; ***************************************************************
; * Device and link definitions for 3172 C   - OFFLOAD        *
; ***************************************************************
;
;
 DEVICE OFFDEV    CLAW  340  TCPIP  OS2TCP  NONE
 LINK   OFFIPLINK OFFLOADLINK1  1  OFFDEV
 LINK   OFFTR1  OFFLOADAPIBROAD 9.67.38.22  OFFDEV  OFFIPLINK
 LINK   OFFEN1  OFFLOADAPIBROAD 9.67.32.22  OFFDEV  OFFIPLINK
 LINK   OFFFD1  OFFLOADAPIBROAD 9.67.32.200 OFFDEV  OFFIPLINK
;
; ***************************************************************
; *          NCP RA6NCSF and RA9NCPO attachments             *
; ***************************************************************
;            ==================================
;            |                                |
;            |          TCPIP18               |
;            |                                |
;            |9.67.32.135         9.67.32.197 |
;            |RAIATC1                 RAIATC3 |
;            ----------------------------------
;          E23||                    E21||
;             ||                       ||
;             ||                       ||
;        ----------------------   ----------------------
;        | NCST LU = RA9TNCS1 |   | NCST LU = RA6TNCS1 |
;        | IP-@: 9.67.38.134  |   | IP-@: 9.67.32.198  |
;        |                    |   |                    |
;  NCPdk| RA9NCPO  NCP SA9    |   | RA6NCSH   NCP SA6   |
;  vers.| NCP V7R1            |   | NCP V7R1            |
;  LIC  |1088        1062     |   | 1089            -  |
;        ----------------------   ----------------------
;          |           |             |              |
;         Tok         Eth           Tok             |
```

```
;              4000          1000            4000
;              0109          5AAB            0206
;              0000          02C4            0000
;
;
;
  DEVICE TORA9D  SNAIUCV  SNALINK  RA9TNCS1 SNALK18A
  LINK   TORA9L  IUCV      1       TORA9D
;
  DEVICE TORA6D  SNAIUCV  SNALINK  RA6TNCS1 SNALK18B
  LINK   TORA6L  IUCV      1       TORA6D
;
; ***********************************************************************
; * TO START THE PROCEDURES (HIGHER LEVEL SERVICES) USE AUTOLOG.
; ***********************************************************************
;
AUTOLOG
   SNALK18                        ; SNAlink to TCP/IP in MVS 20
;  SNALK18A                       ; SNAlink to NCP SA9
;  SNALK18B                       ; SNAlink to NCP SA6
;  L62LK18                        ; SNAlink LU 6.2
   FTPSE18                        ; FTP server - #1
;  ROUTED18                       ; ROUTED server
   SNMPQE                         ; SNMP Query Engine
   SNMPD18                        ; SNMP Agent
   PORTMP18                       ; Port Mapper
;  SMTP18                         ; SMTP server
;  TCPX2518                       ; X.25 NPSI support
;  NAMESE18                       ; Name Server
;  NFS18                          ; NFS Server
;  LPD18                          ; LPD Server
;  PORTS18                        ; NDB Portmap manager
;  NDBSA18                        ; NDB Server 1
;  NDBSB18                        ; NDB Server 2
;  NCPROU18                       ; NCP Route server
ENDAUTOLOG
;
PORT
; Values from RFC 1010, "Assigned numbers"
     21 TCP FTPSE18               ; FTP server  -  #1
     20 TCP FTPSE18  NOAUTOLOG    ; FTP default data port
     23 TCP INTCLIEN              ; Telnet server,same portnumber as
                                  ; on INTERNALCLIENTPARMS statement
     25 TCP SMTP18                ; SMTP server
     53 TCP NAMESE18              ; Name Server
     53 UDP NAMESE18              ; Name Server
    111 UDP PORTMP18              ; Portmapper Server
    111 TCP PORTMP18              ; Portmapper Server
    161 UDP SNMPD18               ; Agent Port for SNMP Messages
    162 UDP SNMPQE                ; SNMP Client port for Trap's
    515 TCP LPD18                 ; Remote Printer Server
    520 UDP ROUTED18              ; RouteD Server
    580 UDP NCPROU18              ; NCPROUTE for RIP support on NCPs
   2049 UDP NFS18                 ; NFS Server
   2221 TCP OFFLFTP               ; reserved port for Offload FTP
   2223 TCP OFFLTN                ; reserved port for Offload telnet
; 4000 TCP MPEBOX                 ; reserved port for MPE box telnet
;
HOME
```

```
; Local host's Internet addresses
; ***********************************************************************
; * 3172 Model 1 -- DO NOT TOUCH -- production for all projects
; ***********************************************************************
   9.67.38.1      TR1          ; MAC=4000 5001 3172
; ***********************************************************************
; * NCP Route IP addresses
; ***********************************************************************
   9.67.38.164    SNALMV20     ; SNALINK to TCP/IP in MVS 20
   9.69.32.135    TORA9L       ; SNALINK to NCP SA9
   9.69.32.197    TORA6L       ; SNALINK to NCP SA6
; ***********************************************************************
; * 3172 Model 3 for 3172 residency  ICP
; ***********************************************************************
   9.67.32.21     EN302        ; MAC=4000 012B 3172
   9.67.38.21     TR304        ; MAC=4000 021B 3172
   9.67.32.201    FD306        ; MAC=4000 033B 3172
;
GATEWAY
; ***********************************************************************
; * 3172 Model 3 MPE box  -- route to OZ OS/2
; ***********************************************************************
; * OLLE ZETTERLUND ****************************************************
  9.67.38.20   = MPETR1  DEFAULTSIZE   HOST ; OFFLINE
; 9.67.32.23   = MPETR1  DEFAULTSIZE   HOST ; temp
  9.67.38.27   = MPETR1  DEFAULTSIZE   HOST ; TKR    PS/2 (BB116)
; 9           = MPETR1  DEFAULTSIZE   0.255.255.0 0.24.97.00 ; DAVE S
; 9           = MPETR1  DEFAULTSIZE   0.255.255.192 0.67.38.00
; 9.67.32.23  = MPEEN1  DEFAULTSIZE   HOST ; ETHERNET PS/2 (LAB)
; 9.67.32.27  = MPEEN1  DEFAULTSIZE   HOST ; ETHERNET PS/2 (LAB)
; 9           = MPEEN1  DEFAULTSIZE   0.255.255.192 0.67.32.00
; 9           = MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.64
  9.67.46.83   = MPEWAC  DEFAULTSIZE   HOST ; SHABANI RXR via WAC
  9.67.46.84   = MPEWAC  DEFAULTSIZE   HOST ; SHABANI RXR via WAC
  9   9.67.46.83 MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.128
  9   9.67.46.84 MPEWAC  DEFAULTSIZE   0.255.255.192 0.67.46.192
; * STEVE SOUTSOS ****************************************************
  9.67.38.28   = TR304   DEFAULTSIZE   HOST ; TKR    PS/2 (BB116)
; * EDWIN LAPITAN ****************************************************
  9.67.38.29   = OFFTR1  DEFAULTSIZE   HOST ; TKR    PS/2 (BB114)
  9            = OFFTR1  2000          0.255.255.192 0.67.38.0
  9            = OFFEN1  1500          0.255.255.192 0.67.32.0
  9            = ICPTR1  2000          0.255.255.192 0.67.36.0
; * marc         ****************************************************
; 9            = OFFTR1  DEFAULTSIZE   0.255.255.192 0.24.97.00
; 9            = OFFEN1  DEFAULTSIZE   0.255.255.192 0.67.32.00
; * LAB TEST STATIONS ************************************************
  9.67.32.23   = EN302   DEFAULTSIZE   HOST ; ETHERNET PS/2 (LAB)
  9.67.38.23   = TR304   DEFAULTSIZE   HOST ; TKR    PS/2 (LAB)
  9.67.32.202  = FD306   DEFAULTSIZE   HOST ; FDDI    PS/2 (LAB)
; 9.69.32.134  = TORA9L  DEFAULTSIZE   HOST
; ***********************************************************************
; * NCPs SA9 and SA6 (RA6NCSH and RA9NCPO) -- Saitoh
; ***********************************************************************
; 9            = TORA9L  DEFAULTSIZE   0.255.255.192 0.69.38.0
; 9            = TORA9L  DEFAULTSIZE   0.255.255.192 0.69.38.128
; 9            = TORA9L  DEFAULTSIZE   0.255.255.192 0.69.32.128
; 9            = TORA6L  DEFAULTSIZE   0.255.255.192 0.69.32.0
; 9            = TORA6L  DEFAULTSIZE   0.255.255.192 0.69.32.192
```

```
; ********************************************************************
; * Default routing
; ********************************************************************
; DEFAULTNET   = MPETR1  DEFAULTSIZE   0
;
;
; ********************************************************************
; * VTAM definitions for TELNET SERVER
; ********************************************************************
;
; Define the VTAM parameters required for the TELNET server
BEGINVTAM
     ; Define logon mode tables to be the defaults shipped with the lates
     ; level of VTAM
  LINEMODE INTERACT ; LINEMODETERMINAL
  3277    D4B32702 ; 32 line screen - default of NSX32702 is 24 line sc
  3278-2-E NSX32702 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-2  D4B32782 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-3-E NSX32702 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-3  D4B32783 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-4-E NSX32702 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-4  D4B32784 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-5-E NSX32702 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-5  D4B32784 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-2-E NSX32702 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-2  D4B32782 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-3-E NSX32702 ; 32 line screen - default of NSX32702 is 24 line sc
  3279-3  D4B32783 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-4-E NSX32702 ; 32 line screen - default of NSX32702 is 24 line sc
  3279-4  D4B32784 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-5-E NSX32702 ; 32 line screen - default of NSX32702 is 24 line sc
  3279-5  D4B32785 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-4-E NSX32704 ; 48 line screen - default of NSX32702 is 24 line sc
  3279-4-E NSX32704 ; 48 line screen - default of NSX32702 is 24 line sc
  3278-5-E NSX32705 ; 132 column screen - default of NSX32702 is 80 colu
  3279-5-E NSX32705 ; 132 column screen - default of NSX32702 is 80 colu
; Define the LUs to be used for general users
  DEFAULTLUS
       RAIAE001 RAIAE002 RAIAE003 RAIAE004 RAIAE005
       RAIAE006 RAIAE007 RAIAE008 RAIAE009 RAIAE010
       RAIAE011 RAIAE012 RAIAE013 RAIAE014 RAIAE015
  ENDDEFAULTLUS
;
  DEFAULTAPPL RAKAA     ; Set the default application for all
                        ; TELNET sessions, NetView Access
ENDVTAM
;
;
; -----------------------------------------------------
; START CH1TR1              ; 3172-1 T/R    (MOD 1)
; START CH1EN1              ; 3172-1 ETH    (MOD 1)
;
; -----------------------------------------------------
  START ICPTR304            ; 3172-3 T/R    (ICP)
  START ICPEN302            ; 3172-3 ETH    (ICP)
  START ICPFD306            ; 3172-3 FDDI   (ICP)
;
; -----------------------------------------------------
  START MPEDEV              ; 3172-3 T/R    (MPE)
```

```
  START OFFDEV                    ;  3172-3 T/R     (OFF)
;
; -----------------------------------------------------
; START TORA9D                    ;  SNALINK TO NCP RA9NCP0
; START TORA6D                    ;  SNALINK TO NCP RA6NCSH
; -----------------------------------------------------
```

B.2 3172 Offload

```
******************************************************************************
******************************************************************************
***
***   GETSETUP - Log of SYSOUT output messages
***
***   Filename:  GETSETUP.LOG
***
***       Date:  3 Feb 1994    Time: 14:43:23
***
******************************************************************************
******************************************************************************
***
*** COMMAND:  syslevel
***
***

C:\OS2\INSTALL\SYSLEVEL.GRE
IBM OS/2 32-bit Graphics Engine
Version 2.10     Component ID 562107701
Type 0-2
Current CSD level: XR02010
Prior   CSD level: XR02010

C:\OS2\INSTALL\SYSLEVEL.OS2
IBM OS/2 Base Operating System
Version 2.10     Component ID 562107701
Type 0-2
Current CSD level: XR02010
Prior   CSD level: XR02010

C:\TCPIP\SYSLEVEL.TCP
 TCP/IP  BASE  for OS/2 2.0 and 2.1
Version 2.00     Component ID 562208600
Current CSD level: UN00000
Prior   CSD level: UN00000

C:\IBMCOM\SYSLEVEL.TRP
IBM OS/2 LAN Adapter and Protocol Support
Version 2.11     Component ID 562125303
Current CSD level: WR06000
Prior   CSD level: WR06000


***
***
******************************************************************************
******************************************************************************
***
*** COMMAND:  ifconfig lan0
***
***

lan0: flags=3063<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
      inet 9.67.38.22 netmask ffffffc0 broadcast 9.67.38.63

***
***
```

```
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan1
***
***


lan1: flags=b063<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
     inet 9.67.32.22 netmask ffffffc0 broadcast 9.67.32.63

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan2
***
***


lan2: flags=a063<UP,BROADCAST,NOTRAILERS,RUNNING,SNAP>
     inet 9.67.32.200 netmask ffffffc0 broadcast 9.67.32.255

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan3
***
***


lan3: flags=80d1<UP,POINTOPOINT,RUNNING,NOARP>
     inet 127.1.1.2 --> 127.1.1.1 netmask ff000000

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan4
***
***


lan4: flags=3032<BROADCAST,POINTOPOINT,NOTRAILERS,BRIDGE,SNAP>
     inet 0.0.0.0 --> 0.0.0.0 netmask 0

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -a
***
***


addr        9.67.38.22 interface 0 mask ffffffc0 broadcast        9.67.38.63
addr        9.67.32.22 interface 1 mask ffffffc0 broadcast        9.67.32.63
addr       9.67.32.200 interface 2 mask ffffffc0 broadcast       9.67.32.255
addr         127.1.1.2 interface 3 mask ff000000 broadcast         127.1.1.1
```

```
***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -r
***
***


    destination          router      refcnt          use flags    snmp  intrf
                                                                   metric
        127.1.1.1      127.1.1.2          0            0  U         -1  lan3
      9.67.32.192    9.67.32.200          0            0  U         -1  lan2
        9.67.32.0     9.67.32.22          0            0  U         -1  lan1
        9.67.38.0     9.67.38.22          1         5014  U         -1  lan0

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -s
***
***


SOCK     TYPE         FOREIGN          LOCAL         FOREIGN        STATE
                        PORT            PORT           HOST

==== ==========     ==========     ==========     ========== ==========
847     DGRAM             0             1859         0.0.0.0    UDP
11      DGRAM             0                0         0.0.0.0    UDP
9         RAW             0                0         0.0.0.0    RAW
8      STREAM             0             2221         0.0.0.0    LISTEN
7      STREAM             0             2223         0.0.0.0    LISTEN


***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -n
***
***


Interface 0: 802.5
physical address    4000011c3172       MTU 2000

speed 4000000 bits/sec
unicast packets received 0
broadcast packets received 1780
total bytes received 136862
unicast packets sent 0
broadcast packets sent 1
total bytes sent 52
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
```

```
packets received in unsupported protocols 0
Interface 1: DIX+802.3
physical address    4000012c3172     MTU 1500

speed 10000000 bits/sec
unicast packets received 0
broadcast packets received 42
total bytes received 4284
unicast packets sent 0
broadcast packets sent 1
total bytes sent 42
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0
Interface 2: 802.5
physical address    4000013c3172     MTU 4352

speed 100000000 bits/sec
unicast packets received 0
broadcast packets received 0
total bytes received 0
unicast packets sent 0
broadcast packets sent 1
total bytes sent 50
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0
Interface 3: claw
physical address    000000000000     MTU 1500

speed 0 bits/sec
unicast packets received 0
broadcast packets received 0
total bytes received 0
unicast packets sent 0
broadcast packets sent 0
total bytes sent 0
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0

***
***
*************************************************************************
*************************************************************************
***
*** COMMAND:  netstat -i
***
***

total packets received 6003
checksum bad 0
packet too short 0
```

```
                    not enough data 0
                    ip header length < data size 0
                    ip length < ip header length 0
                    fragments received 0
                    frags dropped (dups, out of space) 0
                    fragments timed out 0
                    packets forwarded 0
                    packets rcvd for unreachable dest 419
                    packets forwarded on same net 0
                    requests for transmission 6088
                    output packets discarded because no route could be found 1074
                    input packets delivered successfully to user-protocols 5348
                    input packets with an unknown protocol 0
                    output packets successfully fragmented 0
                    output fragments created 0
                    fragmentation failed 0
                    successfully assembled packets 0

                    ***
                    ***
                    ***************************************************************************
                    ***************************************************************************
                    ***
                    *** COMMAND:  netstat -p
                    ***
                    ***

                            ARP table contents:

                    interface     hardware address          IP address    minutes since
                                                                              last use
                    no ARP table entries present

                    ***
                    ***
                    ***************************************************************************
                    ***************************************************************************
                    ***
                    *** COMMAND:  C:\OFFLOAD\INETVER
                    ***
                    ***

                    Inet version = 2.00

                    ***
                    ***
                    ***************************************************************************
                    ***************************************************************************
                    ***
                    *** COMMAND:  DIR C:\OFFLOAD\*.*
                    ***
                    ***

                     The volume label in drive C is OFFLOAD.
                     The Volume Serial Number is 623D:DC14
                     Directory of C:\OFFLOAD
```

```
,               <DIR>        2-02-94   11:05a
,,              <DIR>        2-02-94   11:05a
OFFSOCKD EXE    137129      11-30-93    7:24p
OFFSNMP  EXE    124032      12-18-92    9:40a
NPCAMSG  MSG       640       8-27-92    6:04a
PCAMSG   MSG      3191       9-03-93   11:08a
NSCAMSG  MSG      4226       9-03-93   11:08a
NNSCAMSG MSG       944       9-23-93    3:33p
COPYRGHT IBM      1140       5-07-93    2:00p
READ     ME       8291       1-14-94   12:51p
OFFLOAD  DOC     67895      12-03-93    1:06p
OFFRUN   EXE     20384      11-30-93   11:53a
INETVER  EXE     31942      10-19-93    5:11p
CU3172B  CLW      2114       2-24-92    1:01p
PCACSTRT EXE     13906      10-04-93    4:03p
PCADDI   SYS     64564      11-10-93    9:35a
PCADDIT  SYS     75316      11-10-93    9:38a
PSCA     ABS    138275      10-15-93    2:46p
NSCA960  OUT    196565       8-27-93    9:03a
NSCAMCM  EXE     65536       8-20-93    3:49p
NSCAMCM  POR     65536       4-08-93    1:02p
NSCAMCM  CON        36       8-27-92    2:10p
NSCCSTRT EXE     13923      11-10-93    7:54a
SCCLAWS  STD      1436       8-27-92    2:13p
SCCLAWR  STD      1436       8-27-92    2:13p
GETSETUP CMD     12286      12-10-93    1:23p
OFFSETUP CMD     79808       1-18-94    3:19p
NSCADDI  SYS     79412       1-11-94   12:23p
NSCADDIT SYS     90676       1-11-94   12:25p
PCADEBUG EXE    251496      11-01-93    9:39a
PCADEBUG HLP     29056      10-01-93   10:59a
NSCADBUG EXE    324120      11-01-93   11:30a
NSCADBUG HLP     29568      10-01-93   11:11a
NSCATRAC EXE     26255      11-01-93   11:25a
NSCA     CFG       263       2-03-94    2:42p
NETWORK  CFG       189       2-03-94    2:42p
      36 file(s)    1961586 bytes used
                    48115712 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  C:\OFFLOAD\OFFSOCKD
***
***


02/03/94 14:43:33 OFFSOCKD started. Version 1.17 12/01/93

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\OFFLOAD\PSCAO.CFG
***
***
```

```
 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\OFFLOAD


***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\OFFLOAD\PSCAO.CFG
***
***



***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\OFFLOAD\NSCA.CFG
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\OFFLOAD

NSCA      CFG      263   2-03-94   2:42p
         1 file(s)        263 bytes used
                     48107520 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\OFFLOAD\NSCA.CFG
***
***

(* This file is a creation of              *)
(* the TCP/IP Offload configuration program. *)
(* DO NOT manually modify this file!         *)

ADDR=40 E11 03 40 1 2 0
ADDR=41 E11 03 41 1 2 0
TABL=1 C:\OFFLOAD\SCCLAWS.STD
TABL=2 C:\OFFLOAD\SCCLAWR.STD


***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\OFFLOAD\NETWORK.CFG
```

```
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\OFFLOAD


NETWORK  CFG       189    2-03-94   2:42p
         1 file(s)         189 bytes used
                      48105472 bytes free


***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\OFFLOAD\NETWORK.CFG
***
***


* This file is a creation of                   *
* the TCP/IP OFFLOAD configuration program.    *
* DO NOT manually modify this file!            *

LINK OS2TCP TCPIP 1 40
ROUTE TCPIP TCPIP


***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\CONFIG.SYS
***
***



 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\


CONFIG   SYS      2686    2-03-94   2:41p
         1 file(s)        2686 bytes used
                      48103424 bytes free


***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\CONFIG.SYS
***
***


IFS=C:\OS2\HPFS.IFS  /CACHE:64 /CRECL:4 /AUTOCHECK:DE
CALL=D:\SAVEU2\SU2CRITF.EXE RESTORE D:\SAVEU2
CALL=D:\SAVEU2\SU2CRITF.EXE BACKUP D:\SAVEU2
PROTSHELL=C:\OS2\PMSHELL.EXE
```

```
SET USER_INI=C:\OS2\OS2.INI
SET SYSTEM_INI=C:\OS2\OS2SYS.INI
SET OS2_SHELL=C:\OS2\CMD.EXE
SET AUTOSTART=PROGRAMS,TASKLIST,FOLDERS,CONNECTIONS
SET RESTARTOBJECTS=STARTUPFOLDERSONLY,REBOOTONLY
SET RUNWORKPLACE=C:\OS2\PMSHELL.EXE
SET COMSPEC=C:\OS2\CMD.EXE
LIBPATH=C:\IBMCOM\DLL;.;C:\OS2\DLL;C:\;C:\TCPIP\DLL;D:\DLL;
SET PATH=C:\OS2;C:\OS2\SYSTEM;C:\;C:\TCPIP\BIN;C:\OS2\INSTALL;D:\APPS;C:\OFFLOAD
;
SET DPATH=C:\IBMCOM;C:\OS2;C:\OS2\SYSTEM;C:\OS2\INSTALL;C:\;C:\OS2\BITMAP;C:\OFF
LOAD;
SET PROMPT=$i[$p]
SET HELP=C:\OS2\HELP;C:\TCPIP\HELP;D:\HELP;C:\OFFLOAD;
SET GLOSSARY=C:\OS2\HELP\GLOSS;
SET IPF_KEYS=SBCS
PRIORITY_DISK_IO=YES
FILES=20
DEVICE=C:\IBMCOM\PROTOCOL\LANPDD.OS2
DEVICE=C:\IBMCOM\PROTOCOL\LANVDD.OS2
DEVICE=C:\IBMCOM\LANMSGDD.OS2 /I:C:\IBMCOM
DEVICE=C:\IBMCOM\PROTMAN.OS2 /I:C:\IBMCOM
DEVICE=C:\OS2\TESTCFG.SYS
DEVICE=C:\OS2\DOS.SYS
DEVICE=C:\OS2\PMDD.SYS
BUFFERS=30
IOPL=YES
DISKCACHE=1024,LW,AC:C
MAXWAIT=1
MEMMAN=SWAP,PROTECT
SWAPPATH=C:\ 2048 2048
BREAK=OFF
THREADS=4095
PRINTMONBUFSIZE=134,134,134
COUNTRY=001,C:\OS2\SYSTEM\COUNTRY.SYS
SET KEYS=ON
REM SET DELDIR=C:\DELETE,512;D:\DELETE,512;E:\DELETE,512;
BASEDEV=PRINT02.SYS
BASEDEV=IBM2FLPY.ADD
BASEDEV=IBM2SCSI.ADD /LED
BASEDEV=OS2DASD.DMD
DEVICE=C:\OS2\POINTDD.SYS
DEVICE=C:\OS2\MOUSE.SYS
CODEPAGE=437,850
DEVINFO=KBD,US,C:\OS2\KEYBOARD.DCP
DEVINFO=SCR,VGA,C:\OS2\VIOTBL.DCP
SET VIDEO_DEVICES=VIO_VGA
SET VIO_VGA=DEVICE(BVHVGA)
RUN=XCOPY.EXE C:\OS2\INSTALL\OS2*.INI C:\OS2\INSTALL\OS2*.IN2
RUN=XCOPY.EXE C:\OS2\OS2*.INI C:\OS2\INSTALL\OS2*.IN
SET ETC=C:\TCPIP\ETC
SET TMP=C:\TCPIP\TMP
SET BOOKSHELF=C:\TCPIP\DOC
SET READIBM=C:\TCPIP\DOC
RUN=C:\TCPIP\BIN\CNTRL.EXE
SET HOSTNAME=Offload3172
SET SNMPPORT=4000
SET SYSCONTACT=Edwin Gerald M. Lapitan
SET SYSLOCATION=B657 BB114 x2355
```

```
RUN=C:\IBMCOM\PROTOCOL\NETBIND.EXE
RUN=C:\IBMCOM\LANMSGEX.EXE
DEVICE=C:\OFFLOAD\NSCADDI.SYS M=C:\OFFLOAD\NSCA960.OUT N=C:\OFFLOAD\NSCAMCM C1=C
:\OFFLOAD\NSCA.CFG R=C:\OFFLOAD\NETWORK.CFG
RUN=C:\OFFLOAD\NSCCSTRT.EXE TCPIP >C:\OFFLOAD\NSCCSTRT.LOG
DEVICE=C:\IBMCOM\PROTOCOL\INET.SYS
DEVICE=C:\IBMCOM\PROTOCOL\IFNDIS.SYS
DEVICE=C:\IBMCOM\MACS\ENETBM.OS2
DEVICE=C:\IBMCOM\PROTOCOL\NETBEUI.OS2
DEVICE=C:\IBMCOM\PROTOCOL\NETBIOS.OS2
DEVICE=C:\IBMCOM\PROTOCOL\LANDD.OS2
DEVICE=C:\IBMCOM\PROTOCOL\LANDLLDD.OS2
RUN=C:\IBMCOM\PROTOCOL\LANDLL.EXE
SET SAVEU2=D:
SET TELNET.PASSWORD.ID=popcorn
DEVICE=C:\IBMCOM\MACS\IBMFDDI.OS2
DEVICE=C:\IBMCOM\MACS\IBMNSCA.OS2
DEVICE=C:\IBMCOM\MACS\IBMTRBM.OS2

***
***
******************************************************************************
******************************************************************************
***
*** SET Variables:
***
***

WP_OBJHANDLE=172682
USER_INI=C:\OS2\OS2.INI
SYSTEM_INI=C:\OS2\OS2SYS.INI
OS2_SHELL=C:\OS2\CMD.EXE
AUTOSTART=PROGRAMS,TASKLIST,FOLDERS,CONNECTIONS
RESTARTOBJECTS=STARTUPFOLDERSONLY,REBOOTONLY
RUNWORKPLACE=C:\OS2\PMSHELL.EXE
COMSPEC=C:\OS2\CMD.EXE
PATH=C:\OS2;C:\OS2\SYSTEM;C:\;C:\TCPIP\BIN;C:\OS2\INSTALL;D:\APPS;C:\OFFLOAD;
DPATH=C:\IBMCOM;C:\OS2;C:\OS2\SYSTEM;C:\OS2\INSTALL;C:\;C:\OS2\BITMAP;C:\OFFLOAD
;
PROMPT=$i[$p]
HELP=C:\OS2\HELP;C:\TCPIP\HELP;D:\HELP;C:\OFFLOAD;
GLOSSARY=C:\OS2\HELP\GLOSS;
IPF_KEYS=SBCS
KEYS=ON
VIDEO_DEVICES=VIO_VGA
VIO_VGA=DEVICE(BVHVGA)
ETC=C:\TCPIP\ETC
TMP=C:\TCPIP\TMP
BOOKSHELF=C:\TCPIP\DOC
READIBM=C:\TCPIP\DOC
HOSTNAME=Offload3172
SNMPPORT=4000
SYSCONTACT=Edwin Gerald M. Lapitan
SYSLOCATION=B657 BB114 x2355
SAVEU2=D:
TELNET.PASSWORD.ID=popcorn
WORKPLACE__PROCESS=NO
```

```
***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\TCPIP\BIN\SETUP.CMD
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\TCPIP\BIN

SETUP    CMD      342   1-25-94  11:31a
        1 file(s)        342 bytes used
                    48095232 bytes free

***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\SETUP.CMD
***
***

route -fh
arp -f
ifconfig lan0 9.67.38.22 netmask 255.255.255.192 mtu 2000
ifconfig lan1 9.67.32.22 netmask 255.255.255.192
ifconfig lan2 9.67.32.200 netmask 255.255.255.192 mtu 4352 -bridge  canonical
ifconfig lan3 127.1.1.2 127.1.1.1
REM ifconfig lan4
REM ifconfig lan5
REM ifconfig lan6
REM ifconfig lan7
REM ifconfig sl0

***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\IBMCOM\PROTOCOL.INI
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\IBMCOM

PROTOCOL INI     2033   1-31-94   8:05p
        1 file(s)       2033 bytes used
                    48093184 bytes free

***
***
```

```
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\IBMCOM\PROTOCOL.INI
***
***

[PROT_MAN]

   DRIVERNAME = PROTMAN$

[IBMLXCFG]

   IBMTRBM_nif = IBMTRBM.nif
   LANDD_nif = LANDD.NIF
   NETBEUI_nif = NETBEUI.NIF
   TCPIP_nif = TCPIP.NIF
   ENETBM_nif = ENETBM.nif
   IBMFDDI_nif = IBMFDDI.nif
   IBMNSCA_nif = IBMNSCA.nif

[LANDD_nif]

   DriverName = LANDD$
   Bindings = IBMTRBM_nif
   ETHERAND_TYPE = "I"
   SYSTEM_KEY = 0x0
   OPEN_OPTIONS = 0x2000
   TRACE = 0x0
   LINKS = 8
   MAX_SAPS = 3
   MAX_G_SAPS = 0
   USERS = 3
   TI_TICK_G1 = 255
   T1_TICK_G1 = 15
   T2_TICK_G1 = 3
   TI_TICK_G2 = 255
   T1_TICK_G2 = 25
   T2_TICK_G2 = 10
   IPACKETS = 250
   UIPACKETS = 100
   MAXTRANSMITS = 6
   MINTRANSMITS = 2
   TCBS = 64
   GDTS = 30
   ELEMENTS = 800

[NETBEUI_nif]

   DriverName = netbeui$
   Bindings = IBMTRBM_nif
   ETHERAND_TYPE = "I"
   USEADDRREV = "YES"
   OS2TRACEMASK = 0x0
   SESSIONS = 40
   NCBS = 95
   NAMES = 21
   SELECTORS = 5
   USEMAXDATAGRAM = "NO"
```

```
                    ADAPTRATE = 1000
                    WINDOWERRORS = 0
                    MAXDATARCV = 4168
                    TI = 30000
                    T1 = 500
                    T2 = 200
                    MAXIN = 1
                    MAXOUT = 1
                    NETBIOSTIMEOUT = 500
                    NETBIOSRETRIES = 8
                    NAMECACHE = 0
                    PIGGYBACKACKS = 1
                    DATAGRAMPACKETS = 2
                    PACKETS = 350
                    LOOPPACKETS = 1
                    PIPELINE = 5
                    MAXTRANSMITS = 6
                    MINTRANSMITS = 2
                    DLCRETRIES = 5

            [TCPIP_nif]

                DriverName = TCPIP$
                Bindings = IBMTRBM_nif,ENETBM_nif,IBMFDDI_nif,IBMNSCA_nif

            [IBMTRBM_nif]

                DriverName = IBMTRBM$
                NetAddress = "4000011C3172"
                AdapBuffSize = 1032
                AdapMinTran = 4
                AdapMaxTran = 48
                MaxTransmits = 31
                MinRcvBuffs = 20
                SizWorkBuf = 2048

            [ENETBM_nif]

                DriverName = ENETBM$
                slotnumber = 4
                maxtransmits = 24
                recvbufs = 14
                netaddress = "4000012C3172"

            [IBMFDDI_nif]

                DriverName = IBMFDDI$
                NetAddress = "4000013C3172"
                ReceiveBufSize = 1500

            [IBMNSCA_nif]

                DriverName = IBMNSCA$
                Claw = 1
                Resource = "TCPIP"
                AdapterNum = 1
                Subchannel = 0
                MaxTransmits = 8
                MaxFramesize = 4096
```

```
                      ***
                      ***
          ***************************************************************
          ***************************************************************
                      ***
                      *** COMMAND:  DIR C:\IBMCOM\LANTRAN.LOG
                      ***
                      ***


           The volume label in drive C is OFFLOAD.
           The Volume Serial Number is 623D:DC14
           Directory of C:\IBMCOM

          LANTRAN  LOG      1002   2-03-94  12:37p
                  1 file(s)        1002 bytes used
                            48087040 bytes free

                      ***
                      ***
          ***************************************************************
          ***************************************************************
                      ***
                      *** FILENAME:  C:\IBMCOM\LANTRAN.LOG
                      ***
                      ***


          IBM OS/2 LANMSGDD [09/01/92] 2.01 is loaded and operational.
          IBM OS/2 LAN Protocol Manager
          IBM OS/2 NETBEUI 2.01
          IBM OS/2 NETBIOS 4.0
          Adapter 0 has 95 NCBs, 40 sessions, and 21 names available to NETBIOS applicatio
          ns.
          NETBIOS 4.0 is loaded and operational.
          IBM OS/2 LANDD [09/01/92] 2.01.2
          IBM OS/2 LANDLLDD 2.01
          IBM OS/2 LANDLLDD is loaded and operational.
          SYS0318: Message file LT5.MSG cannot be found.
          SYS0318: Message file LT5.MSG cannot be found.
          SYS0318: Message file LT5.MSG cannot be found.
          SYS0318: Message file LT5.MSG cannot be found.
          SYS0318: Message file LT5.MSG cannot be found.
          IBM Token-Ring Network 16/4 Busmaster Server Adapter/A NDIS device driver
          Version 3.00.15
          Initialization starting for section IBMTRBM_NIF in PROTOCOL.INI.
          IBM OS/2 LAN Netbind
          IBM LANDD is accessing IBM 802.5 LAN Interface.
          Adapter 0 was initialized and opened successfully.
          Adapter 0 is using node address 4000011C3172.
          IBM LANDD was successfully bound to MAC: IBMTRBM_nif->VECTOR.

                      ***
                      ***
          ***************************************************************
          ***************************************************************
                      ***
                      *** COMMAND:  DIR C:\IBMCOM\MACS\*.*
```

```
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\IBMCOM\MACS

 ,              <DIR>      12-08-93   11:22a
 ,,             <DIR>      12-08-93   11:22a
 IBMPCA   NIF     1946    3-30-92    1:51p
 ELNKII   NIF     3064   11-27-91    1:20p
 ELNKII   OS2    17892    6-20-91    4:31p
 ELNKMC   NIF     1463   11-27-91    1:23p
 ELNKMC   OS2    16599   10-28-91    4:58p
 IBM16OS2 NIF     3961    7-26-93    3:26p
 IBM16TR  OS2    19508    7-26-93    3:14p
 IBMNET   NIF     2129    2-20-92    2:14p
 IBMNET   OS2    13572    9-01-92    4:59a
 IBMNETA  NIF     2135    2-20-92    2:14p
 IBMNETA  OS2    13604    9-01-92    4:59a
 IBMTOK   NIF     4751    6-22-92    3:56p
 IBMTOK   OS2    15140    9-03-92    7:01a
 IBMTRBM  NIF     3534    1-31-92    2:16p
 IBMTRBM  OS2    20724    9-01-92    5:00a
 IBMXLN   NIF     1328    2-12-92    1:18p
 IBMXLN   OS2    12372    9-01-92    5:00a
 MACETH   NIF     2390    2-20-92    2:15p
 MACETH   OS2    17460    9-15-91    9:16p
 MACETH2  OS2    17460    9-15-91    9:16p
 MACWD    OS2    17972    8-11-92   10:04a
 MACWD2   OS2    17972    8-11-92   10:04a
 MACWDAT  NIF     3516    8-11-92    9:26a
 MACWDMC  NIF     2380    8-11-92    9:26a
 MONT400  BIN    45440    4-10-91   11:06a
 UBNEI    OS2    27604    2-10-92   12:01p
 UBNEIPC  NIF     3228    1-31-92    2:16p
 UBNEIPS  NIF     2339    1-31-92    2:16p
 WRTRAM   BIN      922    2-19-91    2:05p
 ENETBM   NIF     1271    6-29-93    1:03p
 ENETBM   OS2    34757    6-29-93    1:03p
 ENETBM   SYM     4324    6-29-93    1:03p
 IBMFDDI  BIN   131072    6-29-93    1:03p
 IBMFDDI  NIF     2882    6-29-93    1:03p
 IBMFDDI  OS2    29748    6-29-93    1:03p
 IBMPCA   OS2    19508    9-22-93    3:36p
 IBMNSCA  NIF     1895    5-25-93   10:48a
 IBMNSCA  OS2    19508    9-23-93    3:33p
         40 file(s)     557370 bytes used
                      48080896 bytes free


***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\IBMCOM\PROTOCOL\*.*
***
***
```

```
 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\IBMCOM\PROTOCOL

,            <DIR>      12-08-93  11:22a
,,           <DIR>      12-08-93  11:22a
TCPIP    NIF      142    7-26-93   3:30p
LANDD    NIF    10267    8-27-92  11:36a
IFNDIS   SYS    31935    8-05-93  10:21a
INET     SYS    99631    8-05-93  10:20a
NETBIND  EXE    13657    9-01-92   5:00a
LANDD    OS2   114228    9-03-92   7:01a
LANDLL   EXE      512    8-20-91   1:26p
LANDLLDD OS2    30336    8-18-92   9:52a
LANPDD   OS2     2198    9-08-92   7:33a
LANVDD   OS2    36944    9-17-92   7:07a
LANVMEM  SYS     4734    9-08-92   7:34a
NETBEUI  NIF    14433    8-27-92  11:36a
NETBEUI  OS2    95412    9-22-92   4:36p
NETBIOS  OS2    15364    9-11-92   8:58a
ODI2NDI  NIF     2592    8-27-92  11:36a
ODI2NDI  OS2    18484    9-15-92   3:57p
BACKUP       <DIR>       1-05-94  12:06p
      19 file(s)    490869 bytes used
                  48078848 bytes free

***
***
***************************************************************************
***************************************************************************
***
*** COMMAND:  DIR C:\STARTUP.CMD
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\


***
***
***************************************************************************
***************************************************************************
***
*** FILENAME:  C:\STARTUP.CMD
***
***


***
***
***************************************************************************
***************************************************************************
***
*** COMMAND:  DIR C:\TCPIP\BIN\TCPSTART.CMD
```

```
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\TCPIP\BIN


TCPSTART CMD     1268    1-25-94  11:31a
         1 file(s)        1268 bytes used
                     48074752 bytes free


***
***
******************************************************************************
******************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\TCPSTART.CMD
***
***


@echo off

echo CONFIGURING TCP/IP .....
IF EXIST C:\TCPIP\BIN\B4TCP.CMD CALL C:\TCPIP\BIN\B4TCP.CMD
IF EXIST C:\TCPIP\BIN\SETUP.CMD CALL C:\TCPIP\BIN\SETUP.CMD
echo ..... FINISHED CONFIGURING TCP/IP


echo STARTING THE TCP/IP PROCESSES .....
REM start /min inetd
REM echo     ..... INET Daemon Started
start /min telnetd -p 2223
echo      ..... TELNET Daemon Started
start /min ftpd -p 2221
echo      ..... FTP Daemon Started
REM start tftpd
REM echo     ..... TFTP Daemon Started
REM start pmx -nocopyright
REM echo     ..... X System Server Started
REM start talkd
REM echo     ..... TALK Daemon Started
REM start portmap
REM echo     ..... Portmapper Started
REM start nfsd
REM echo     ..... Network File System Server Started
REM call nfsstart
REM echo     ..... Network File System Client Started
REM start routed
REM echo     ..... ROUTED Started
REM start sendmail -bd -q30m
REM echo     ..... SENDMAIL Started
REM start nr2
REM echo     ..... NR2 Started
REM start lamail
REM echo     ..... LAMAIL Started
REM detach lprportd
REM echo     ..... LPRPORTD Started
echo ..... FINISHED STARTING THE TCP/IP PROCESSES
```

```
IF EXIST C:\TCPIP\BIN\TCPEXIT.CMD CALL C:\TCPIP\BIN\TCPEXIT.CMD
echo .....  EXITING TCPSTART.CMD  .....

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\TCPIP\BIN\TCPEXIT.CMD
***
***


 The volume label in drive C is OFFLOAD.
 The Volume Serial Number is 623D:DC14
 Directory of C:\TCPIP\BIN

TCPEXIT  CMD      138   2-03-94   2:42p
        1 file(s)         138 bytes used
                   48072704 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\TCPEXIT.CMD
***
***

START /min "TCP/IP Offload Server" OFFRUN API TCPIP
START /min "TCP/IP Offload SNMP Subagent" OFFSNMP public
START "OS/2 Window"
exit

***
***
*****************************************************************************
***   GETSETUP - End of Data
*****************************************************************************
```

B.3 3172 MPE

```
********************************************************************************
********************************************************************************
***
***   GETSETUP - Log of SYSOUT output messages
***
***   Filename:  GETSETUP.LOG
***
***        Date:  2 Feb 1994    Time: 16:59:35
***
********************************************************************************
********************************************************************************
***
*** COMMAND:  ver
***
***


The Operating System/2 Version is 2.10

***
***
********************************************************************************
********************************************************************************
***
*** COMMAND:  ifconfig lan0
***
***


lan0: flags=3063<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
      inet 9.67.38.20 netmask fffffc0 broadcast 9.67.38.63

***
***
********************************************************************************
********************************************************************************
***
*** COMMAND:  ifconfig lan1
***
***


lan1: flags=3063<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
      inet 9.67.46.85 netmask fffffc0 broadcast 9.67.46.127

***
***
********************************************************************************
********************************************************************************
***
*** COMMAND:  ifconfig lan2
***
***


lan2: flags=b063<UP,BROADCAST,NOTRAILERS,RUNNING,BRIDGE,SNAP>
      inet 9.67.32.20 netmask fffffc0 broadcast 9.67.32.63

***
***
```

```
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan3
***
***


lan3: flags=80d1<UP,POINTOPOINT,RUNNING,NOARP>
      inet 9.67.38.20 --> 127.1.1.1 netmask ffffffc0

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  ifconfig lan4
***
***


lan4: flags=3032<BROADCAST,POINTOPOINT,NOTRAILERS,BRIDGE,SNAP>
      inet 0.0.0.0 --> 0.0.0.0 netmask 0

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -a
***
***


addr       9.67.38.20 interface 0 mask ffffffc0 broadcast        9.67.38.63
addr       9.67.46.85 interface 1 mask ffffffc0 broadcast       9.67.46.127
addr       9.67.32.20 interface 2 mask ffffffc0 broadcast        9.67.32.63
addr       9.67.38.20 interface 3 mask ffffffc0 broadcast         127.1.1.1

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -r
***
***


    destination        router     refcnt      use flags    snmp  intrf
                                                            metric
       127.1.1.1    9.67.38.20        0         0  U         -1   lan3
         default    9.67.38.20        1      4828  U         -1   lan0
       9.67.32.0    9.67.32.20        0         0  U         -1   lan2
      9.67.46.64    9.67.46.85        0         0  U         -1   lan1
       9.67.38.0    9.67.38.20        1       186  U         -1   lan0

***
***
*************************************************************************
*************************************************************************
***
```

```
*** COMMAND:  netstat -s
***
***

SOCK      TYPE         FOREIGN         LOCAL        FOREIGN      STATE
                        PORT           PORT          HOST
====  ==========    ==========    ==========    ========== ==========
44       DGRAM            0           1054          0.0.0.0    UDP
10       DGRAM            0             0           0.0.0.0    UDP
9         RAW             0             0           0.0.0.0    RAW
8        STREAM           0           5000          0.0.0.0    LISTEN

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  netstat -n
***
***

Interface 0: 802.5
physical address    4000014a3172      MTU 1500

speed 4000000 bits/sec
unicast packets received 3
broadcast packets received 67
total bytes received 5890
unicast packets sent 2
broadcast packets sent 2
total bytes sent 332
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0
Interface 1: 802.5
physical address    4000011a3172      MTU 1500

speed 65536 bits/sec
unicast packets received 25
broadcast packets received 1
total bytes received 2342
unicast packets sent 0
broadcast packets sent 1
total bytes sent 52
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0
Interface 2: DIX+802.3
physical address    4000012a3172      MTU 1492

speed 10000000 bits/sec
unicast packets received 0
broadcast packets received 0
total bytes received 0
unicast packets sent 0
```

```
broadcast packets sent 1
total bytes sent 50
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0
Interface 3: claw
physical address     000000000000     MTU 1500

speed 0 bits/sec
unicast packets received 0
broadcast packets received 0
total bytes received 0
unicast packets sent 0
broadcast packets sent 0
total bytes sent 0
packets discarded on transmission 0
packets discarded on reception 0
received packets in error 0
errors trying to send 0
packets received in unsupported protocols 0

***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  netstat -i
***
***

total packets received 5079
checksum bad 0
packet too short 0
not enough data 0
ip header length < data size 0
ip length < ip header length 0
fragments received 0
frags dropped (dups, out of space) 0
fragments timed out 0
packets forwarded 4811
packets rcvd for unreachable dest 0
packets forwarded on same net 0
requests for transmission 5016
output packets discarded because no route could be found 0
input packets delivered successfully to user-protocols 234
input packets with an unknown protocol 0
output packets successfully fragmented 0
output fragments created 0
fragmentation failed 0
successfully assembled packets 0

***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  netstat -p
```

```
        ***
        ***

             ARP table contents:

   interface      hardware address           IP address   minutes since
                                                           last use
      0           400000032216               9.67.38.27   1

   ***
   ***
   *****************************************************************************
   *****************************************************************************
   ***
   *** COMMAND:  DIR C:\OFFLOAD\*.*
   ***
   ***


   The volume label in drive C is OS2.
   The Volume Serial Number is A225:9014
   Directory of C:\OFFLOAD

   ,,           <DIR>      12-08-93    5:51p
   ,,           <DIR>      12-08-93    5:51p
   OFFSOCKD EXE    140757   9-02-93    8:54a
   OFFSNMP  EXE    124032  12-18-92    9:40a
   NPCAMSG  MSG       640   8-27-92    6:04a
   PCAMSG   MSG      2889   1-08-93    5:21a
   NSCAMSG  MSG      3924  11-12-92   10:38a
   NNSCAMSG MSG       642   5-28-93    9:37a
   COPYRGHT IBM      1140   8-27-92    1:34p
   READ     ME      16595   9-22-93    2:07p
   OFFLOAD  DOC     67883   9-07-93    7:28a
   OFFRUN   EXE     12915   2-26-93    9:43a
   CU3172B  CLW      2114   2-24-92    1:01p
   PCACSTRT EXE     16377   9-11-92    6:01a
   PCADDI   SYS     67636   1-21-93   10:08a
   PCADDIT  SYS     75316   6-09-93    7:21a
   PSCA     ABS    136627   4-24-92    3:12p
   NSCA960  OUT    199164   4-08-93    1:01p
   NSCAMCM  EXE     65536   4-08-93    1:01p
   NSCAMCM  POR     65536   4-08-93    1:02p
   NSCAMCM  CON        36   8-27-92    2:10p
   NSCCSTRT EXE     16377   9-04-92    9:09a
   SCCLAWS  STD      1436   8-27-92    2:13p
   SCCLAWR  STD      1436   8-27-92    2:13p
   OFFSNMP  SCR     10198  12-16-92    5:50p
   OFFSNMP  TXT     15243  12-16-92    5:50p
   OFFSNMP  PS      40753  12-16-92    5:50p
   GETSETUP CMD     11988   8-03-93    9:31a
   OFFSETUP CMD     47542   9-13-93    2:37p
   NSCADDI  SYS     76340   7-16-93    2:07p
   NSCADDIT SYS     88116   7-16-93   11:28a
   PCADEBUG EXE    237838   2-09-93    1:17p
   PCADEBUG HLP     29107   1-28-93   11:26a
   NSCADBUG EXE    308232   7-16-93   11:32a
   NSCADBUG HLP     29568   1-28-93    7:18a
   NSCATRAC EXE     25662   7-16-93    8:22a
```

```
NETWORK  CFG      189   1-26-94   3:39p
NSCA     CFG      263   1-26-94   3:39p
       38 file(s)    1940047 bytes used
                     39249920 bytes free

***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\OFFLOAD\PSCAO.CFG
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\OFFLOAD


***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\OFFLOAD\PSCAO.CFG
***
***


***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\OFFLOAD\NSCA.CFG
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\OFFLOAD

NSCA     CFG      263   1-26-94   3:39p
        1 file(s)        263 bytes used
                     39245824 bytes free

***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\OFFLOAD\NSCA.CFG
***
***
```

```
                    (* This file (NSCA.CFG) is a creation of     *)
                    (* the TCP/IP Offload configuration program. *)
                    (* DO NOT manually modify this file!          *)

                    ADDR=20 E11 03 20 1 2 0
                    ADDR=21 E11 03 21 1 2 0
                    TABL=1 C:\OFFLOAD\SCCLAWS.STD
                    TABL=2 C:\OFFLOAD\SCCLAWR.STD


                    ***
                    ***
                    *****************************************************************************
                    *****************************************************************************
                    ***
                    *** COMMAND:  DIR C:\OFFLOAD\NETWORK.CFG
                    ***
                    ***


                     The volume label in drive C is OS2.
                     The Volume Serial Number is A225:9014
                     Directory of C:\OFFLOAD

                    NETWORK  CFG      189    1-26-94    3:39p
                            1 file(s)         189 bytes used
                                         39241728 bytes free

                    ***
                    ***
                    *****************************************************************************
                    *****************************************************************************
                    ***
                    *** FILENAME:  C:\OFFLOAD\NETWORK.CFG
                    ***
                    ***

                    * This file (NETWORK.CFG) is a creation of    *
                    * the TCP/IP OFFLOAD configuration program.   *
                    * DO NOT manually modify this file!           *

                    LINK OS2TCP TCPIP 1 20
                    ROUTE TCPIP TCPIP

                    ***
                    ***
                    *****************************************************************************
                    *****************************************************************************
                    ***
                    *** COMMAND:  DIR C:\CONFIG.SYS
                    ***
                    ***


                     The volume label in drive C is OS2.
                     The Volume Serial Number is A225:9014
                     Directory of C:\

                    CONFIG   SYS     2956    2-02-94    4:50p
```

```
          1 file(s)       2956 bytes used
                      39239680 bytes free


***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\CONFIG.SYS
***
***

PROTSHELL=C:\OS2\PMSHELL.EXE
SET USER_INI=C:\OS2\OS2.INI
SET SYSTEM_INI=C:\OS2\OS2SYS.INI
SET OS2_SHELL=C:\OS2\CMD.EXE
SET AUTOSTART=PROGRAMS,TASKLIST,FOLDERS,CONNECTIONS
SET RUNWORKPLACE=C:\OS2\PMSHELL.EXE
SET COMSPEC=C:\OS2\CMD.EXE
LIBPATH=C:\IBMCOM\DLL;.;C:\OS2\DLL;C:\OS2\MDOS;C:\;C:\OS2\APPS\DLL;C:\TCPIP\DLL;
SET PATH=C:\OS2;C:\OS2\SYSTEM;W:\OS2\MDOS\WINOS2;C:\OS2\INSTALL;C:\;C:\OS2\MDOS;
C:\OS2\APPS;C:\TCPIP\BIN;C:\IBMREC\BIN;C:\OFFLOAD;
SET DPATH=C:\IBMCOM;C:\OS2;C:\OS2\SYSTEM;W:\OS2\MDOS\WINOS2;C:\OS2\INSTALL;C:\;C
:\OS2\BITMAP;C:\OS2\MDOS;C:\OS2\APPS;C:\IBMREC;C:\OFFLOAD;
SET PROMPT=$i[$p]
SET HELP=C:\OS2\HELP;C:\OS2\HELP\TUTORIAL;C:\TCPIP\HELP;C:\OFFLOAD;
SET GLOSSARY=C:\OS2\HELP\GLOSS;
SET IPF_KEYS=SBCS
PRIORITY_DISK_IO=YES
FILES=20
DEVICE=C:\IBMCOM\LANMSGDD.OS2 /I:C:\IBMCOM
DEVICE=C:\IBMCOM\PROTMAN.OS2 /I:C:\IBMCOM
DEVICE=C:\OS2\TESTCFG.SYS
DEVICE=C:\OS2\DOS.SYS
DEVICE=C:\OS2\PMDD.SYS
BUFFERS=30
IOPL=YES
DISKCACHE=1024,LW,AC:C
MAXWAIT=1
MEMMAN=SWAP,PROTECT
SWAPPATH=C:\OS2\SYSTEM 2048 2048
BREAK=OFF
THREADS=4095
PRINTMONBUFSIZE=134,134,134
COUNTRY=001,C:\OS2\SYSTEM\COUNTRY.SYS
SET KEYS=ON
REM SET DELDIR=C:\DELETE,512;
BASEDEV=PRINT02.SYS
BASEDEV=IBM2FLPY.ADD
BASEDEV=IBM2SCSI.ADD /LED
BASEDEV=OS2DASD.DMD
SET BOOKSHELF=C:\OS2\BOOK;C:\TCPIP\DOC;
PROTECTONLY=NO
SHELL=C:\OS2\MDOS\COMMAND.COM C:\OS2\MDOS
FCBS=16,8
RMSIZE=640
DEVICE=C:\OS2\MDOS\VEMM.SYS
DOS=LOW,NOUMB
DEVICE=C:\OS2\MDOS\VDPX.SYS
```

```
DEVICE=C:\OS2\MDOS\VXMS.SYS /UMB
DEVICE=C:\OS2\MDOS\VDPMI.SYS
DEVICE=C:\OS2\MDOS\VCDROM.SYS
DEVICE=C:\OS2\MDOS\VMOUSE.SYS
DEVICE=C:\OS2\POINTDD.SYS
DEVICE=C:\OS2\MOUSE.SYS
DEVICE=C:\OS2\COM.SYS
DEVICE=C:\OS2\MDOS\VCOM.SYS
CODEPAGE=437,850
DEVINFO=KBD,US,C:\OS2\KEYBOARD.DCP
BASEDEV=XGA.SYS
DEVICE=C:\OS2\XGARING0.SYS
DEVINFO=SCR,VGA,C:\OS2\VIOTBL.DCP
SET VIDEO_DEVICES=VIO_XGA
SET VIO_XGA=DEVICE(BVHVGA,BVHXGA)
DEVICE=C:\OS2\MDOS\VVGA.SYS
DEVICE=C:\OS2\MDOS\VXGA.SYS
RUN=C:\IBMCOM\PROTOCOL\NETBIND.EXE
RUN=C:\IBMCOM\LANMSGEX.EXE
DEVICE=C:\OFFLOAD\NSCADDI.SYS M=C:\OFFLOAD\NSCA960.OUT N=C:\OFFLOAD\NSCAMCM C1=C
:\OFFLOAD\NSCA.CFG R=C:\OFFLOAD\NETWORK.CFG
RUN=C:\OFFLOAD\NSCCSTRT.EXE TCPIP >C:\OFFLOAD\NSCCSTRT.LOG
DEVICE=C:\IBMCOM\PROTOCOL\INET.SYS
DEVICE=C:\IBMCOM\PROTOCOL\IFNDIS.SYS
SET ETC=C:\TCPIP\ETC
SET TMP=C:\TCPIP\TMP
SET READIBM=C:\TCPIP\DOC
RUN=C:\TCPIP\BIN\CNTRL.EXE
DEVICE=C:\IBMCOM\MACS\IBMTOK.OS2
SET SNMPPORT=4000
DEVICE=C:\IBMCOM\MACS\IBMWAC.OS2
DEVICE=C:\IBMCOM\PROTOCOL\GSDFRP.200
DEVICE=C:\IBMCOM\PROTOCOL\NETBEUI.OS2
DEVICE=C:\IBMCOM\PROTOCOL\NETBIOS.OS2
DEVICE=C:\IBMCOM\PROTOCOL\LANDD.OS2
DEVICE=C:\IBMCOM\PROTOCOL\LANDLLDD.OS2
DEVICE=C:\IBMCOM\MACS\GSDBR14.200
RUN=C:\IBMCOM\PROTOCOL\LANDLL.EXE
DEVICE=C:\IBMREC\BIN\LDS.SYS
SET SESSIONS=1
SET LDSSERVER=3172DIST
DEVICE=C:\IBMCOM\MACS\IBMNSCA.OS2
DEVICE=C:\IBMCOM\MACS\ENETBM.OS2
DEVICE=C:\IBMCOM\PROTOCOL\GSDSRB.200
SET TELNET.PASSWORD.ID=mpe
REM RUN=C:\GSD\GSDBRMGR.EXE

***
***
****************************************************************************
****************************************************************************
***
*** SET Variables:
***
***

WP_OBJHANDLE=188607
USER_INI=C:\OS2\OS2.INI
SYSTEM_INI=C:\OS2\OS2SYS.INI
```

```
OS2_SHELL=C:\OS2\CMD.EXE
AUTOSTART=PROGRAMS,TASKLIST,FOLDERS,CONNECTIONS
RUNWORKPLACE=C:\OS2\PMSHELL.EXE
COMSPEC=C:\OS2\CMD.EXE
PATH=C:\OS2;C:\OS2\SYSTEM;W:\OS2\MDOS\WINOS2;C:\OS2\INSTALL;C:\;C:\OS2\MDOS;C:\O
S2\APPS;C:\TCPIP\BIN;C:\IBMREC\BIN;C:\OFFLOAD;
DPATH=C:\IBMCOM;C:\OS2;C:\OS2\SYSTEM;W:\OS2\MDOS\WINOS2;C:\OS2\INSTALL;C:\;C:\OS
2\BITMAP;C:\OS2\MDOS;C:\OS2\APPS;C:\IBMREC;C:\OFFLOAD;
PROMPT=$i[$p]
HELP=C:\OS2\HELP;C:\OS2\HELP\TUTORIAL;C:\TCPIP\HELP;C:\OFFLOAD;
GLOSSARY=C:\OS2\HELP\GLOSS;
IPF_KEYS=SBCS
KEYS=ON
BOOKSHELF=C:\OS2\BOOK;C:\TCPIP\DOC;
VIDEO_DEVICES=VIO_XGA
VIO_XGA=DEVICE(BVHVGA,BVHXGA)
ETC=C:\TCPIP\ETC
TMP=C:\TCPIP\TMP
READIBM=C:\TCPIP\DOC
SNMPPORT=4000
SESSIONS=1
LDSSERVER=3172DIST
TELNET.PASSWORD.ID=mpe
WORKPLACE__PROCESS=NO


***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\TCPIP\BIN\SETUP.CMD
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\TCPIP\BIN

SETUP    CMD     368   1-25-94   5:00p
        1 file(s)         368 bytes used
                    39233536 bytes free

***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\SETUP.CMD
***
***


route -fh
arp -f
ifconfig lan0 9.67.38.20 netmask 255.255.255.192
ifconfig lan1 9.67.46.85 netmask 255.255.255.192
ifconfig lan2 9.67.32.20 netmask 255.255.255.192  802.3
ifconfig lan3 9.67.38.20 127.1.1.1 netmask 255.255.255.192
REM ifconfig lan4
```

```
                REM ifconfig lan5
                REM ifconfig lan6
                REM ifconfig lan7
                REM ifconfig sl0
                route add default 9.67.38.20 2

                ***
                ***
                ****************************************************************************
                ****************************************************************************
                ***
                *** COMMAND:  DIR C:\IBMCOM\PROTOCOL.INI
                ***
                ***


                 The volume label in drive C is OS2.
                 The Volume Serial Number is A225:9014
                 Directory of C:\IBMCOM

                PROTOCOL INI     3219    2-02-94   8:45a
                        1 file(s)          3219 bytes used
                                      39229440 bytes free

                ***
                ***
                ****************************************************************************
                ****************************************************************************
                ***
                *** FILENAME:  C:\IBMCOM\PROTOCOL.INI
                ***
                ***

                [PROT_MAN]

                   DRIVERNAME = PROTMAN$

                [IBMLXCFG]

                   IBMTOK_nif = IBMTOK.nif
                   GSDSRB_nif = GSDSRB.NIF
                   LANDD_nif = LANDD.NIF
                   NETBEUI_nif = NETBEUI.NIF
                   TCPIP_nif = TCPIP.NIF
                   IBMWAC_nif = IBMWAC.nif
                   GSDFRP_nif = GSDFRP.NIF
                   GSDFRM_nif = GSDFRM.nif
                   IBMNSCA_nif = IBMNSCA.nif
                   ENETBM_nif = ENETBM.nif

                [GSDFRP_nif]

                   DriverName = GSDFRP$
                   Bindings = ,IBMWAC_nif
                   MACADDRESS = "4000011A3172"
                   VIRTMACPREFIX = "4000FF"
                   LMITYPE = 3
                   MAXDLCIS = 50
                   RING = 0xFFF
```

```
        MAXTRANSIZE = 600
        MAXTXFRAGSIZE = 614
        RCVPOOLSIZE = 50
        CIR = 2048
        CIRBC = 2048
        CIRBE = 2048
        T391LIVT = 10
        N391FSPC = 6
        T392SETO = 15
        N392ERTH = 3
        N393EVNT = 4
        SIZETXQUEUE = 8
        CSMID = "3172AWAC"

[GSDSRB_nif]

        DriverName = GSDSRB$
        Bindings = IBMTOK_nif,GSDFRM_nif
        RING = 0x582,0xFFF
        LINESPEED = 4000000,64000
        BRIDGENUM = 15
        PRIORITY = 32768
        MSDU = 4472
        MAXAGE = 20
        HELLOTIME = 2

[LANDD_nif]

        DriverName = LANDD$
        Bindings = IBMTOK_nif,GSDFRM_nif,ENETBM_nif
        NETADDRESS = "4000014A3172","4000011A3172",
        ETHERAND_TYPE = "I","I","I"
        SYSTEM_KEY = 0x0,0x0,0x0
        OPEN_OPTIONS = 0x2000,0x2000,0x2000
        TRACE = 0x0,0x0,0x0
        LINKS = 8,8,8
        MAX_SAPS = 3,3,3
        MAX_G_SAPS = 0,0,0
        USERS = 3,3,3
        TI_TICK_G1 = 255,255,255
        T1_TICK_G1 = 15,15,15
        T2_TICK_G1 = 3,3,3
        TI_TICK_G2 = 255,255,255
        T1_TICK_G2 = 25,25,25
        T2_TICK_G2 = 10,10,10
        IPACKETS = 250,250,250
        UIPACKETS = 100,100,100
        MAXTRANSMITS = 6,6,6
        MINTRANSMITS = 2,2,2
        TCBS = 64,64,64
        GDTS = 30,30,30
        ELEMENTS = 800,800,800

[NETBEUI_nif]

        DriverName = netbeui$
        Bindings = IBMTOK_nif,GSDFRM_nif,ENETBM_nif
        NETADDRESS = "T4000014A3172","T4000011A3172",
        ETHERAND_TYPE = "I"
```

```
                    USEADDRREV = "YES"
                    OS2TRACEMASK = 0x0
                    SESSIONS = 40
                    NCBS = 95
                    NAMES = 21
                    SELECTORS = 5
                    USEMAXDATAGRAM = "NO"
                    ADAPTRATE = 1000
                    WINDOWERRORS = 0
                    MAXDATARCV = 4168
                    TI = 30000
                    T1 = 500
                    T2 = 200
                    MAXIN = 1
                    MAXOUT = 1
                    NETBIOSTIMEOUT = 500
                    NETBIOSRETRIES = 8
                    NAMECACHE = 0
                    PIGGYBACKACKS = 1
                    DATAGRAMPACKETS = 2
                    PACKETS = 350
                    LOOPPACKETS = 1
                    PIPELINE = 5
                    MAXTRANSMITS = 6
                    MINTRANSMITS = 2
                    DLCRETRIES = 5

            [TCPIP_nif]

                    DriverName = TCPIP$
                    Bindings = IBMTOK_nif,GSDFRM_nif,ENETBM_nif,IBMNSCA_nif

            [IBMTOK_nif]

                    DriverName = IBMTOK$
                    ADAPTER = "PRIMARY"
                    NETADDRESS = "4000014A3172"
                    MAXTRANSMITS = 12
                    RECVBUFS = 3
                    RECVBUFSIZE = 2040
                    XMITBUFS = 3
                    XMITBUFSIZE = 2040
                    ENABLEBRIDGE

            [IBMWAC_nif]

                    DriverName = IBMWAC$
                    WACCARDNUM = 4
                    WACPORTNUM = 0
                    RAMADDRESS = 0x0D0000
                    RTS = 0
                    NRZI = 0
                    RS232MODE = 0
                    X21MODE = 0
                    LINESPEED = "64K"
                    MaxData = 2272
                    MACTYPE = "HDLC"
                    MaxTransmits = 8
```

```
[GSDFRM_nif]

    DriverName = GSDFRM$

[IBMNSCA_nif]

    DriverName = IBMNSCA$
    Claw = 1
    Resource = "TCPIP"
    AdapterNum = 1
    Subchannel = 0
    MaxTransmits = 8
    MaxFramesize = 4096

[ENETBM_nif]

    DriverName = ENETBM$
    maxtransmits = 24
    recvbufs = 14
    netaddress = "4000012A3172"


***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\IBMCOM\LANTRAN.LOG
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\IBMCOM


LANTRAN  LOG      1700   2-02-94   4:54p
        1 file(s)       1700 bytes used
                    39223296 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\IBMCOM\LANTRAN.LOG
***
***

IBM OS/2 LANMSGDD [09/01/92] 2.01 is loaded and operational.
IBM OS/2 LAN Protocol Manager
IBM - IBM Token-Ring Network Driver, Version V.2.02
Port: 0   Hardware Interface: V35
I/O Port: 0400   Irq: 10   Shared Ram: 000C4000
Rx Clock: External        Tx Clock: External
IBM OS/2 IBMWAC 1.00 successfully loaded.
IBM OS/2 RouteXpander/2 Version 1.0 successfully loaded.
IBM OS/2 NETBEUI 2.01
IBM OS/2 NETBIOS 4.0
```

```
Adapter 0 has 95 NCBs, 40 sessions, and 21 names available to NETBIOS applicatio
ns.
Adapter 1 has 95 NCBs, 40 sessions, and 21 names available to NETBIOS applicatio
ns.
Adapter 2 has 95 NCBs, 40 sessions, and 21 names available to NETBIOS applicatio
ns.
NETBIOS 4.0 is loaded and operational.
IBM OS/2 LANDD [09/01/92] 2.01.2
IBM OS/2 LANDLLDD 2.01
IBM OS/2 LANDLLDD is loaded and operational.
IBM - GSD Source Route Bridge V 1.0 17:23:30, Jul 27 1993
IBM OS/2 LAN Netbind
IBM Token-Ring adapter data rate is 4 mbps.
IBM LANDD is accessing IBM 802.5 LAN Interface.
Adapter 0 was initialized and opened successfully.
Adapter 0 is using node address 4000014A3172.
IBM LANDD was successfully bound to MAC: IBMTOK_nif->VECTOR.
IBM LANDD is accessing IBM 802.5 LAN Interface.
Adapter 1 was initialized and opened successfully.
Adapter 1 is using node address 4000011A3172.
IBM LANDD was successfully bound to MAC: GSDFRM_nif->VECTOR.
IBM LANDD is accessing IBM 802.3 LAN Interface.
Adapter 2 was initialized and opened successfully.
Adapter 2 is using node address 4000012A3172.  The Token-Ring format is 02008054
8C4E.
IBM LANDD was successfully bound to MAC: ENETBM_nif->VECTOR.
Binding MAC: [IBMTOK_NIFB] as Port #1
Binding MAC: [GSDFRM_NIFB] as Port #2

***
***
****************************************************************************
****************************************************************************
***
*** COMMAND:  DIR C:\IBMCOM\MACS\*.*
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\IBMCOM\MACS

 ,              <DIR>     12-08-93    5:06p
 ,,             <DIR>     12-08-93    5:06p
 IBMWAC    NIF     6380   10-15-92    9:45a
 ELNKII    NIF     3064   11-27-91    1:20p
 ELNKII    OS2    17892    6-20-91    4:31p
 ELNKMC    NIF     1463   11-27-91    1:23p
 ELNKMC    OS2    16599   10-28-91    4:58p
 IBM16OS2  NIF     3961    7-26-93    3:26p
 IBM16TR   OS2    19508    7-26-93    3:14p
 IBMNET    NIF     2129    2-20-92    2:14p
 IBMNET    OS2    13572    9-01-92    4:59a
 IBMNETA   NIF     2135    2-20-92    2:14p
 IBMNETA   OS2    13604    9-01-92    4:59a
 IBMTOK    NIF     5782   11-12-92   10:21a
 IBMTOK    OS2    25652   11-16-92    1:05p
 IBMTRBM   NIF     3534    1-31-92    2:16p
```

```
IBMTRBM  OS2     20724    9-01-92   5:00a
IBMXLN   NIF      1328    2-12-92   1:18p
IBMXLN   OS2     12372    9-01-92   5:00a
MACETH   NIF      2390    2-20-92   2:15p
MACETH   OS2     17460    9-15-91   9:16p
MACETH2  OS2     17460    9-15-91   9:16p
MACWD    OS2     17972    8-11-92  10:04a
MACWD2   OS2     17972    8-11-92  10:04a
MACWDAT  NIF      3516    8-11-92   9:26a
MACWDMC  NIF      2380    8-11-92   9:26a
MONT400  BIN     45440    4-10-91  11:06a
UBNEI    OS2     27604    2-10-92  12:01p
UBNEIPC  NIF      3228    1-31-92   2:16p
UBNEIPS  NIF      2339    1-31-92   2:16p
WRTRAM   BIN       922    2-19-91   2:05p
ENETBM   NIF      1271    6-29-93   1:03p
ENETBM   OS2     34757    6-29-93   1:03p
ENETBM   SYM      4324    6-29-93   1:03p
IBMFDDI  BIN    131072    6-29-93   1:03p
IBMFDDI  NIF      2882    6-29-93   1:03p
IBMFDDI  OS2     29748    6-29-93   1:03p
IBMWAC   OS2     68660   11-15-92   1:25p
IBMPCA   NIF      1946    3-30-92   1:51p
IBMPCA   OS2     19508    9-22-93   3:36p
IBMNSCA  NIF      1895    5-25-93  10:48a
IBMNSCA  OS2     18996    5-26-93   7:08a
GSDBR14  200      1060    1-29-93   2:32p
GSDFRM   NIF       177    9-27-92   3:32p
IBMTOK   OLD     15140    9-03-92   7:01a
         45 file(s)     659818 bytes used
                      39217152 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\IBMCOM\PROTOCOL\*.*
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\IBMCOM\PROTOCOL

,            <DIR>       12-08-93   5:06p
,,           <DIR>       12-08-93   5:06p
IFNDISNL SYS     714    7-12-93   2:06p
IFNDIS   SYS   31935    8-05-93  10:21a
INET     SYS   99631    8-05-93  10:20a
NETBIND  EXE   13657    9-01-92   5:00a
TCPIP    NIF     143    3-11-92  10:50a
LANDD    NIF   10267    8-27-92  11:36a
LANDD    OS2  114228    9-03-92   7:01a
LANDLL   EXE     512    8-20-91   1:26p
LANDLLDD OS2   30336    8-18-92   9:52a
LANPDD   OS2    2198    9-08-92   7:33a
LANVDD   OS2   36944    9-17-92   7:07a
```

```
LANVMEM  SYS      4734   9-08-92   7:34a
NETBEUI  NIF     14433   8-27-92  11:36a
NETBEUI  OS2     95412   9-22-92   4:36p
NETBIOS  OS2     15364   9-11-92   8:58a
ODI2NDI  NIF      2592   8-27-92  11:36a
ODI2NDI  OS2     18484   9-15-92   3:57p
GSDFRP   200     80436   8-30-93   4:46p
GSDFRP   NIF      8629  11-06-92  11:24a
GSDSRB   200     43572   7-27-93   5:33p
GSDSRB   NIF      3178  10-23-92  10:05a
        23 file(s)      627399 bytes used
                      39215104 bytes free


***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\STARTUP.CMD
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\

STARTUP  CMD       101   2-02-94   4:50p
         1 file(s)         101 bytes used
                      39213056 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\STARTUP.CMD
***
***


REM START /MIN C:\GSD\GSDNMA.EXE
REM START /MIN C:\GSD\GSDNMA.EXE /SNMP=9.67.38.20
@exit




***
***
*****************************************************************************
*****************************************************************************
***
*** COMMAND:  DIR C:\TCPIP\BIN\TCPSTART.CMD
***
***


 The volume label in drive C is OS2.
```

```
 The Volume Serial Number is A225:9014
 Directory of C:\TCPIP\BIN

TCPSTART CMD    1208  1-25-94   5:00p
        1 file(s)        1208 bytes used
                     39211008 bytes free


***
***
****************************************************************************
****************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\TCPSTART.CMD
***
***


@echo off

echo CONFIGURING TCP/IP .....
IF EXIST C:\TCPIP\BIN\B4TCP.CMD CALL C:\TCPIP\BIN\B4TCP.CMD
IF EXIST C:\TCPIP\BIN\SETUP.CMD CALL C:\TCPIP\BIN\SETUP.CMD
echo ..... FINISHED CONFIGURING TCP/IP


echo STARTING THE TCP/IP PROCESSES .....
REM start /min inetd
REM echo      ..... INET Daemon Started
start /min telnetd -p 5000
echo      ..... TELNET Daemon Started
REM start tftpd
REM echo      ..... TFTP Daemon Started
REM start pmx -nocopyright
REM echo      ..... X System Server Started
REM start talkd
REM echo      ..... TALK Daemon Started
REM start portmap
REM echo      ..... Portmapper Started
REM start nfsd
REM echo      ..... Network File System Server Started
REM call nfsstart
REM echo      ..... Network File System Client Started
REM start routed
REM echo      ..... ROUTED Started
REM start sendmail -bd -q30m
REM echo      ..... SENDMAIL Started
REM start nr2
REM echo      ..... NR2 Started
REM start lamail
REM echo      ..... LAMAIL Started
REM detach lprportd
REM echo      ..... LPRPORTD Started
echo ..... FINISHED STARTING THE TCP/IP PROCESSES
IF EXIST C:\TCPIP\BIN\TCPEXIT.CMD CALL C:\TCPIP\BIN\TCPEXIT.CMD
echo .....  EXITING TCPSTART.CMD  .....


***
***
**************************************************************************
**************************************************************************
```

```
***
*** COMMAND:  DIR C:\TCPIP\BIN\TCPEXIT.CMD
***
***


 The volume label in drive C is OS2.
 The Volume Serial Number is A225:9014
 Directory of C:\TCPIP\BIN

TCPEXIT  CMD       138   1-26-94   3:39p
        1 file(s)         138 bytes used
                     39204864 bytes free

***
***
*****************************************************************************
*****************************************************************************
***
*** FILENAME:  C:\TCPIP\BIN\TCPEXIT.CMD
***
***

START /min "TCP/IP Offload Server" OFFRUN API TCPIP
START /min "TCP/IP Offload SNMP Subagent" OFFSNMP public
START "OS/2 Window"
exit

***
***
*****************************************************************************
***   GETSETUP - End of Data
*****************************************************************************
```

B.4 3172 Offload Restore

These four files are customized for the Token-Ring 16/4 Busmaster Adapter,
when creating OS/2 boot diskettes to restore the Offload environment as
described in "Creating Your OS/2 Boot Diskettes" on page 312.

B.4.1 CONFIG.SYS

```
BUFFERS=32
IOPL=YES
MEMMAN=NOSWAP
PROTSHELL=A:\CMD.EXE /K A:\STARTUP.CMD
PROTECTONLY=YES
LIBPATH=.;A:\;C:\;D:\;E:\;F:\;G:\;H:\;I:\;J:\;K:\;L:\;M:\;N:\;O:\;P:\;Q:\;R:\;S:
\;T:\;U:\;V:\;W:\;X:\;Y:\;Z:\;
SET PATH=A:\;\;
SET DPATH=A:\;\;
IFS=HPFS.IFS /C:64 /AUTOCHECK:C
PAUSEONERROR=NO
CODEPAGE=850
DEVINFO=KBD,US,KEYBOARD.DCP
DEVINFO=SCR,EGA,VTBL850.DCP
SET KEYS=ON
DEVICE=A:\LANPDD.OS2
DEVICE=A:\LANMSGDD.OS2 /I:A:\
DEVICE=A:\PROTMAN.OS2 /I:A:\
DEVICE=A:\VDISK.SYS 640,256,32
RUN=A:\NETBIND.EXE
RUN=A:\LANMSGEX.EXE
DEVICE=A:\NETBEUI.OS2
DEVICE=A:\IBMTRBM.OS2
DEVICE=A:\NETBIOS.OS2
BASEDEV=PRINT01.SYS
BASEDEV=IBM1FLPY.ADD
BASEDEV=IBM1S506.ADD
BASEDEV=IBM2FLPY.ADD
BASEDEV=IBM2ADSK.ADD
BASEDEV=IBM2SCSI.ADD
BASEDEV=IBMINT13.I13
BASEDEV=OS2DASD.DMD
SET TRANSPORT=SU2TSN
SET LIBRARIAN=LIB8565B
```

B.4.2 PROTOCOL.INI

```
[PROT_MAN]

DriverName = PROTMAN$

[IBMLXCFG]

IBMTRBM_nif = IBMTRBM.nif
NETBEUI_nif = NETBEUI.nif

[NETBEUI_nif]

DriverName = netbeui$
Bindings = IBMTRBM_nif
ETHERAND_TYPE = 14
```

```
                    USEADDRREV = YES
                    SESSIONS = 40
                    NCBS = 95
                    NAMES = 21
                    SELECTORS = 5
                    USEMAXDATAGRAM = NO
                    ADAPTRATE = 1000
                    WINDOWERRORS = 0
                    TI = 30000
                    T1 = 500
                    T2 = 200
                    MAXIN = 1
                    MAXOUT = 2
                    NETBIOSTIMEOUT = 500
                    NETBIOSRETRIES = 8
                    NAMECACHE = 16
                    PIGGYBACKACKS = 1
                    DATAGRAMPACKETS = 2
                    PACKETS = 350
                    PIPELINE = 5
                    MAXTRANSMITS = 6
                    MINTRANSMITS = 2
                    DLCRETRIES = 5

                    [IBMTRBM_nif]

                    DriverName = IBMTRBM$
                    MaxTransmits = 31
                    MinRcvBuffs = 20
                    SizWorkBuf =2048
```

B.4.3 IBMTRBM.NIF

```
                    [IBMTRBM]
                     Type = NDIS_SNGL
                     Title = "IBM Token-Ring Network Busmaster Server Adapter"
                     Version = 1.0
                     DriverName = IBMTRBM$
                     XPORTS = NETBEUI LANDD
                     COPYFILE = A:\MONT400.BIN, A:\WRTRAM.BIN, A:\LT4.MSG, A:\LT4H.MSG

                    [File]
                     Name = IBMTRBM.OS2
                     Path = A:\

                    [NetAddress]
                     display = "Network adapter address"
                     type = HexString
                     strlength = 12
                     Range = 400000000000 - 7FFFFFFFFFFF
                     Optional = Yes
                     Editable = Yes
                     Virtual = No
                     Help = "This parameter overrides the network address of the network
                     adapter card.  The value of this parameter is a hexadecimal string of
                     12 digits, as in 400001020304.  The address
                     must be unique among all other network adapter addresses on the
                     network."
```

```
[AdapBuffSize]
 display = "Adapter card buffer size"
 type = Decimal
 Default = "1032"
 Range = 96-2048
 Step = 8
 Optional = Yes
 Editable = Yes
 Virtual = No
 Help = "This parameter specifies the size of the buffers on the
  network adapter card.  The value of this parameter must be a multiple
  of 8.  Increase this parameter if you are sending large frames
  through the network."

[AdapMinTran]
 display = "Minimum adapter card transmit buffers"
 type = Decimal
 Default = "4"
 Range = 4 - 676
 Optional = Yes
 Editable = Yes
 Virtual = No
 Help = "This parameter specifies the minimum amount of buffer
  resources reserved for transmit buffers.  This parameter value
  can be increased in a system that is transmit bound."

[AdapMaxTran]
 display = "Maximum adapter card transmit buffers"
 type = Decimal
 Default = "48"
 Range = 6 - 676
 Optional = Yes
 Editable = Yes
 Virtual = No
 Help = "This parameter specifies the maximum amount of buffer resources
  reserved for transmit buffers.  This parameter specifies the maximum
  amount of buffers contained in the buffer resource pool that are
  available for transmitting data.  By default, this parameter defines
  the minimum number of buffers available for receiving data and can
  be reduced in a system that is receive bound."

[MaxTransmits]
 display = "Maximum number of queued transmits"
 type = Decimal
 Default = "31"
 Range = 1 -  459
 Optional = Yes
 Editable = Yes
 Virtual = No
 Help = "This parameter specifies the maximum number of transmit queue
  entries.  The network adapter driver allocates approximately 260
  bytes for each transmit queue entry.  The value of this parameter
  should be high enough to accommodate the sum of all Maximum Number
  of Queued Transmits parameter values for all protocol drivers using
  the adapter concurrently."

[MinRcvBuffs]
 display = "Minimum number of adapter driver receive buffers"
 type = Decimal
```

```
                    Default = "20"
                    Range = 1 - 3260
                    Optional = Yes
                    Editable = Yes
                    Virtual = No
                    Help = "This parameter specifies the minimum number of receive buffers
                      that are allocated.  The value must have the following relationship:
                      (Minimum Adapter Driver Receive Buffers value x Size of Adapter Driver
                      Receive Buffer value) > size of the largest frame on the network.
                      This value must be > 4500 bytes on a 4MB network, and > 18000 bytes on
                      a 16MB network."

                    [SizWorkBuf]
                    display = "Size of adapter driver receive buffer"
                    type = Decimal
                    Default = "2048"
                    Range = 96 - 18000
                    Optional = Yes
                    Editable = Yes
                    Virtual = No
                    Help = "This parameter specifies the size of each receive buffer.
                    Refer to the Minimum Adapter Driver Receive Buffers parameter
                    for more information about the value of this parameter."
```

B.4.4 NETBEUI.NIF

```
                    ; common section
                    [NETBEUI]
                     Type = Protocol
                     Title = "IBM OS/2 NETBIOS"
                     Version = 2.1
                     Drivername = netbeui$

                    [FILE]
                     Name = NETBEUI.OS2,NETBIOS.OS2
                     path= A:\

                    ; parameter section
                    [NETADDRESS]
                    DISPLAY = "Network adapter address"
                    TYPE = String
                    STRLENGTH = 13
                    SCOPE = local
                    OPTIONAL = yes
                    EDITABLE = yes
                    HELP = "Enter the type of address (I or T) followed by a 12 digit
                            hexadecimal address.  I is for IEEE standard notation,
                            Ethernet address format and T is for IBM Token-Ring
                            Network format."

                    [ETHERAND_TYPE]
                     Tag       = etherand_type
                     Display   = "Type of Ethernet driver support"
                     Type      = String
                     StrLength = 1
                     Default   = "I"
                     Set       = "I","D"
                     Scope     = global
                     Optional  = yes
```

```
         Editable = yes
         Help    = "This parameter specifies the default protocol conventions
         to use when the NETBIOS protocol is bound to an Ethernet network
         adapter driver that supports both IEEE 802.3 and DIX 2.0 conventions.
         The value I is for IEEE 802.3 and the value D is for DIX 2.0."

         [USEADDRREV]
          Tag      = useaddrrev
          Display  = "Universally administered address reversed"
          Type     = String
          StrLength = 3
          Default  = "YES"
          Set      = "YES","NO"
          Scope    = global
          Optional = yes
          Editable = yes
          Help     = "This parameter specifies whether the address used for the
          permanently encoded address and NAME_NUMBER_1 is reversed. If set to
          YES, the burned-in address used in the ADAPTER_STATUS command and
          in NAME_NUMBER_1 will be byte reversed (if the address is X'010203040506',
          it will be saved as X'060504030201')."

         [OS2TRACEMASK]
         DISPLAY = "NETBIOS trace level"
         TYPE = Hexadecimal
         DEFAULT = 0
         RANGE = 0-ffff
         STEP = 1
         SCOPE = global
         OPTIONAL = yes
         EDITABLE = yes
         HELP = "This parameter specifies the type of information to trace.
                 Refer to the IBM Local Area Network Technical Reference
                 for details about tracing particular network activities."

         [SESSIONS]
          Tag      = sessions
          Display  = "Maximum sessions"
          Type     = decimal
          Default  = "40"
          Range    = 1 - 254
          Scope    = global
          Optional = yes
          Editable = yes
          Help     = "This parameter specifies the maximum number of NETBIOS
          sessions that can be open simultaneously.  The NETBIOS protocol
          uses a session each time it adds or finds a NETBIOS name.  Increase
          the value of this parameter if ADD.NAME or FIND.NAME requests
          occur simultaneously.  If a request fails due to lack of sessions,
          the protocol returns an interface-busy error."

         [NCBS]
          Tag      = NCBS
          Display  = "Maximum commands"
          Type     = decimal
          Default  = "95"
          Range    = 1 - 255
          Scope    = global
          Optional = yes
```

```
Editable  = yes
Help      = "This parameter specifies the number of network control
block (NCB) descriptors to allocate for managing NCBs submitted
to the NETBIOS protocol."

[NAMES]
Tag       = names
Display   = "Maximum names"
Type      = decimal
Default   = "21"
Range     = 2 - 254
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the maximum number of NETBIOS
names that can be defined.  One name is reserved for defining the
station address of the network adapter card.  If the NETBIOS protocol
is bound to multiple network adapter drivers, this parameter specifies
the maximum number of NETBIOS names in each network adapter driver's
name table."

[SELECTORS]
Tag       = selectors
Display   = "GDT selectors"
Type      = decimal
Default   = "5"
Range     = 2 - 100
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the number of internal data
descriptors to allocate for global descriptor table (GDT) selectors.
GDT selectors are a limited OS/2 resource.  If too many GDT selectors
are allocated, performance of other application programs and protocol
drivers may be hindered."

[USEMAXDATAGRAM]
Tag       = usemaxdatagram
Display   = "Full buffer datagrams"
Type      = String
StrLength = 3
Default   = "NO"
Set       = "YES","NO"
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies whether to request the full
transmit buffer size for datagrams.  If this parameter is set to NO,
the length of a datagram has a maximum of 512 bytes.  Set this
parameter to YES if you require the full transmit buffer size
for datagrams."

[ADAPTRATE]
Tag       = adaptrate
Display   = "Adaptive windowing interval"
Type      = decimal
Default   = "1000"
Range     = 0 - 65535
Scope     = global
```

```
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the time, in milliseconds,
between runs of the adaptive window algorithm.  For each link, the
NETBIOS protocol uses the adaptive window algorithm to change the
Maximum Receives Outstanding and Maximum Transmits Outstanding
parameter values to match the values set on the remote workstation.
If this parameter has a value of 0, the algorithm is turned off."

[WINDOWERRORS]
Tag       = windowerrors
Display   = "Window errors"
Type      = decimal
Default   = "0"
Range     = 0 - 10
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the number of dropped packets
that the adaptive window allows before decreasing the Maximum
Transmits Outstanding parameter value.  Increase the value of this
parameter on a network with a heavy workload.  Decrease the value
of this parameter on a network with a light workload."

[MAXDATARCV]
Tag       = maxdatarcv
Display   = "Maximum receive data size"
Type      = decimal
Default   = "4168"
Range     = 512 - 16384
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the maximum receive data
size, in bytes.  This is the maximum size user data in any frame
that this node wants to receive on a session.  The partner will
limit the size for the user data in frames transmitted over the
session to this size or the size available in its transmit
buffer, whichever is smaller.  NETBIOS takes into account the
maximum size that bridges in the path will forward.  It will
never send a frame larger than the bridge will forward."

[TI]
Tag       = TI
Display   = "Inactivity timer - Ti"
Type      = decimal
Default   = "30000"
Range     = 1000 - 65535
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the inactivity timer value in
milliseconds.  The inactivity timer determines how often the NETBIOS
protocol checks an inactive link to verify that the link is still
operational.  To minimize unnecessary link checks, it is recommended
that you set this parameter to 30000 milliseconds.
Refer to the Response Timer - T1 parameter for more information."

[T1]
```

```
         Tag       = T1
         Display   = "Response timer - T1"
         Type      = decimal
         Default   = "500"
         Range     = 50 - 65535
         Scope     = global
         Optional  = yes
         Editable  = yes
         Help      = "This parameter specifies the transmission timer value
         for NETBIOS links and determines, in milliseconds, the delay before
         transmitting a link-level frame again if no acknowledgment is
         received.  The three timer parameters must have the following
         relationship: T2 < T1 <Ti.  The T1 parameter value should be
         approximately 2 to 5 times the T2 parameter value."

         [T2]
         Tag       = T2
         Display   = "Acknowledgment timer - T2"
         Type      = decimal
         Default   = "200"
         Range     = 50 - 65535
         Scope     = global
         Optional  = yes
         Editable  = yes
         Help      = "This parameter specifies the delayed acknowledgment
         timer value and determines, in milliseconds, the length of the
         delay before acknowledging a received frame, when the number of
         frames received is less than the Maximum Receives Outstanding parameter
         value."

         [MAXIN]
         Tag       = maxin
         Display   = "Maximum receives outstanding"
         Type      = decimal
         Default   = "1"
         Range     = 1 - 127
         Scope     = global
         Optional  = yes
         Editable  = yes
         Help      = "This parameter specifies the number of NETBIOS message
         packets to receive before sending an acknowledgment.  The Maximum
         Receives Outstanding parameter value should be less than or equal to
         the Maximum Transmits Outstanding parameter value."

         [MAXOUT]
         Tag       = maxout
         Display   = "Maximum transmits outstanding"
         Type      = decimal
         Default   = "1"
         Range     = 1 - 127
         Scope     = global
         Optional  = yes
         Editable  = yes
         Help      = "This parameter specifies the number of NETBIOS message
         packets to send before expecting an acknowledgment.  The Maximum
         Transmits Outstanding parameter value should be greater than the
         Maximum Receives Outstanding parameter value."

         [NETBIOSTIMEOUT]
```

```
Tag       = netbiostimeout
Display   = "Query timeout"
Type      = decimal
Default   = "500"
Range     = 500 - 10000
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the time, in milliseconds,
that the NETBIOS protocol waits between transmission attempts.  Refer
to the NETBIOS Retries parameter for more information."

[NETBIOSRETRIES]
Tag       = netbiosretries
Display   = "NETBIOS retries"
Type      = decimal
Default   = "8"
Range     = 1 - 50
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the number of times the NETBIOS
protocol attempts transmissions at the NETBIOS level before assuming
that the receiver is not present.  The transmission activities include
name claims, session setups, and other similar actions.  Refer
to the Query Timeout parameter for more information."

[NAMECACHE]
Tag       = namecache
Display   = "Number of names in remote name directory"
Type      = decimal
Default   = "0"
Range     = 0 - 255
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies the number of remote names that
the workstation contacts.  If this parameter is set to 0, the remote
name directory is not used.  The remote name directory reduces the
number of frames broadcast to the NETBIOS functional address on the
network.  The remote name directory sends a frame to a specific
node whenever possible."

[PIGGYBACKACKS]
Tag       = piggybackacks
Display   = "Piggybacked acknowledgments"
Type      = decimal
Default   = "1"
Set       = "0","1"
Scope     = global
Optional  = yes
Editable  = yes
Help      = "This parameter specifies whether the NETBIOS protocol
sends and receives acknowledgments piggybacked with incoming data.
If this parameter is set to 1, the workstation sends and requests
piggybacked acknowledgments.  If this parameter is set to 0, the
workstation neither sends nor requests piggybacked acknowledgments."

[DATAGRAMPACKETS]
```

```
              Tag       = datagrampackets
              Display   = "UI-frame descriptors"
              Type      = decimal
              Default   = "2"
              Range     = 2 - 1000
              Scope     = global
              Optional  = yes
              Editable  = yes
              Help      = "This parameter specifies the number of data descriptors
              to allocate for packeting NETBIOS datagrams into UI-frames.  Increase
              this parameter value when the NETBIOS protocol sends a large number
              of datagrams."

              [PACKETS]
              Tag       = packets
              Display   = "I-frame descriptors"
              Type      = decimal
              Default   = "350"
              Range     = 1 - 1000
              Scope     = global
              Optional  = yes
              Editable  = yes
              Help      = "This parameter specifies the number of I-frame packet
              descriptors that the NETBIOS protocol can use to build DLC frames
              from NETBIOS messages.  Increase the value of this parameter if large
              frames are being sent through the network."

              [LOOPPACKETS]
              Tag       = looppackets
              Display   = "Loopback frame descriptors"
              Type      = decimal
              Default   = "1"
              Range     = 1 - 1000
              Scope     = global
              Optional  = yes
              Editable  = yes
              Help      = "This parameter specifies the number of internal
              loopback packet descriptors.  Loopback packets are used when
              sending I frames or UI frames, if the sending node and the
              receiving node are the same."

              [PIPELINE]
              Tag       = pipline
              Display   = "Pipeline packets"
              Type      = decimal
              Default   = "5"
              Range     = 1 - 200
              Scope     = global
              Optional  = yes
              Editable  = yes
              Help      = "This parameter specifies the number of NETBIOS message
               packets that are prebuilt and waiting in a pipeline for each session.
               Increase the value of this parameter if long streams of packets are
               usually sent.  Decrease the value of this parameter if short,
               occasional groups of packets are sent."

              [MAXTRANSMITS]
              Tag       = maxtransmits
              Display   = "Maximum transmits"
```

```
Type     = decimal
Default  = "6"
Range    = 1 - 10000
Scope    = global
Optional = yes
Editable = yes
Help     = "This parameter specifies the number of packets that the
NETBIOS protocol can send at once to a network adapter driver.  The
NETBIOS protocol queues the packets internally when this parameter
value is low.  The network adapter driver must queue the packets when
this parameter value is high."

[MINTRANSMITS]
Tag      = mintransmits
Display  = "Minimum transmits"
Type     = decimal
Default  = "2"
Range    = 0 - 9999
Scope    = global
Optional = yes
Editable = yes
Help     = "When a network adapter driver returns an out-of-resource
condition, the NETBIOS protocol stops sending packets.  This parameter
specifies the number of transmission confirmations the NETBIOS protocol
must receive from the network adapter driver before sending additional
packets.  This value should be less than the Maximum Transmits
parameter value."

[DLCRETRIES]
Tag      = dlcretries
Display  = "DLC retries"
Type     = decimal
Default  = "5"
Range    = 1 - 65535
Scope    = global
Optional = yes
Editable = yes
Help     = "This parameter specifies the number of additional
transmission attempts that the NETBIOS protocol makes before
assuming that the receiving workstation's DLC layer is not
responding.  The value of this parameter can be low on a reliable
network that does not drop many packets.  Increase this
parameter value on a network that drops a large number of packets."

[NETFLAGS]
Tag      = netflags
Display  = "NetFlags"
Type     = Hexadecimal
Default  = 0
RANGE = 0-ffff
Scope    = global
Optional = yes
Editable = no
Help     = "This parameter in for IBM use only.  This parameter cannot
be changed."
```

:12 refid=RFC.1294

Appendix C. RFC 1294. Multiprotocol Interconnect over Frame Relay

Network Working Group   T. Bradley
Request for Comments: 1294   C. Brown
                                        Wellfleet Communications, Inc.
                                                            A. Malis
                                                    BBN Communications
                                                        January 1992

Multiprotocol Interconnect over frame relay

1. Status of this Memo

This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

2. Abstract

This memo describes an encapsulation method for carrying network interconnect traffic over a frame relay backbone. It covers aspects of both Bridging and Routing. Systems with the ability to transfer both this encapsulation method, and others must have a priori knowledge of which virtual circuits will carry which encapsulation method and this encapsulation must only be used over virtual circuits that have been explicitly configured for its use.

3. Acknowledgements

Comments and contributions from many sources, especially those from Ray Samora of Proteon, Ken Rehbehn of Netrix Corporation, Fred Baker and Charles Carvalho of Advanced Computer Communications and Mostafa Sherif of AT&T have been incorporated into this document. Special thanks to Dory Leifer of University of Michigan for his contributions to the resolution of fragmentation issues. This document could not have been completed without the expertise of the IP over Large Public Data Networks working group of the IETF.

4. Conventions

The following language conventions are used in the items of specification in this document:

o Must, Shall or Mandatory -- the item is an absolute requirement of the specification.

o Should or Recommended -- the item should generally be followed for all but exceptional circumstances.

o May or Optional -- the item is truly optional and may be followed or ignored according to the needs of the implementor.

5. Introduction

The following discussion applies to those devices which serve as end stations (DTEs) on a public or private frame relay network (for example, provided by a common carrier or PTT). It will not discuss the behavior of those stations that are considered a part of the frame relay network (DCEs) other than to explain situations in which the DTE must react.

The frame relay network provides a number of virtual circuits that form the basis for connections between stations attached to the same frame relay network. The resulting set of interconnected devices forms a private frame relay group which may be either fully interconnected with a complete "mesh" of virtual circuits, or only partially interconnected. In either case, each virtual circuit is uniquely identified at each frame relay interface by a Data Link Connection Identifier (DLCI). In most circumstances DLCIs have strictly local significance at each frame relay interface.

The specifications in this document are intended to apply to both switched and permanent virtual circuits.

6. Frame Format

All protocols must encapsulate their packets within a Q.922 Annex A [1,2]. Additionally, frames shall contain information necessary to identify the protocol carried within the Protocol Data Unit (PDU), thus allowing the receiver to properly process the incoming packet. The format shall be as follows:

```
              +----------------------------+
              |    flag (7E hexadecimal)    |
              +----------------------------+
              |       Q.922 Address*        |
              +--                        --+
              |                            |
              +----------------------------+
              | Control (UI = 0x03)         |
              +----------------------------+
              | Optional Pad(s)    (0x00)   |
              +----------------------------+
              | NLPID                       |
              +----------------------------+
              |                            |
              |              .             |
              |              .             |
              |              .             |
              |            Data            |
              |              .             |
              |              .             |
              +----------------------------+
              |   Frame Check Sequence      |
              +--          .             --+
              |        (two octets)         |
              +----------------------------+
              |   flag (7E hexadecimal)     |
              +----------------------------+
```
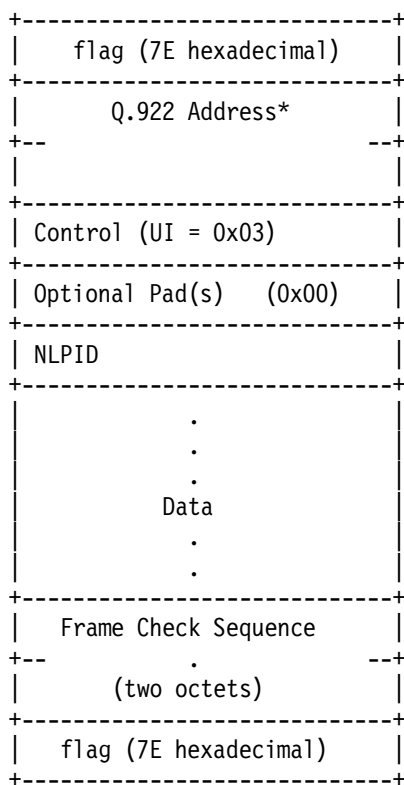
   * Q.922 addresses, as presently defined, are two octets and
     contain a 10-bit DLCI. In some networks Q.922 addresses may
     optionally be increased to three or four octets.

The control field is the Q.922 control field. The UI (0x03) value is
used unless it is negotiated otherwise. The use of XID (0xAF or
0xBF) is permitted and is discussed later.

The pad field is an optional field used to align the remainder of the
frame to a convenient boundary for the sender. There may be zero or
more pad octets within the pad field and all must have a value of
zero.

The Network Level Protocol ID (NLPID) field is administered by ISO
and CCITT. It contains values for many different protocols including
IP, CLNP and IEEE Subnetwork Access Protocol (SNAP)[10].
This field
tells the receiver what encapsulation or what protocol follows.
Values for this field are defined in ISO/IEC TR 9577 [3].
A NLPI D
value of 0x00 is defined within ISO/IEC TR 9577 as the Null Network
Layer or Inactive Set. Since it cannot be distinguished from a pad
field, and because it has no significance within the context of this
encapsulation scheme, a NLPID value of 0x00 is invalid under the
frame relay encapsulation. The known NLPID values are listed in the
Appendix.

For full interoperability with older frame relay encapsulation
formats, a station may implement section 15, Backward Compatibility.

There is no commonly implemented maximum frame size for frame relay.
A network must, however, support at least a 262 octet maximum.
Generally, the maximum will be greater than or equal to 1600 octets,
but each frame relay provider will specify an appropriate value for
its network. A frame relay DTE, therefore, must allow the maximum
acceptable frame size to be configurable.

The minimum frame size allowed for frame relay is five octets between
the opening and closing flags.

7. Interconnect Issues

There are two basic types of data packets that travel within the
frame relay network, routed packets and bridged packets. These
packets have distinct formats and therefore, must contain an
indication that the destination may use to correctly interpret the
contents of the frame. This indication is embedded within the NLPID
and SNAP header information.

For those protocols that do not have a NLPID already assigned, it is
necessary to provide a mechanism to allow easy protocol
identification. There is a NLPID value defined indicating the
presence of a SNAP header.

A SNAP header is of the form

```
+------------------------------+
| Organizationally Unique      |
+--           +--------------+
| Identifier  | Protocol     |
+--------------+--------------+
| Identifier  |
+--------------+
```
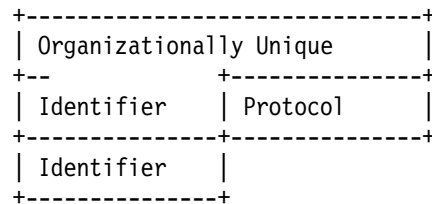
All stations must be able to accept and properly interpret both the
NLPID encapsulation and the SNAP header encapsulation for a routed
packet.

The three-octet Organizationally Unique Identifier (OUI) identifies
an organization which administers the meaning of the Protocol
Identifier (PID) which follows. Together they identify a distinct
protocol. Note that OUI 0x00-00-00 specifies that the following PID
is an EtherType.

7.1. Routed Frames

Some protocols will have an assigned NLPID, but because the NLPID
numbering space is so limited many protocols do not have a specific
NLPID assigned to them. When packets of such protocols are routed
over frame relay networks they are sent using the NLPID 0x80 (which
indicates a SNAP follows), OUI 0x00-00-00 (which indicates an
EtherType follows), and the EtherType of the protocol in use.

```
              Format of Routed Frames
        +------------------------------+
        |          Q.922 Address       |
        +------------------------------+
        |Control  0x03 | pad(s)  0x00  |
        +------------------------------+
        | NLPID   0x80 | OUI     0x00  |
        +---------------+            --+
        | OUI  0x00-00                 |
        +------------------------------+
        |          EtherType           |
        +------------------------------+
        |          Protocol Data       |
        +------------------------------+
        | FCS                          |
        +------------------------------+
```
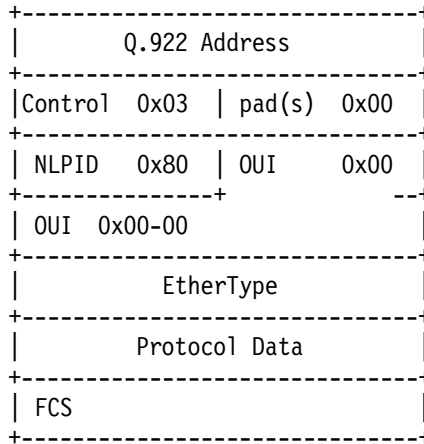
In the few cases when a protocol has an assigned NLPID (see appendix), 48 bits can be saved using the format below:

```
          Format of Routed NLPID Protocol
        +------------------------------+
        |          Q.922 Address       |
        +------------------------------+
        |Control  0x03 |     NLPID     |
        +------------------------------+
        |          Protocol Data       |
        +------------------------------+
        | FCS                          |
        +------------------------------+
```
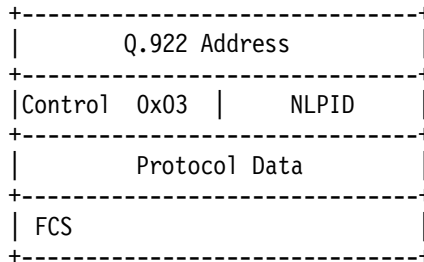
In the particular case of an Internet IP datagram, the NLPID is 0xCC.

```
          Format of Routed IP Datagram
        +------------------------------+
        |          Q.922 Address       |
        +------------------------------+
        |Control  0x03 | NLPID  0xCC   |
        +------------------------------+
        |          IP Datagram         |
        +------------------------------+
        | FCS                          |
        +------------------------------+
```
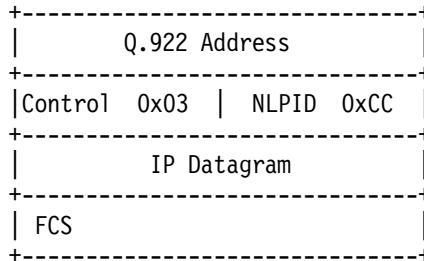
7.2. Bridged Frames

The second type of frame relay traffic is bridged packets. These packets are encapsulated using the NLPID value of 0x80 indicating SNAP and the following SNAP header identifies the format of the bridged packet. The OUI value used for this encapsulation is the 802.1 organization code 0x00-80-C2. The following two octets (PID) specify the form of the MAC header, which immediately follows the SNAP header. Additionally, the PID indicates whether the original FCS is preserved within the bridged frame.

The 802.1 organization has reserved the following values to be used with frame relay:

```
                    PID Values for OUI 0x00-80-C2

       with preserved FCS   w/o preserved FCS    Media
       ------------------    -----------------    ----------------
       0x00-01               0x00-07              802.3/Ethernet
       0x00-02               0x00-08              802.4
       0x00-03               0x00-09              802.5
       0x00-04               0x00-0A              FDDI
       0x00-05               0x00-0B              802.6
```

In addition, the PID value 0x00-0E, when used with OUI 0x00-80-C2, identifies Bridged Protocol Data Units (BPDUs).

A packet bridged over frame relay will, therefore, have one of the following formats:

```
   Format of Bridged Ethernet/802.3 Frame
   +------------------------------+
   |        Q.922 Address         |
   +------------------------------+
   |Control  0x03 | pad(s)  0x00  |
   +------------------------------+
   | NLPID   0x80 | OUI     0x00  |
   +---------------+          --+
   | OUI  0x80-C2                 |
   +------------------------------+
   | PID 0x00-01 or 0x00-07       |
   +------------------------------+
   | MAC destination address      |
   +------------------------------+
   | (remainder of MAC frame)     |
   +------------------------------+
   | LAN FCS (if PID is 0x00-01)  |
   +------------------------------+
   | FCS                          |
   +------------------------------+

   Format of Bridged 802.4 Frame
   +------------------------------+
   |        Q.922 Address         |
   +------------------------------+
   |Control  0x03 | pad(s)  0x00  |
   +------------------------------+
   | NLPID   0x80 | OUI     0x00  |
   +---------------+          --+
   | OUI  0x80-C2                 |
   +------------------------------+
   | PID 0x00-02 or 0x00-08       |
   +------------------------------+
   |  pad  0x00    | Frame Control|
   +------------------------------+
   | MAC destination address      |
   +------------------------------+
   | (remainder of MAC frame)     |
   +------------------------------+
   | LAN FCS (if PID is 0x00-02)  |
   +------------------------------+
   | FCS                          |
   +------------------------------+
```
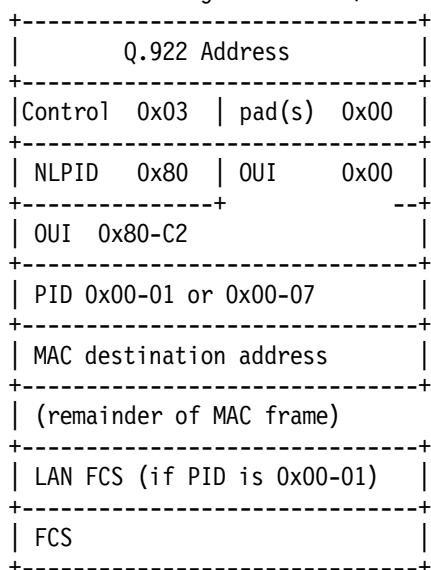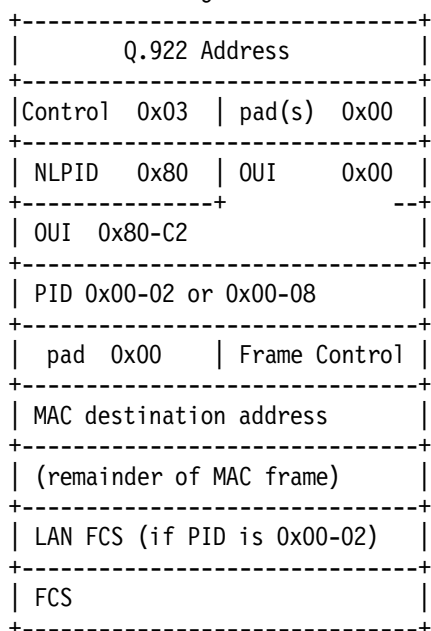
```
      Format of Bridged 802.5 Frame
+------------------------------+
|         Q.922 Address        |
+------------------------------+
|Control  0x03 | pad(s)  0x00  |
+------------------------------+
| NLPID  0x80  | OUI     0x00  |
+--------------+        --+
| OUI  0x80-C2                 |
+------------------------------+
| PID 0x00-03 or 0x00-09       |
+------------------------------+
| Access Control| Frame Control |
+------------------------------+
| MAC destination address      |
|              .               |
|              .               |
+------------------------------+
| (remainder of MAC frame)     |
+------------------------------+
| LAN FCS (if PID is 0x00-03)  |
|                              |
+------------------------------+
| FCS                          |
+------------------------------+


      Format of Bridged FDDI Frame
+------------------------------+
|         Q.922 Address        |
+------------------------------+
|Control  0x03 | pad(s)  0x00  |
+------------------------------+
| NLPID  0x80  | OUI     0x00  |
+--------------+        --+
| OUI  0x80-C2                 |
+------------------------------+
| PID 0x00-04 or 0x00-0A       |
+------------------------------+
| Access Control| Frame Control |
+------------------------------+
| MAC destination address      |
|              .               |
|              .               |
+------------------------------+
| (remainder of MAC frame)     |
+------------------------------+
| LAN FCS (if PID is 0x00-04)  |
|                              |
+------------------------------+
| FCS                          |
+------------------------------+
```

```
            Format of Bridged 802.6 Frame
        +------------------------------+
        |        Q.922 Address         |
        | Control 0x03  | pad(s)  0x00 |
        +------------------------------+
        | NLPID   0x80  | OUI     0x00 |
        +---------------+          --+
        | OUI  0x80-C2                 |
        +------------------------------+
        | PID 0x00-05 or 0x00-0B       |
        +------------------------------+
        |   Reserved    |    BEtag     |  Common
        +---------------+--------------+  PDU
        |           BAsize             |  Header
        +------------------------------+
        | MAC destination address      |
        +------------------------------+
        | (remainder of MAC frame)     |
        +------------------------------+
        |                              |
        +-     Common PDU Trailer     -+
        |                              |
        +------------------------------+
        | FCS                          |
        +------------------------------+
```
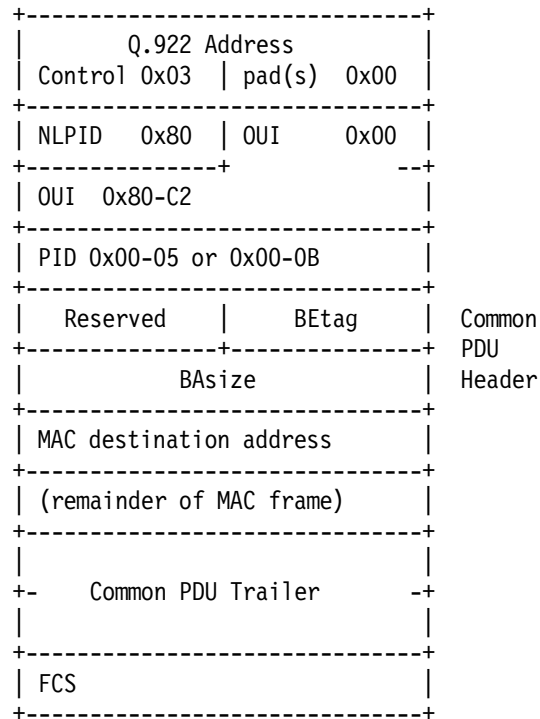
The Common Protocol Data Unit (PDU) Header and Trailer are
conveyed to allow pipelining at the egress bridge to an 802.6
subnetwork. Specifically, the Common PDU Header contains the
BAsize field, which contains the length of the PDU. If this field
is not available to the egress 802.6 bridge, then that bridge
cannot begin to transmit the segmented PDU until it has received
the entire PDU, calculated the length, and inserted the length
into the BAsize field. If the field is available, the egress
802.6 bridge can extract the length from the BAsize field of the
Common PDU Header, insert it into the corresponding field of the
first segment, and immediately transmit the segment onto the 802.6
subnetwork. Thus, the bridge can begin transmitting the 802.6 PDU
before it has received the complete PDU.

One should note that the Common PDU Header and Trailer of the
encapsulated frame should not be simply copied to the outgoing
802.6 subnetwork because the encapsulated BEtag value may conflict
with the previous BEtag value transmitted by that bridge.

```
      Format of BPDU Frame
+-------------------------------+
|        Q.922 Address          |
+-------------------------------+
|Control  0x03 | pad(s)  0x00   |
+-------------------------------+
| NLPID   0x80 | OUI     0x00   |
+---------------+          --+
| OUI  0x80-C2                   |
+-------------------------------+
| PID 0x00-0E                    |
+-------------------------------+  ----
| 802.1(d) Protocol Identifier  |  BPDU, as defined
+-------------------------------+  by 802.1(d),
| Version = 00  |  BPDU Type    |  section 5.3
+-------------------------------+
| (remainder of BPDU)           |
+-------------------------------+  ----
| FCS                           |
+-------------------------------+
```
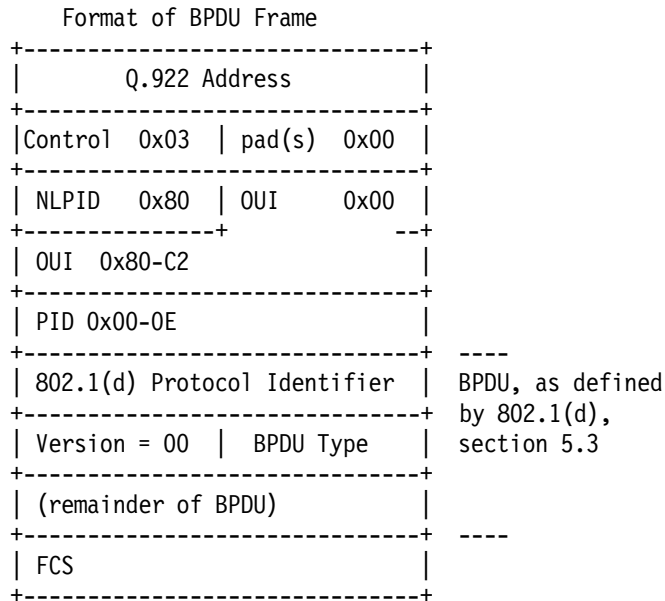
8. Data Link Layer Parameter Negotiation

frame relay stations may choose to support the Exchange
Identification (XID) specified in Appendix III of Q.922 [1$rbrk..
This
XID exchange allows the following parameters to be negotiated at the
initialization of a frame relay circuit: maximum frame size N201,
retransmission timer T200, and the maximum number of outstanding I
frames K.

A station may indicate its unwillingness to support acknowledged mode
multiple frame operation by specifying a value of zero for the
maximum window size, K.

If this exchange is not used, these values must be statically
configured by mutual agreement of Data Link Connection (DLC)
endpoints, or must be defaulted to the values specified in Section
5.9 of Q.922:

```
            N201: 260 octets

              K:  3 for a 16 Kbps link,
                  7 for a 64 Kbps link,
                 32 for a 384 Kbps link,
                 40 for a 1.536 Mbps or above link

            T200: 1.5 seconds [see Q.922 for further details]
```

If a station supporting XID receives an XID frame, it shall respond
with an XID response. In processing an XID, if the remote maximum
frame size is smaller than the local maximum, the local system shall
reduce the maximum size it uses over this DLC to the remotely
specified value. Note that this shall be done before generating a
response XID.

The following diagram describes the use of XID to specify non-use of
acknowledged mode multiple frame operation.

```
        Non-use of Acknowledged Mode Multiple Frame Operation
              +--------------+
              |   Address    |      (2,3 or 4 octets)
              |              |
              +--------------+
              | Control 0xAF |
              +--------------+
              | format  0x82 |
              +--------------+
              | Group ID 0x80|
              +--------------+
              | Group Length |      (2 octets)
              |    0x00-0E   |
              +--------------+
              |    0x05      |   PI = Frame Size (transmit)
              +--------------+
              |    0x02      |   PL = 2
              +--------------+
              |   Maximum    |      (2 octets)
              |  Frame Size  |
              +--------------+
              |    0x06      |   PI = Frame Size (receive)
              +--------------+
              |    0x02      |   PL = 2
              +--------------+
              |   Maximum    |      (2 octets)
              |  Frame Size  |
              +--------------+
              |    0x07      |   PI = Window Size
              +--------------+
              |    0x01      |   PL = 1
              +--------------+
              |    0x00      |
              +--------------+
              |    0x09      |   PI = Retransmission Timer
              +--------------+
              |    0x01      |   PL = 1
              +--------------+
              |    0x00      |
              +--------------+
              |     FCS      |      (2 octets)
              |              |
              +--------------+
```

9. Fragmentation Issues

   Fragmentation allows the exchange of packets that are greater than
   the maximum frame size supported by the underlying network. In the
   case of frame relay, the network may support a maximum frame size as
   small as 262 octets. Because of this small maximum size, it is
   advantageous to support fragmentation and reassembly.

   Unlike IP fragmentation procedures, the scope of frame relay
   fragmentation procedure is limited to the boundary (or DTEs) of the
   frame relay network.

The general format of fragmented packets is the same as any other
encapsulated protocol. The most significant difference being that
the fragmented packet will contain the encapsulation header. That
is, a packet is first encapsulated (with the exception of the address
and control fields) as defined above. Large packets are then broken
up into frames appropriate for the given frame relay network and are
encapsulated using the frame relay fragmentation format. In this
way, a station receiving fragments may reassemble them and then put
the reassembled packet through the same processing path as a packet
that had not been fragmented.

Within frame relay fragments are encapsulated using the SNAP format
with an OUI of 0x00-80-C2 and a PID of 0x00-0D. Individual fragments
will, therefore, have the following format:

```
        +---------------+---------------+
        |        Q.922 Address          |
        +---------------+---------------+
        | Control 0x03  | pad      0x00 |
        +---------------+---------------+
        | NLPID   0x80  | OUI      0x00 |
        +---------------+---------------+
        | OUI                   0x80-C2 |
        +---------------+---------------+
        | PID                   0x00-0D |
        +---------------+---------------+
        |        sequence number        |
        +---------------+---------------+
        |F| RSVD   |offset              |
        +---------------+---------------+
        |      fragment data            |
        |               .               |
        |               .               |
        |               .               |
        +---------------+---------------+
        |              FCS              |
        +---------------+---------------+
```
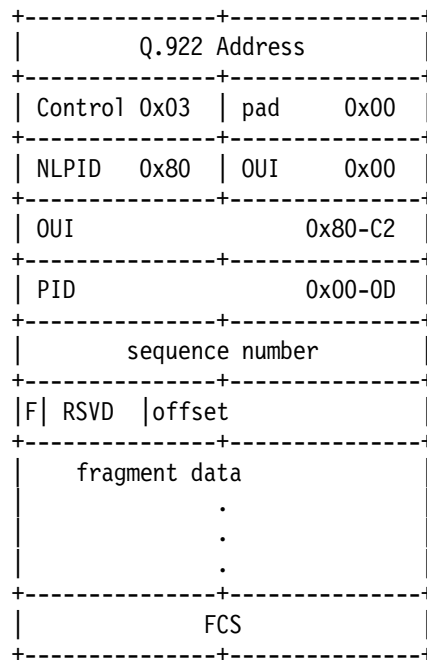
The sequence field is a two octet identifier that is incremented
every time a new complete message is fragmented. It allows detection
of lost frames and is set to a random value at initialization.

The reserved field is 4 bits long and is not currently defined. It
must be set to 0.

The final bit is a one bit field set to 1 on the last fragment and
set to 0 for all other fragments.

The offset field is an 11 bit value representing the logical offset
of this fragment in bytes divided by 32. The first fragment must have
an offset of zero.

The following figure shows how a large IP datagram is fragmented over
frame relay. In this example, the complete datagram is fragmented
into two frame relay frames.

```
                              frame relay Fragmentation Example
                                          +-----------+-----------+
                                          |     Q.922 Address      |
                                          +-----------+-----------+
                                          | Ctrl 0x03 | pad   0x00 |
                                          +-----------+-----------+
                                          |NLPID 0x80 | OUI 0x00   |
                                          +-----------+-----------+
                                          | OUI         0x80-C2    |
           +-----------+-----------+      +-----------+-----------+
           | pad 0x00  |NLPID 0xCC |      | PID         0x00-0D    |
           +-----------+-----------+      +-----------+-----------+
           |                       |      | sequence number   n   |
           |                       |      +-----------+-----------+
           |                       |      |0| RSVD |offset (0)     |
           |                       |      +-----------+-----------+
           |                       |      | pad 0x00   |NLPID 0xCC |
           |                       |      +-----------+-----------+
           |                       |        first m bytes of
           |    large IP datagram  | ...  |   IP datagram          |
           |                       |      |                        |
           |                       |      +-----------+-----------+
           |                       |      |          FCS           |
           |                       |      +-----------+-----------+
           |                       |
           |                       |      +-----------+-----------+
           |                       |      |     Q.922 Address      |
           |                       |      +-----------+-----------+
           |                       |      | Ctrl 0x03 | pad   0x00 |
           +-----------+-----------+      +-----------+-----------+
                                          |NLPID 0x80 | OUI 0x00   |
                                          +-----------+-----------+
                                          | OUI         0x80-C2    |
                                          +-----------+-----------+
                                          | PID         0x00-0D    |
                                          +-----------+-----------+
                                          | sequence number   n   |
                                          +-----------+-----------+
                                          |1| RSVD |offset (m/32)  |
                                          +-----------+-----------+
                                          |  remainder of IP       |
                                          |     datagram           |
                                          +-----------+-----------+
                                          |          FCS           |
                                          +-----------+-----------+
```
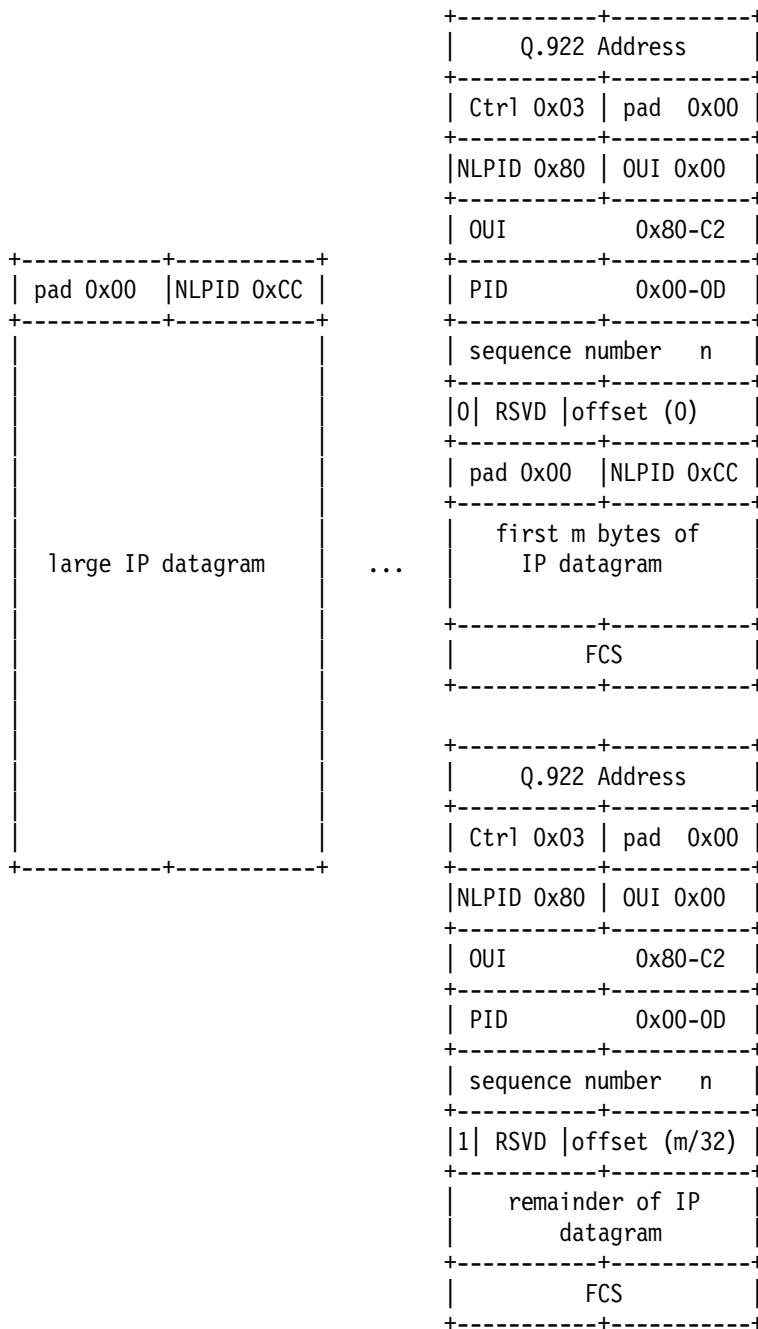
Fragments must be sent in order starting with a zero offset and
ending with the final fragment. These fragments must not be
interrupted with other packets or information intended for the same
DLC. An end station must be able to re-assemble up to 2K octets and
is suggested to support up to 8K octet re-assembly. If at any time
during this re-assembly process, a fragment is corrupted or a
fragment is missing, the entire message is dropped. The upper layer
protocol is responsible for any retransmission in this case.

This fragmentation algorithm is not intended to reliably handle all
possible failure conditions. As with IP fragmentation, there is a
small possibility of reassembly error and delivery of an erroneous
packet. Inclusion of a higher layer checksum greatly reduces this

risk.

10. Address Resolution

There are situations in which a frame relay station may wish to
dynamically resolve a protocol address. Address resolution may be
accomplished using the standard Address Resolution Protocol (ARP) [6]
encapsulated within a SNAP encoded frame relay packet as follows:

```
              +----------------------+----------------------+
              | Q.922 Address                               |
              +----------------------+----------------------+
              | Control (UI)  0x03    |     pad(s)  0x00     |
              +----------------------+----------------------+
              |   NLPID = 0x80        |                      | SNAP Header
              +----------------------+  OUI = 0x00-00-00    + Indicating
              |                                             | ARP
              +----------------------+----------------------+
              |  PID = 0x0806                               |
              +----------------------+----------------------+
              |              ARP packet                     |
              |                       .                     |
              |                       .                     |
              |                       .                     |
              +----------------------+----------------------+
```
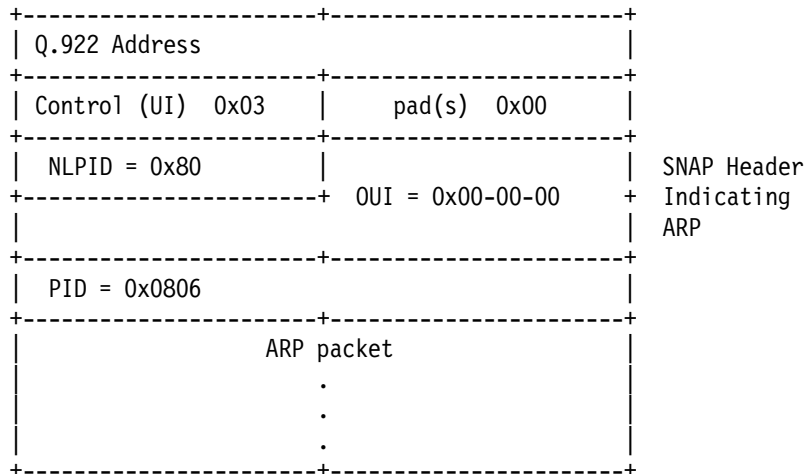
Where the ARP packet has the following format and values:

```
    Data:
      ar$hrd   16 bits     Hardware type
      ar$pro   16 bits     Protocol type
      ar$hln    8 bits     Octet length of hardware address (n)
      ar$pln    8 bits     Octet length of protocol address (m)
      ar$op    16 bits     Operation code (request or reply)
      ar$sha   noctets     source hardware address
      ar$spa   moctets     source protocol address
      ar$tha   noctets     target hardware address
      ar$tpa   moctets     target protocol address

      ar$hrd - assigned to frame relay is 15 decimal
               (0x000F) [7]

      ar$pro - see assigned numbers for protocol ID number for
               the protocol using ARP. (IP is 0x0800).

      ar$hln - length in bytes of the address field (2, 3, or 4)

      ar$pln - protocol address length is dependent on the
               protocol (ar$pro) (for IP ar$pln is 4).

      ar$op -  1 for request and 2 for reply.

      ar$sha - Q.922 source hardware address, with C/R, FECN,
               BECN, and DE set to zero.

      ar$tha - Q.922 target hardware address, with C/R, FECN,
               BECN, and DE set to zero.
```

Because DLCIs within most frame relay networks have only local

significance, an end station will not have a specific DLCI assigned
to itself. Therefore, such a station does not have an address to put
into the ARP request or reply. Fortunately, the frame relay network
does provide a method for obtaining the correct DLCIs. The solution
proposed for the locally addressed frame relay network below will
work equally well for a network where DLCIs have global significance.

The DLCI carried within the frame relay header is modified as it
traverses the network. When the packet arrives at its destination,
the DLCI has been set to the value that, from the standpoint of the
receiving station, corresponds to the sending station. For example,
in figure 1 below, if station A were to send a message to station B,
it would place DLCI 50 in the frame relay header. When station B
received this message, however, the DLCI would have been modified by
the network and would appear to B as DLCI 70.
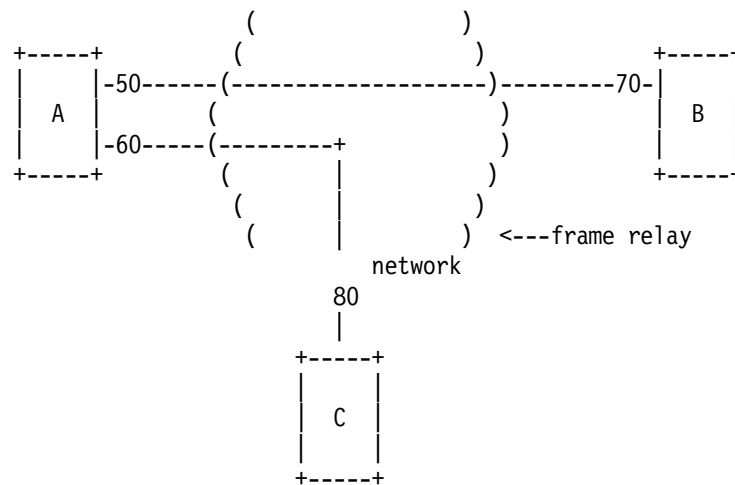
```
                          (                    )
    +-----+               (                    )            +-----+
    |     | -50------(--------------------)---------70-|     |
    |  A  |               (                    )            |  B  |
    |     | -60-----(---------+                 )            |     |
    +-----+               (        |            )            +-----+
                          (        |            )
                          (        |            )  <---frame relay
                                 network
                            80
                             |
                          +-----+
                          |     |
                          |  C  |
                          |     |
                          +-----+
                        Figure 1
```

Lines between stations represent data link connections (DLCs).
The numbers indicate the local DLCI associated with each
connection.

```
      DLCI to Q.922 Address Table for Figure 1

      DLCI (decimal)   Q.922 address (hex)
           50                0x0C21
           60                0x0CC1
           70                0x1061
           80                0x1401
```

If you know about frame relay, you should understand the
corrolation between DLCI and Q.922 address. For the uninitiated,
the translation between DLCI and Q.922 address is based on a two
byte address length using the Q.922 encoding format. The format
is:

```
  8  7  6  5  4  3   2  1
+-----------------------+---+--+
|  DLCI (high order)    |c/r|ea|
+-----------------------+---+--+
| DLCI (lower) |FECN|BECN|DE |EA|
+--------------+----+----+---+--+
```
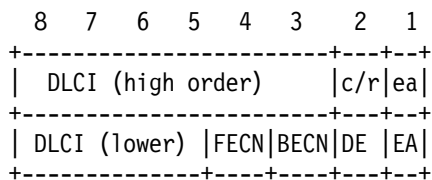
For ARP and its variants, the FECN, BECN, C/R and DE bits are
assumed to be 0.

When an ARP message reaches a destination, all hardware addresses
will be invalid. The address found in the frame header will,
however, be correct. Though it does violate the purity of layering,
frame relay may use the address in the header as the sender hardware
address. It should also be noted that the target hardware address,
in both ARP request and reply, will also be invalid. This should not
cause problems since ARP does not rely on these fields and in fact,
an implementation may zero fill or ignore the target hardware address
field entirely.

As an example of how this address replacement scheme may work, refer
to figure 1. If station A (protocol address pA) wished to resolve
the address of station B (protocol address pB), it would format an
ARP request with the following values:

```
     ARP request from A
       ar$op    1 (request)
       ar$sha   unknown
       ar$spa   pA
       ar$tha   undefined
       ar$tpa   pB
```

Because station A will not have a source address associated with it,
the source hardware address field is not valid. Therefore, when the
ARP packet is received, it must extract the correct address from the
frame relay header and place it in the source hardware address field.
This way, the ARP request from A will become:

```
     ARP request from A as modified by B
       ar$op    1 (request)
       ar$sha   0x1061 (DLCI 70) from frame relay header
       ar$spa   pA
       ar$tha   undefined
       ar$tpa   pB
```

Station B's ARP will then be able to store station A's protocol
address and Q.922 address association correctly. Next, station B
will form a reply message. Many implementations simply place the
source addresses from the ARP request into the target addresses and
then fills in the source addresses with its addresses. In this case,
the ARP response would be:

```
     ARP response from B
       ar$op     2 (response)
       ar$sha    unknown
       ar$spa    pB
       ar$tha    0x1061 (DLCI 70)
       ar$tpa    pA
```

Again, the source hardware address is unknown and when the request is

received, station A will extract the address from the frame relay
header and place it in the source hardware address field. Therefore,
the response will become:

```
ARP response from B as modified by A
  ar$op     2 (response)
  ar$sha    0x0C21 (DLCI 50)
  ar$spa    pB
  ar$tha    0x1061 (DLCI 70)
  ar$tpa    pA
```

Station A will now correctly recognize station B having protocol
address pB associated with Q.922 address 0x0C21 (DLCI 50).

Reverse ARP (RARP) [8] will work in exactly the same way. Still
using figure 1, if we assume station C is an address server, the
following RARP exchanges will occur:

```
RARP request from A                RARP request as modified by C
  ar$op  3 (RARP request)            ar$op  3  (RARP request)
  ar$sha unknown                     ar$sha 0x1401 (DLCI 80)
  ar$spa undefined                   ar$spa undefined
  ar$tha 0x0CC1 (DLCI 60)            ar$tha 0x0CC1 (DLCI 60)
  ar$tpa pC                          ar$tpa pC
```

Station C will then look up the protocol address corresponding to
Q.922 address 0x1401 (DLCI 80) and send the RARP response.

```
RARP response from C               RARP response as modified by A
  ar$op  4  (RARP response)          ar$op  4 (RARP response)
  ar$sha unknown                     ar$sha 0x0CC1 (DLCI 60)
  ar$spa pC                          ar$spa pC
  ar$tha 0x1401 (DLCI 80)            ar$tha 0x1401 (DLCI 80)
  ar$tpa pA                          ar$tpa pA
```

This means that the frame relay interface must only intervene in the
processing of incoming packets.

In the absence of suitable multicast, ARP may still be implemented.
To do this, the end station simply sends a copy of the ARP request
through each relevant DLC, thereby simulating a broadcast.

The use of multicast addresses in a frame relay environment is
presently under study by frame relay providers. At such time that
the issues surrounding multicasting are resolved, multicast
addressing may become useful in sending ARP requests and other
"broadcast" messages.

Because of the inefficiencies of broadcasting in a frame relay
environment, a new address resolution variation was developed. It is
called Inverse ARP [11] and describes a method for resolving a
protocol address when the hardware address is already known. In
frame relay's case, the known hardware address is the DLCI. Using
Inverse ARP for frame relay follows the same pattern as ARP and RARP
use. That is the source hardware address is inserted at the
receiving station.

In our example, station A may use Inverse ARP to discover the
protocol address of the station associated with its DLCI 50. The
Inverse ARP request would be as follows:

```
             InARP Request from A (DLCI 50)
             ar$op   8       (InARP request)
             ar$sha  unknown
             ar$spa  pA
             ar$tha  0x0C21  (DLCI 50)
             ar$tpa  unknown
```

When Station B receives this packet, it will modify the source
hardware address with the Q.922 address from the frame relay header.
This way, the InARP request from A will become:

```
             ar$op   8       (InARP request)
             ar$sha  0x1061
             ar$spa  pA
             ar$tha  0x0C21
             ar$tpa  unknown.
```

Station B will format an Inverse ARP response and send it to station
A as it would for any ARP message.

11. IP over frame relay

Internet Protocol [9] (IP) datagrams sent over a frame relay network
conform to the encapsulation described previously. Within this
context, IP could be encapsulated in two different ways.

```
        1.  NLPID value indicating IP

        +---------------------+---------------------+
        | Q.922 Address                             |
        +---------------------+---------------------+
        | Control (UI)  0x03  | NLPID = 0xCC        |
        +---------------------+---------------------+
        | IP Packet           .                     |
        |                     .                     |
        |                     .                     |
        +---------------------+---------------------+


        2.  NLPID value indicating SNAP

        +---------------------+---------------------+
        | Q.922 Address                             |
        +---------------------+---------------------+
        | Control (UI)  0x03  |    pad(s)   0x00    |
        +---------------------+---------------------+
        |  NLPID = 0x80       |                     | SNAP Header
        +---------------------+  OUI = 0x00-00-00   + Indicating
        |                     |                     | IP
        +---------------------+---------------------+
        |  PID = 0x0800                             |
        +---------------------+---------------------+
        |               IP packet                   |
        |                     .                     |
        |                     .                     |
        |                     .                     |
        +---------------------+---------------------+
```
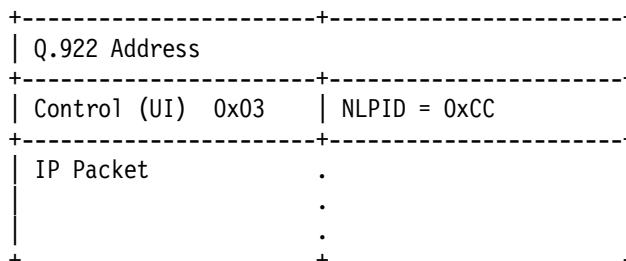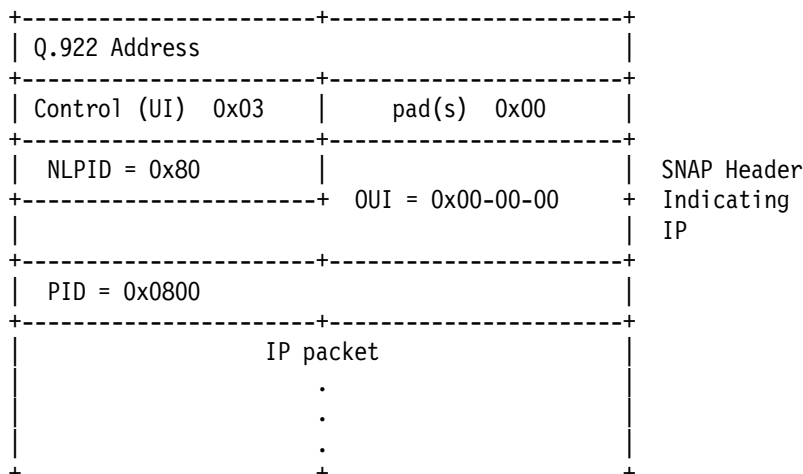
Although both of these encapsulations are supported under the given
definitions, it is advantageous to select only one method as the
appropriate mechanism for encapsulating IP data. Therefore, IP data

shall be encapsulated using the NLPID value of 0xCC indicating IP as shown in option 1 above. This (option 1) is more efficient in transmission (48 fewer bits), and is consistent with the encapsulation of IP in X.25.

12. Other Protocols over frame relay

As with IP encapsulation, there are alternate ways to transmit various protocols within the scope of this definition. To eliminate the conflicts, the SNAP encapsulation is only used if no NLPID value is defined for the given protocol.

As an example of how this works, ISO CLNP has a NLPID defined (0x81). Therefore, the NLPID field will indicate ISO CLNP and the data packet will follow immediately. The frame would be as follows:

```
+----------------------+----------------------+
|               Q.922 Address                 |
+----------------------+----------------------+
| Control     (0x03)   | NLPID  - 0x81 (CLNP) |
+---------------------------------------------+
| CLNP packet                                 |
|                    .                        |
|                    .                        |
+---------------------------------------------+
```
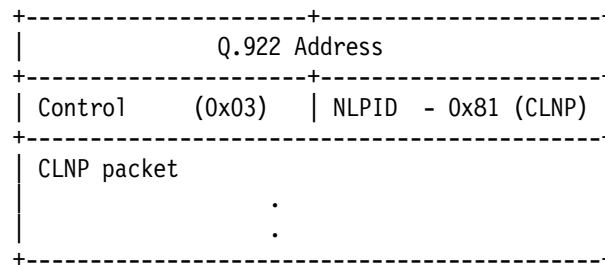
13. Bridging in a frame relay network

A frame relay interface acting as a bridge must be able to flood, forward, and filter packets.

Flooding is performed by sending the packet to all possible destinations. In the frame relay environment this means sending the packet through each relevant DLC.

To forward a packet, a bridge must be able to associate a destination MAC address with a DLC. It is unreasonable and perhaps impossible to require bridges to statically configure an association of every possible destination MAC address with a DLC. Therefore, frame relay bridges must provide enough information to allow a frame relay interface to dynamically learn about foreign destinations beyond the set of frame relay stations.

To accomplish dynamic learning, a bridged packet shall conform to the encapsulation described within section 7. In this way, the receiving frame relay interface will know to look into the bridged packet and learn the association between foreign destination and frame relay station.

14. For Future Study

It may be desirable for the two ends of a connection to have the capability to negotiate end-to-end configuration and service parameters. The actual protocol and parameters to be negotiated will be a topic of future RFCs.

15. Backward Compatibility

This section is included in this RFC for completeness only. It is not intended to suggest additional requirements.

Some existing frame relay stations use the NLPID value of 0xCE to indicate an escape to Ethernet Packet Types as defined in the latest version of the Assigned Numbers (RFC 1060) [7]. In this case, the frame will have the following format:

```
+----------------------------+
| Q.922 Address              |
+--                        --+
|                            |
+----------------------------+
| Control (UI = 0x03)        |
+----------------------------+
| Optional Pad(s)   (0x00)   |
+----------------------------+
| NLPID    (0xCE)            |
+----------------------------+
| Ethertype                  |
+-                         -+
|                            |
+----------------------------+
|            .               |
|            .               |
|           Data             |
|            .               |
|            .               |
+----------------------------+
|    Frame Check Sequence    |
+--          .            --+
|        (two octets)        |
+----------------------------+
```
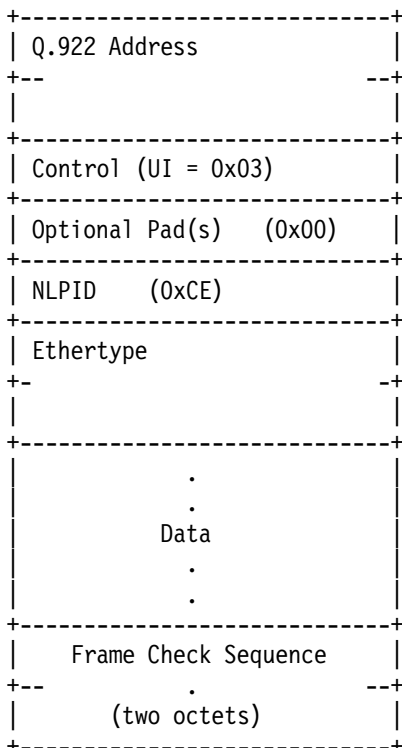
The Ethertype field is a 16-bit value used to identify a protocol type for the following PDU.

In order to be fully interoperable with stations that use this encoding, frame relay stations may recognize the NLPID value of 0xCE and interpret the following two byte Ethertype. It is never necessary to generate this encapsulation format only to properly interpret it's meaning.

For example, IP encapsulated with this NLPID value will have the following format:

```
+----------------------+----------------------+
|Q.922 Address                                |
+----------------------+----------------------+
|Control (UI)  0x03    | NLPID    0xCE        |
+----------------------+----------------------+
|Ethertype [7]                     0x0800     |
+----------------------+----------------------+
|  IP Packet                                  |
|                      .                      |
|                      .                      |
+----------------------+----------------------+
```
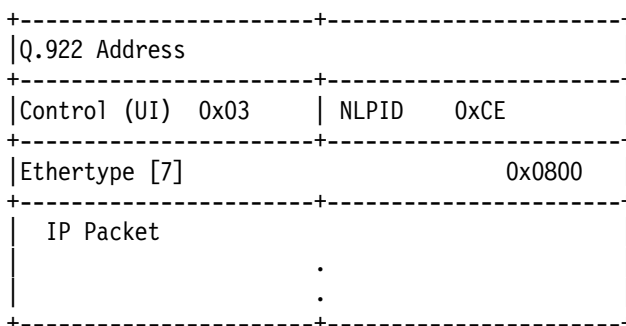
16. Appendix

List of Known NLPIDs

```
0x00    Null Network Layer or Inactive Set
        (not used with frame relay)
0x80    SNAP
0x81    ISO CLNP
0x82    ISO ESIS
0x83    ISO ISIS
0xCC    Internet IP
0xCE    EtherType - unofficial temporary use
```

List of PIDs of OUI 00-80-C2

with preserved FCS	w/o preserved FCS	Media
0x00-01	0x00-07	802.3/Ethernet
0x00-02	0x00-08	802.4
0x00-03	0x00-09	802.5
0x00-04	0x00-0A	FDDI
0x00-05	0x00-0B	802.6
0x00-0D		Fragments
0x00-0E		BPDUs

17. References

[1] International Telegraph and Telephone Consultative Committee, "ISDN Data Link Layer Specification for Frame Mode Bearer Services", CCITT Recommendation Q.922, 19 April 1991 .

[2] American National Standard For Telecommunications - Integrated Services Digital Network - Core Aspects of Frame Protocol for Use with frame relay Bearer Service, ANSI T1.618-1991, 18 June 1991.

[3] Information technology - Telecommunications and Information Exchange between systems - Protocol Identification in the Network Layer, ISO/IEC TR 9577: 1990 (E) 1990-10-15.

[4] Baker, Fred, "Point to Point Protocol Extensions for Bridging", Point to Point Working Group, RFC-1220, April 1991.

[5] International Standard, Information Processing Systems - Local Area Networks - Logical Link Control, ISO 8802-2: 1989 (E), IEEE Std 802.2-1989, 1989-12-31.

[6] Plummer, David C., An Ethernet Address Resolution Protocol", RFC-826, November 1982.

[7] Reynolds, J. and Postel, J., "Assigned Numbers", RFC-1060, ISI, March 1990.

[8] Finlayson, Mann, Mogul, Theimer, "A Reverse Address Resolution Protocol", RFC-903, Stanford University, June 1984.

[9] Postel, J. and Reynolds, J., "A Standard for the Transmission of IP Datagrams over IEEE 802 Networks", RFC-1042, ISI, February

1988.

[10] IEEE, "IEEE Standard for Local and Metropolitan Area Networks: Overview and architecture", IEEE Standards 802-1990.

[11] Bradley, T., and C. Brown, "Inverse Address Resolution Protocol", RFC-1293, Wellfleet Communications, Inc., January 1992.

18. Security Considerations

Security issues are not addressed in this memo.

19. Authors' Addresses

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Appendix D. RFC 1293. Inverse Address Resolution Protocol

Inverse Address Resolution Protocol

1. Status of this Memo

  This RFC specifies an IAB standards track protocol for the Internet
  community, and requests discussion and suggestions for improvements.
  Please refer to the current edition of the "IAB Official Protocol
  Standards" for the standardization state and status of this protocol.
  Distribution of this memo is unlimited.

2. Abstract

  This memo describes additions to ARP that will allow a station to
  request a protocol address corresponding to a given hardware address.
  Specifically, this applies to frame relay stations that may have a
  Data Link Connection Identifier (DLCI), the frame relay equivalent of
  a hardware address, associated with an established Permanent Virtual
  Circuit (PVC), but do not know the protocol address of the station on
  the other side of this connection. It will also apply to other
  networks with similar circumstances.

3. Conventions

  The following language conventions are used in the items of
  specification in this document:

    o Must, Will, Shall or Mandatory -- the item is an absolute
      requirement of the specification.

    o Should or Recommended -- the item should generally be
      followed for all but exceptional circumstances.

    o May or Optional -- the item is truly optional and may be
      followed or ignored according to the needs of the
      implementor.

4. Introduction

  This document will rely heavily on frame relay as an example of how
  the Inverse Address Resolution Protocol (InARP) can be useful. It is
  not, however, intended that InARP be used exclusively with frame
  relay. InARP may be used in any network that provides destination
  hardware addresses without indicating corresponding protocol
  addresses.

5. Motivation

The motivation for the development of Inverse ARP is a result of the desire to make dynamic address resolution within frame relay both possible and efficient. Permanent virtual circuits (PVCs) and eventually switched virtual circuits (SVCs) are identified by a Data Link Connection Identifier (DLCI). These DLCIs define a single virtual connection through the wide area network (WAN) and are the frame relay equivalent to a hardware address. Periodically, through the exchange of signalling messages, a network may announce a new virtual circuit with its corresponding DLCI. Unfortunately, protocol addressing is not included in the announcement. The station receiving such an indication will learn of the new connection, but will not be able to address the other side. Without a new configuration or mechanism for discovering the protocol address of the other side, this new virtual circuit is unusable.

Other resolution methods were considered to solve the problems, but were rejected. Reverse ARP •4", for example, seemed like a good candidate, but the response to a request is the protocol address of the requesting station not the station receiving the request as we wanted. IP specific mechanisms were limiting since we wished to allow protocol address resolution of many protocols. For this reason, we expanded the ARP protocol.

Inverse Address Resolution Protocol (InARP) will allow a frame relay station to discover the protocol address of a station associated with the virtual circuit. It is more efficiently than simulating a broadcast with multiple copies of the same message and it is more flexible than relying on static configuration.

6. Packet Format

Inverse ARP is an extension of the existing ARP. Therefore, it has the same format as standard ARP.

```
ar$hrd   16 bits        Hardware type
ar$pro   16 bits        Protocol type
ar$hln    8 bits        Byte length of each hardware address (n)
ar$pln    8 bits        Byte length of each protocol address (m)
ar$op    16 bits        Operation code
ar$sha   nbytes         source hardware address
ar$spa   mbytes         source protocol address
ar$tha   nbytes         target hardware address
ar$tpa   mbytes         target protocol address
```

Possible values for hardware and protocol types are the same as those for ARP and may be found in the current Assigned Numbers RFC •2".

Length of the hardware and protocol address are dependent on the environment in which InARP is running. For example, if IP is running over frame relay, the hardware address length is between 2 and 4, and the protocol address length is 4.

The operation code indicates the type of message, request or reply.

```
 InARP request = 8
 InARP reply = 9
```

These values were chosen so as not to conflict with other ARP extensions.

7. Protocol Operation

Basic InARP operates essentially the same as ARP with the exception that InARP does not broadcast requests. This is because the hardware address of the destination station is already known. A requesting station simply formats a request by inserting its source hardware and protocol addresses and the known target hardware address. It then zero fills the target protocol address field. Finally, it will encapsulate the packet for the specific network and send it directly to the target station.

Upon receiving an InARP request, a station may put the requester's protocol address/hardware address mapping into its ARP cache as it would any ARP request. Unlike other ARP requests, however, the receiving station may assume that any InARP request it receives is destined for it. For every InARP request, the receiving station may format a proper reply using the source addresses from the request as the target addresses of the reply. If the station is unable or unwilling to reply, it ignores the request.

When the requesting station receives the InARP reply, it may complete the ARP table entry and use the provided address information. Note: as with ARP, information learned via InARP may be aged or invalidated under certain circumstances.

7.1. Operation with Multi-Addressed Hosts

In the context of this discussion, a Multi-Addressed host will refer to a host that has multiple protocol addresses assigned to a single interface. If such a station receives an InARP request, it must choose one address with which to respond. To make such a selection, the receiving station must first look at the protocol address of the requesting station, and then respond with the protocol address corresponding to the network of the requester. For example, if the requesting station is probing for an IP address, the responding multi-addressed station should respond with an IP address which corresponds to the same subnet as the requesting station. If the station does not have an address that is appropriate for the request it should not respond. In the IP example, if the receiving station does not have an IP address assigned to the interface that is a part of the requested subnet, the receiving station would not respond.

A multi-addressed host may choose to send an InARP request for each of the addresses defined for the given interface. It should be noted, however, that the receiving side may answer some or none of the requests depending on its configuration.

7.2. Protocol Operation Within frame relay

One case where Inverse ARP can be used is when a new virtual circuit is signalled. The frame relay station may format an InARP request

addressed to the new virtual circuit. If the other side supports
InARP, it may return a reply indicating the protocol address
requested.

The format for an InARP request is a follows:

```
ar$hrd - 0x000F the value assigned to frame relay
ar$pro - protocol type for which you are searching
             (i.e.  IP = 0x0800)
ar$hln - 2,3, or 4 byte addressing length
ar$pln - byte length of protocol address for which you
            are searching (for IP = 4)
ar$op  - 8; InARP request
ar$sha - Q.922 address of requesting station
ar$spa - protocol address of requesting station
ar$tha - Q.922 addressed of newly announced virtual circuit
ar$tpa - 0; This is what we're looking for
```

The InARP response will be completed similarly.

```
ar$hrd - 0x000F the value assigned to frame relay
ar$pro - protocol type for which you are searching
             (i.e.  IP = 0x0800)
ar$hln - 2,3, or 4 byte addressing length
ar$pln - byte length of protocol address for which you
            are searching (for IP = 4)
ar$op  - 9; InARP response
ar$sha - Q.922 address of responding station
ar$spa - protocol address requested
ar$tha - Q.922 address of requesting station
ar$tpa - protocol address of requesting station
```

Note that the Q.922 addresses specified have the C/R, FECN, BECN, and
DE bits set to zero.

Procedures for using InARP over a frame relay network are identical
to those for using ARP and RARP discussed in section 10 of the
Multiprotocol Interconnect over frame relay Networks document [3].

8. References

 1. Plummer, David C., "An Ethernet Address Resolution Protocol",
     RFC-826, November 1982.

 2.   Reynolds, J. and Postel, J., "Assigned Numbers", RFC-1060, ISI,
     March 1990.

 3. Bradley, T., Brown, C., Malis, A.,   "Multiprotocol Interconnect
     over frame relay Networks", RFC-1294, January 1992.

 4. Finlayson, Mann, Mogul, Theimer, "A Reverse Address Resolution
     Protocol", RFC-903, Stanford University, June 1984.

9. Security Considerations

Security issues are not addressed in this memo.

10. Authors' Addresses

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Appendix E. 3172 Enterprise Specific MIB, ASN.1 Source

The following ASN.1 description was used by NetView/6000 to manage the 3172
TCP/IP subagent.

```
--/*****************************************************************
-- *(c) Copyright IBM Corporation 1991                          *
-- *                                                            *
-- *      Author : yannick Bollati, IBM France                  *
-- *               ITSC Raleigh                                 *
-- *                                                            *
-- *      Progam name : IBM 3172 private MIB                     *
-- *                    ASN.1 Description file                  *
-- *                    Version 1 (December 1991)               *
-- *                                                            *
-- *      Description : Managing the IBM 3172 private MIB        *
-- *                                                            *
-- *      Publication : Overview and Examples of using          *
-- *                    AIX NetView/6000                        *
-- *                    GG24-3804                               *
-- *                                                            *
-- *****************************************************************
--@(#) IBM 3172 private MIB ASN.1 Description file Version 1 (Dec 1991)
--
--  This ASN.1 MIB Description could be used by Netview/6000 (load MIB)
--
--  Nota : The "counter" type had been translated to "INTEGER" because
--  Netview/6000 is only able to graph INTEGER (Dec 91)
--
        LOOKSNAD-MIB DEFINITIONS ::= BEGIN
        IMPORTS
            enterprises, OBJECT-TYPE
                FROM RFC1155-SMI;
    ibm OBJECT IDENTIFIER ::= { enterprises 2 }
    ibmProd OBJECT IDENTIFIER ::= { ibm 6 }
    ibm3172 OBJECT IDENTIFIER ::= { ibmProd 1}
--
--           IBM 3172 System Table
--

    ibm3172SystemTable OBJECT-TYPE
    SYNTAX ibm3172SystemTableSyntax
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172 1 }
    ibm3172SystemTableSyntax ::=
        SEQUENCE
        {
```

Figure 223 (Part 1 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
            ibm3172Descr,
            ibm3172Contact,
            ibm3172Location,
            ibm3172ifNumber
            }

        ibm3172Descr OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..253))
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
             ""
        ::= { ibm3172SystemTable 1 }
        ibm3172Contact OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..32))
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
             ""
        ::= { ibm3172SystemTable 2 }
        ibm3172Location OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..32))
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
             ""
        ::= { ibm3172SystemTable 3 }
        ibm3172ifNumber OBJECT-TYPE
        SYNTAX  INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
             ""
        ::= { ibm3172SystemTable 4 }
--
--   IBM 3172 Trap Table
--
    ibm3172ifTrapTable OBJECT-TYPE
    SYNTAX ibm3172ifTableSyntax
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172 2 }
    ibm3172ifTableSyntax ::=
        SEQUENCE
             {
             ibm3172ifTrapEnable
             }
    ibm3172ifTrapEnable OBJECT-TYPE
    SYNTAX INTEGER { disabled(0), enabled(1) }
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172ifTrapTable 1 }
```

Figure 223 (Part 2 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
--
--   IBM 3172 Chanel Counters
--
    ibm3172ifChanCounters OBJECT-TYPE
    SYNTAX ibm3172ifChanCountersSyntax
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172 3 }
    ibm3172ifChanCountersSyntax ::=
        SEQUENCE
        {
        ibm3172ifInChanOctets,
        ibm3172ifOutChanOctets,
        ibm3172ifInChanBlocks,
        ibm3172ifOutChanBlocks
        }
    ibm3172ifInChanOctets OBJECT-TYPE
    SYNTAX INTEGER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172ifChanCounters 1 }
        ibm3172ifOutChanOctets OBJECT-TYPE        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
            ""
        ::= { ibm3172ifChanCounters 2 }
        ibm3172ifInChanBlocks OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
            ""
        ::= { ibm3172ifChanCounters 3 }
        ibm3172ifOutChanBlocks OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
            ""
        ::= { ibm3172ifChanCounters 4 }
--
--      LAN Counters Table
--

    ibm3172ifLANCounters OBJECT-TYPE
    SYNTAX ibm3172ifLANCountersSyntax
    ACCESS read-only
    STATUS mandatory
```

Figure 223 (Part 3 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
      DESCRIPTION
          ″″
      ::= { ibm3172 4 }
      ibm3172ifLANCountersSyntax ::=
            SEQUENCE
            {
            ibm3172ifInLANOctets,
            ibm3172ifOutLANOctets,
            ibm3172ifInLANFrames,
            ibm3172ifOutLANFrames,
            ibm3172ifInLANErrors,
            ibm3172ifOutLANErrors,
            ibm3172ifInLANDiscards,
            ibm3172ifOutLANDiscards
            }
      ibm3172ifInLANOctets OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
          ″″
      ::= { ibm3172ifLANCounters 1 }
          ibm3172ifOutLANOctets OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
              ″″
          ::= { ibm3172ifLANCounters 2 }
          ibm3172ifInLANFrames OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
                ″″
          ::= { ibm3172ifLANCounters 3 }
          ibm3172ifOutLANFrames OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
                ″″
          ::= { ibm3172ifLANCounters 4 }
          ibm3172ifInLANErrors OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
                ″″
          ::= { ibm3172ifLANCounters 5 }
          ibm3172ifOutLANErrors OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
                ″″
```

Figure 223 (Part 4 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
              ::= { ibm3172ifLANCounters 6 }
              ibm3172ifInLANDiscards OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
                    ""
              ::= { ibm3172ifLANCounters 7 }
              ibm3172ifOutLANDiscards OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
                    ""
              ::= { ibm3172ifLANCounters 8 }
--
--        IBM 3172 Interfaces Blocker task Table
--
      ibm3172ifBlkCounters OBJECT-TYPE
      SYNTAX ibm3172ifBlkCountersSyntax
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
            ""
      ::= { ibm3172 5 }
      ibm3172ifBlkCountersSyntax ::=
            SEQUENCE
            {
            ibm3172ifBlkRcvOctets,
            ibm3172ifBlkXmitOpctets,
            ibm3172ifBlkRcvFrames,
            ibm3172ifBlkXmitBlocks,
            ibm3172ifInBlkErrors,
            ibm3172ifInBlkDiscards
            }
      ibm3172ifBlkRcvOctets OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
            ""
      ::= { ibm3172ifBlkCounters 1 }
              ibm3172ifBlkXmitOctets OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
                    ""
              ::= { ibm3172ifBlkCounters 2 }
              ibm3172ifBlkRcvFrames OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
                    ""
```

Figure 223 (Part 5 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
        ::= { ibm3172ifBlkCounters 3 }
        ibm3172ifBlkXmitBlocks OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifBlkCounters 4 }
        ibm3172ifInBlkErrors OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifBlkCounters 5 }
        ibm3172ifInBlkDiscards OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifBlkCounters 6 }
--
--      IBM 3172  Deblocker task Table
--
    ibm3172ifDblkCounters OBJECT-TYPE
    SYNTAX ibm3172ifDblkCountersSyntax
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172 6 }
    ibm3172ifDblkCountersSyntax ::=
        SEQUENCE
        {
                ibm3172ifDblkRcvOctets,
                ibm3172ifDblkXmitOpctets,
                ibm3172ifDblkRcvFrames,
                ibm3172ifDblkXmitBlocks,
                ibm3172ifInDblkErrors,
                ibm3172ifInDblkDiscards
                }
        ibm3172ifDblkRcvOctets OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""          ::= { ibm3172ifDblkCounters 1 }
        ibm3172ifDblkXmitOctets OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
```

Figure 223 (Part 6 of 7). 3172 Subagent Private MIB (ASN.1 Format)

```
        ::= { ibm3172ifDblkCounters 2 }
        ibm3172ifDblkRcvFrames OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifDblkCounters 3 }
        ibm3172ifDblkXmitBlocks OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifDblkCounters 4 }
        ibm3172ifInDblkErrors OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifDblkCounters 5 }
        ibm3172ifInDblkDiscards OBJECT-TYPE
        SYNTAX INTEGER
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
                ""
        ::= { ibm3172ifDblkCounters 6 }
--
--    IBM 3172   device Table
--
    ibm3172ifDeviceTable OBJECT-TYPE
    SYNTAX ibm3172ifDeviceTableSyntax
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172 7 }
    ibm3172ifDeviceTableSyntax ::=
        SEQUENCE
        {
        ibm3172ifDeviceNumber
        }
    ibm3172ifDeviceNumber OBJECT-TYPE
    SYNTAX INTEGER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        ""
    ::= { ibm3172ifDeviceTable 1 }

      END
```

Figure 223 (Part 7 of 7). 3172 Subagent Private MIB (ASN.1 Format)

Appendix F. Features, Guidelines and Limitations

The IBM 3172 Model 3 Interconnect Controller is a communications processor that functions primarily as a direct channel-attached LAN-to-host gateway. The 3172 interfaces multiple types of LANs and WANs to IBM and plug compatible host processors via Parallel or ESCON channel attachment.

F.1 Model 3 Configurations

The 3172 Model 3, depending on how it is configured, can function as either a LAN-to-host gateway or a WAN-to-host gateway. The Model 3 may be configured for LAN-to-host support, using FDDI, token-ring, or Ethernet connections. The WAN-to-host support includes, X.21, V.35, RS-232, or RS-422/449 attachment over frame relay and SDLC point-to-point or multi-point links.

The 3172 Model 3 is based on the Intel 80486 platform.

Gateway functionality is provided by either the Interconnect Controller Program (ICP) or OS/2. With IBM OS/2 V2.1 and TCP/IP V2.0 for OS/2 in conjunction with Offload of TCP/IP software, it is capable of offloading some of the protocol processing functions that would otherwise be the task of a host CPU. Using SNA\Communications the 3172 provides an SNA\SDLC pathway for LAN and WAN attached stations. The 3172 Model 3 may be configured to run in one of several ways for LAN-to-host mode or WAN-to-host mode.

F.1.1 LAN-to-Host Mode

The 3172 Model 3 may be configured in various LAN-to-host modes. In LAN-to-host mode, the 3172 Model 3 may run under the Interconnect Control Program Version 3 or using OS/2 Version 2.1, with Offload of TCP/IP for MVS, Offload of TCP/IP for VM, LFS/ESA, LANRES/VM, or LANRES/MVS or SNA Communications Program Version 1 Release 1, Offload mode is recommended when the most efficient use of host processor cycles is the primary consideration. SNA\Communications provides another attractive means of LAN-to-Host attachment for SNA traffic.

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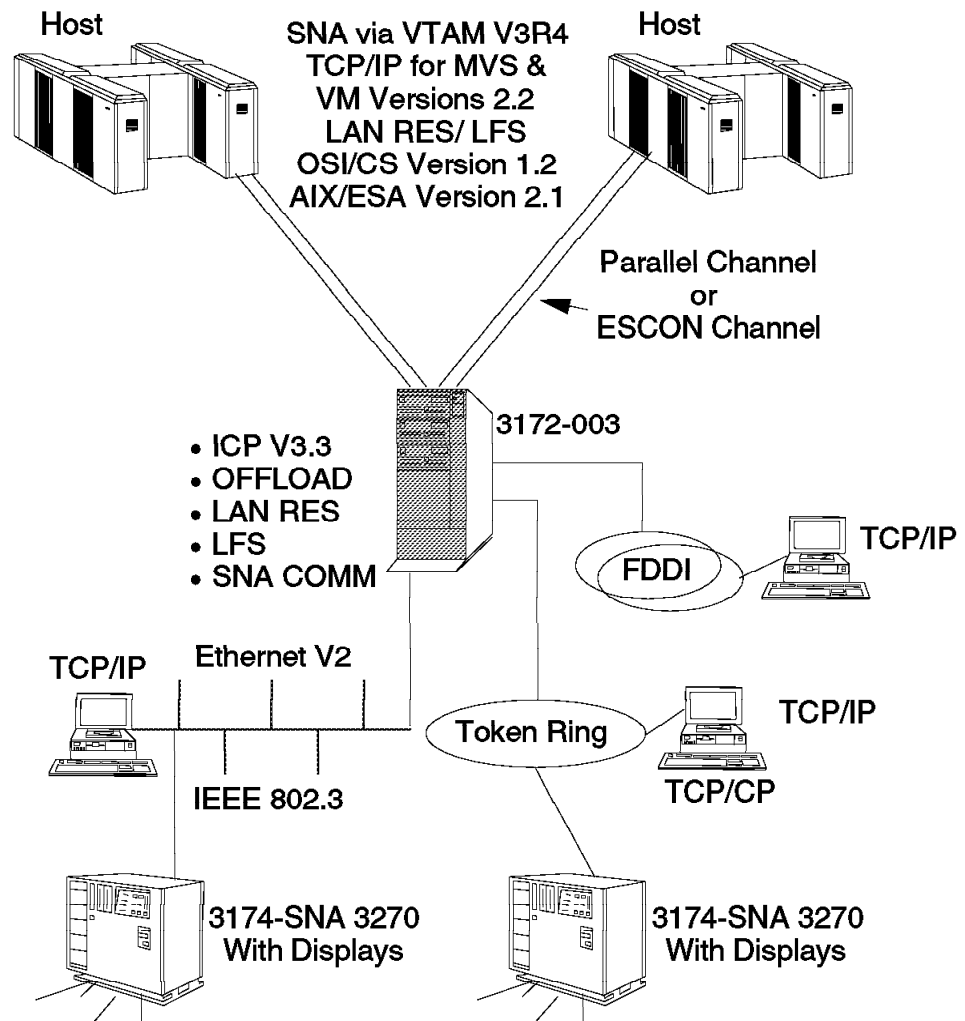
Figure 224. LAN-to-Host Mode

Note: The following modes of operation are mutually exclusive. The 3172 Model 3 will not run in LAN-to-host mode using ICP with the Offload Hardware Feature (FC 2700) installed. ICP will only run in 8MB of memory.

Abbreviation

Feature Code is shortened to FC from hereon.

---

1. Interconnect Control Program Version 3 supports:

   • Two S/390 parallel channel adapters (FC 2501) or one ESCON Channel adapter (FC 2800)

   • One FDDI adapter (FC 2300)

   • One 25 MHz 80486SX (standard) processor or one 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium** processor (FC 2850)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225, FC 2235, FC 2245). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two.

2. OS/2 Platform (Offload Mode) supports:

- Offload of TCP/IP mode with the Offload Hardware Feature (FC 2700)

- One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

- One FDDI adapter (FC 2300)

- One 25 MHz 80486SX (standard) processor or one 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium processor (FC 2850)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225, FC 2235, FC 2245). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two.

3. LFS/ESA, LANRES/VM AND LANRES/MVS (when minimal workstation data is stored in the 3172 Model 3) supports:

- One Hardware Package1 (FC 2710)

- One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

- One 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium processor (FC 2850)

- One FDDI adapter (FC 2300)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two.

- Three 16MB memory upgrades (FC 2810)

4. LFS/ESA, LANRES/VM AND LANRES/MVS (when workstation data is stored in the 3172 Model 3 and on the Host) supports:

- One Hardware Package2 (FC 2720)

- One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

- One 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium processor (FC 2850)

- One FDDI adapter (FC 2300)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two.

- Two 16MB memory upgrades (FC 2810)

5. OS/2 Platform (SNA Communications Program) supports:

- One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

- One FDDI adapter (FC 2300)

- One 25 MHz 80486SX (standard) processor or one 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium** processor (FC 2850)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225, FC 2235, FC 2245). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two. Each WAN adapter installed reduces the maximum by one.

- Up to four ARTIC Portmaster adapters (FC 2930, FC 2940, FC 2950, FC 2960) and/or up to two WAC adapters (FC 2900, FC 2910, FC 2920) in any combination not to exceed a maximum of four. ARTIC adapters and WAC adapters may be intermingled, but the maximum number of WAC adapters is two. Each LAN adapter installed reduces the maximum number of WAN adapters by one. Installation of an FDDI adapter limits the maximum number of WAN adapters to two.

- TCP/IP Offload mode with the Offload Hardware Feature (FC 2700)

F.1.2 WAN-to-Host Mode

MPE: The 3172 may be configured to operate over a wide area network using public access facilities. Wide area connections are provided through two different platforms. The first is Multiprotocol Extensions (MPE) and the second is SNA Communications Program V1.1 (SNA/Comm). MPE and SNA/Comm both have interfaces for a frame-relay network. MPE supports SNA by bridging frame-relay to a token-ring, while SNA/Comm supports SNA over frame-relay natively and additionally will support SDLC line concentration in a point-to-point or multipoint network. MPE is wide area only, while SNA/Comm is both local and wide area. Each will connect at a variety of speeds using one of several available interfaces including X.21, V.35, RS422/449 and RS/232. The first example we overview is MPE. In the following diagram, SNA is bridged via frame relay to token-ring by a 3172 with MPE and then passes through an SNA gateway to a VTAM host. TCP/IP is routed over the same frame relay connection directly through the Offload code and then to MVS or VM TCP/IP.
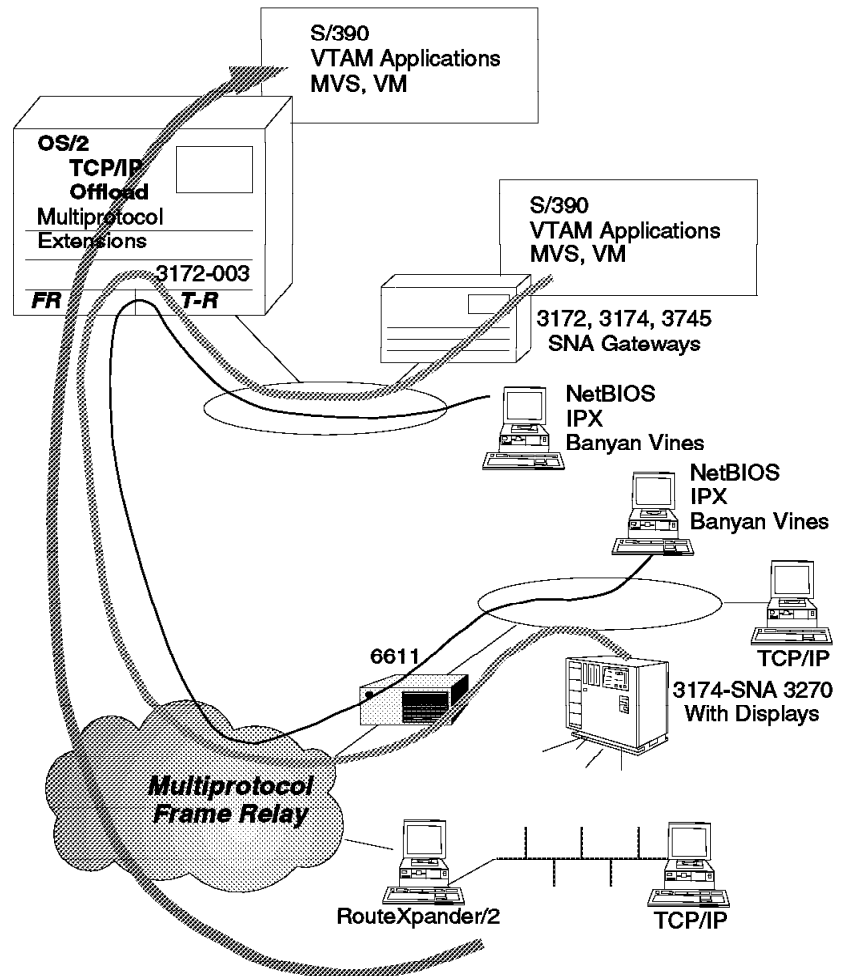
Figure 225. WAN-to-Host Mode Using MPE

1. Multiprotocol Networking Software Solution, Release 1.0 supports:

   • One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

   • One 25 MHz 80486SX (standard) processor or one 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium processor (FC 2850)

   • One X.21 WAC adapter (FC 2900) or one V.35 WAC adapter (FC 2910) or one RS-422/449 WAC adapter (FC 2920)

   • One TCP/IP Offload Hardware (FC 2700)

   • One preloaded software for VM (FC 3000) or one preloaded software for MVS (FC 3010)

   • One token-ring (FC 2210) is always required with the Preload Software for VM or MVS

- One preloaded software for VM (FC 3000) or MVS (FC 3010) is always needed for the VM or MVS Offload of TCP/IP

SNA/Comm: The second way that the 3172 may operate over a wide area network is with the SNA Communications Program Version 1 Release 1 (SNA/Comm). This product affords the enterprise the ability to concentrate SNA devices over leased lines or through a token-ring, Ethernet or FDDI LAN connection. This product contains support for the ESCON Multiple Image Facility (EMIF) which enables connection to multiple VTAMs. TCP/IP Offload for MVS or TCP/IP Offload for VM may run concurrently with SNA/Comm, thus providing a multiprotocol gateway to a S/390 host. If X.25 connectivity is a requirement for SNA traffic this is supported with RouteXpander V2 and the X.25 Xpander/2 product and SNA/Comm.
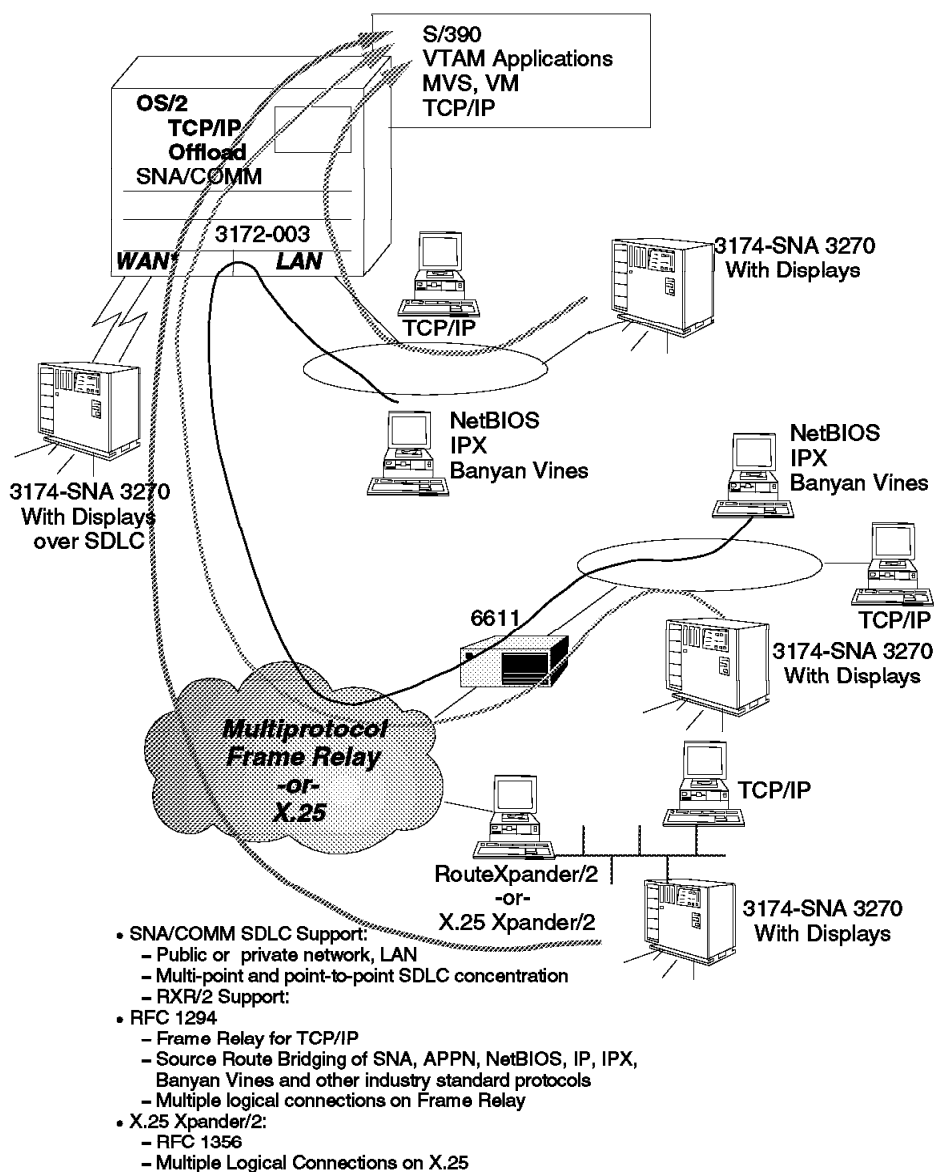
Figure 226. WAN-to-Host Mode Using SNA/Comm

1. SNA Communications Program Version 1 Release 1 supports:

- One S/390 parallel channel adapter (FC 2501) or one ESCON Channel adapter (FC 2800)

- One 25 MHz 80486SX (standard) processor or one 50 MHz 80486DX processor (FC 2830) or one 66 MHz Pentium processor (FC 2850)

- One FDDI adapter (FC 2300)

- Up to four token-ring and/or Ethernet adapters in any combination (FC 2215, FC 2225, FC 2235, FC 2245). Installation of an FDDI adapter limits the maximum number of token-ring/Ethernet adapters to two.

- Up to two X.21 WAC adapters (FC 2900) or two V.35 WAC adapters (FC 2910) or two RS-422/449 WAC adapters (FC 2920).

- Up to four ARTIC Portmaster adapters (FC 2930, FC 2940, FC 2950, FC 2960) and/or up to two WAC adapters (FC 2900, FC 2910, FC 2920) in any combination not to exceed a maximum of four. ARTIC adapters and WAC adapters may be intermingled, but the maximum number of WAC adapters is two. Each LAN adapter installed reduces the maximum number of WAN adapters by one. Installation of an FDDI adapter limits the maximum number of WAN adapters to two.

- One TCP/IP Offload Hardware (FC 2700)

- One SNA Communications Program preloaded software (FC 3020)

- One SNA Communications Program software with TCP/IP Offload for VM preloaded (FC 3040)

- One SNA Communications Program software with TCP/IP Offload for MVS preloaded (FC 3041)

F.2 Standard and Optional Feature Codes

F.2.1 Base Features and Codes

The base feature codes associated with the 3172 Model 3 are for power and rack mounting options. Customer requirements will vary depending on their location and so these feature codes will not be included here. Customers may contact their IBM representative for further configuration assistance in these regards.

F.2.2 Selected Feature Codes and Descriptions

TOKEN-RING 16/4 ADAPTER (FC 2210)

This adapter attaches to either a 16 or 4 Mbps token-ring network that conforms to the IEEE 802.5 architecture. This adapter is only supported on the 3172 Model 3 with X.21 Wide Area Connector (FC 2900), V.35 Wide Area Connector (FC 2910), RS-422/449 Wide Area Connector (FC 2920), Preloaded Software for VM (FC 3000), or Preloaded Software for MVS (FC 3010). Attachment cable (IBM P/N 6339098 or equivalent) is charged and must be ordered separately.

A minimum of one or a maximum of two token-ring adapter cards can be installed in a 3172 Model 3 without FDDI adapter card (FC 2300) installed. If an FDDI adapter card is installed, only one token-ring adapter card (FC 2210) can be installed in a 3172 Model 3. A minimum of one token-ring (FC 2210) is always required with either Preloaded Software for VM (FC 3000) or Preloaded Software for MVS (FC 3010). This feature is factory or field installable.

TOKEN-RING 16/4 ADAPTER (FC 2215)

This adapter attaches to either a 16 or 4 Mbps token-ring Network that conforms to the IEEE 802.5 architecture. Attachment cable (IBM P/N 6339098 or equivalent) is charged and must be ordered separately.

A minimum of zero or a maximum of four token-ring adapter cards can be installed in a 3172 Model 3 without FDDI adapter card (FC 2300) installed. If an FDDI adapter card is installed, a minimum of zero or a maximum of two token-ring adapter cards can be installed in a 3172 Model 3. FC 2215 is not supported with either FC 3000 or FC 3010. This feature is factory or field installable.

ETHERNET ADAPTER (FC 2225)

This adapter provides attachment to 10 Mbps Ethernet LANs and conforms to the IEEE 802.3 architecture. Connections to both ″thin″ and ″thick″ Ethernet LANs are supported. Attachment cables to the transceiver are not provided by IBM. A slide latch is required for attachment to a standard Ethernet coaxial cable with an 802.3 compatible 15-pin DIX connector. To support thin Ethernet coaxial cable (RG-58), a BNC T-connector or connection to the onboard transceiver is required.

One or a maximum of four Ethernet adapter cards may be installed in a 3172 Model 3 without an FDDI adapter card (FC 2300) installed. If an FDDI adapter card is installed, one or a maximum of two Ethernet adapter cards may be installed in a 3172 Model 3. With either Offload of TCP/IP for VM (FC 3000) or Offload of TCP/IP for MVS feature (FC 3010), one or a maximum of two Ethernet adapter cards may be installed without an FDDI adapter installed and no Ethernet adapter cards may be installed with an FDDI adapter installed. This feature is factory or field installable.

AUTO LANSTREAMER (FC 2235)

This adapter attaches to a 16 or 4 Mbps token-ring network that conforms to the IEEE 802.5 architecture. This adapter has one RJ45 connector. The adapter is shipped with a conversion cable (RJ45 to STP cable) that plugs into the RJ45 connector on the adapter and into which the standard token-ring adapter universal data connector cable (IBM P/N 6339098 or equivalent) plugs. The standard token-ring cable must be ordered separately. A single cable (IBM P/N 60G1063 or equivalent) may be ordered separately to replace the combination of the conversion cable and standard token-ring adapter cable. This adapter also supports the use of token-ring STP or UTP cable containing two pairs of wires. The twisted-pair cable may have either an RJ45 connector on each end or an RJ45 connector on one end and an RJ11 connector on the other end and must be ordered separately.

ETHERSTREAMER MC 32 (FC 2245)

This adapter provides attachment to 10 Mbps Ethernet LANs and conforms to the IEEE 802.3 architecture. Connections to both 10BaseT (RJ45), 10Base5 (mini AUI) and 10Base2 (coax) Ethernet LANs are supported. A conversion cable (P/N 59G9004) which converts from mini-AUI to AUI is shipped with each EtherStreamer adapter. Full-duplex mode is only supported through the 10BaseT (RJ45) connection and this mode requires an Ethernet full-duplex capable switch (such as the IBM 8271 EtherStreamer switch). The 10BaseT (RJ45) connection supports the use of a Category 3, 4 or 5 UTP cable with an appropriate

connector. Attachment cables to the external (AUI) transceiver are not provided by IBM. A slide latch is required for attachment to a standard Ethernet coaxial cable with an 802.3 compatible 15-pin DIX connector. To support thin Ethernet coaxial cable (RG-58), a BNC T-connector or connection to the onboard transceiver is required.

One or a maximum of four Ethernet adapter cards may be installed in a 3172 Model 3 without an FDDI adapter card (FC 2300) installed. If an FDDI adapter card is installed, one or a maximum of two Ethernet adapter cards may be installed in a 3172 Model 3. With either Offload of TCP/IP for VM (FC 3000) or Offload of TCP/IP for MVS feature (FC 3010), one or a maximum of two Ethernet adapter cards may be installed without an FDDI adapter installed and no Ethernet adapter cards may be installed with an FDDI adapter installed. This feature is factory or field installable.

FDDI ADAPTER (FC 2300)

This adapter provides attachment to a 100 Mbps FDDI Local Area Network (LAN) that conforms to the American National Standard Institute (ANSI) X3T9.5 and International Organization for Standardization (ISO) 9314 architectures. Two feature slots are required to implement the dual ring station that is supported in the 3172 Model 3.

Two multimode (62.5/125 micron) FDDI jumper cables are required to connect the adapter into the FDDI ring. These jumper cables are not provided with this feature and must be ordered separately. Refer to the *IBM Cabling System Optical Fiber Planning and Installation Guide* (GA27-003943), and *IBM FDDI Network Introduction and Planning Guide* (GA27-003892), for more information about the jumper cables, planning, design and installation of optical fiber cabling systems.

A maximum of one FDDI adapter may be installed in a 3172 Model 3 with or without other LAN adapter cards (FC 2210 token-ring for WAC, FC 2215 token-ring, FC 2225 Ethernet). If an FDDI adapter is used with the 3172 Model 3, the 3172 Model 3 must be installed in 9309-002 rack and in a computer room (Class A Environment). This feature is factory or field installable.

INTERCONNECT CONTROLLER RACK MOUNTING ASSEMBLY MODEL 3 (FC 2500)

This feature allows the 3172 Model 3 to be mounted in the 9309-002 Rack Enclosure. The feature includes slides, a tray and a channel cable mounting plate. Each 3172 Model 3 mounted in the 9309-002 must be ordered with this feature. This feature may also be used to install the 3172 Model 3 in a compatible OEM EIA rack. Refer to the *3172 Interconnect Controller Model 3 Hardware Planning Guide* GA27-4003 for more information.

S/390 PARALLEL CHANNEL ADAPTER (FC 2501)

This interface with an IBM S/390 parallel channel appears as if it is an IBM 3088. The channel adapter supports speeds up to 4.5 megabytes per second. One channel adapter is always required and shipped with the 3172 Model 3 and is mutually exclusive with an IBM ESCON adapter (FC 2800).

This feature includes the adapter, adapter cable, and the channel cable adapter plate. Channel cables (group 0185) must be ordered separately.

In a LAN-to-host environment, a minimum of one or a maximum of two PCA cards can be installed in a 3172 Model 3 when IBM ESCON adapter is not installed. In an Offload environment, a maximum of two or a minimum of one channel adapter card can be installed in a 3172 Model 3. Only one channel may be used. The remaining channel will not be utilized. This feature is factory or field installable.

OFFLOAD HARDWARE (FC 2700)

This feature includes the following: 9524-001 XGA display for Northern Hemisphere countries, 9524-004 for Southern Hemisphere countries (power cord and model will ship according to the country code), IBM keyboard, XGA display adapter, and 8MB non-ECC memory expansion. With this feature, the system board will have 16MB RAM. This feature is mandatory for TCP/IP Offload, Preloaded Software for VM (FC 3000), and Preloaded Software for MVS (FC 3010). This feature is factory or field installable.

MOUSE AND MOUSE EXTENSION KIT (FC 2705)

This feature is highly recommended for OS/2 users and is mandatory for preloaded software (FC 3000, 3010, 3020, 3030, 3031, 3040, 3041). It includes an IBM PS/2 mouse and an extender cable to allow the use of the mouse at a greater range than the standard cable affords.

HARDWARE PACKAGE1 (FC 2710)

This feature includes the following: 9524-001 XGA display for Northern Hemisphere countries, 9524-004 for Southern Hemisphere countries (power cord and model will ship according to the country code), IBM keyboard, XGA display adapter, and 16MB ECC RAM.

50 MHz 80486DX processor card (FC 2830) and Rack Mounting Assembly (FC 2500) are mandatory features with Hardware Package1 (FC 2710). When ordering FC 2830, 2500, 2710, and base 3172 Model 3, the 25 MHz 80486SX processor in the base 3172 Model 3 is replaced with 50 MHz 80486DX processor card in factory. This feature is for factory installation only.

HARDWARE PACKAGE1 UPGRADE FROM BASE 3172 Model 3 (FC 2711)

This feature allows users to upgrade their existing base 3172 Model 3 hardware, which has the 25 MHz 80486SX processor without TCP/IP Offload feature, to Hardware Package1 (FC 2710). 50 MHz 80486DX processor card (FC 2830) must be installed with this feature. This feature is only supported with the base 3172 Model 3 already installed in the 9309-002 rack. This is only field installable.

HARDWARE PACKAGE1 UPGRADE FROM TCP/IP OFFLOAD 3172 Model 3 (FC 2712)

This feature allows users to upgrade their existing 3172 Model 3, which has the 25 MHz 80486SX processor with TCP/IP Offload feature (FC 2700), to Hardware Package1 (FC 2710). 50 MHz 80486DX processor card (FC 2830) must be installed with this feature. This feature is only supported with the base 3172 Model 3 already installed in the 9309-002 rack.

When this upgrade feature (FC 2712) and 50 MHz 80486DX processor card feature (FC 2830) are ordered, the 25 MHz 80486SX, and 16MB memory (non-ECC) in the

base hardware are replaced in field with the 50 MHz 80486DX, and 16MB ECC RAM. This is only field installable.

HARDWARE PACKAGE2 (FC 2720)

This feature includes the following: 9524-001 XGA display for Northern Hemisphere countries, 9524-004 for Southern Hemisphere countries (power cord and model will ship according to the country code), IBM keyboard, XGA display adapter, 32MB ECC RAM, and 1GB DASD with enhanced SCSI adapter.

50 MHz 80486DX processor card (FC 2830) and Rack Mounting Assembly (FC 2500) are mandatory. This feature is only for factory installation.

HARDWARE PACKAGE1 TO 2 UPGRADE (FC 2721)

This feature allows users to upgrade their Hardware Package1 of the 3172 Model 3 to Hardware Package2. This feature replaces 80MB DASD with 1GB DASD and enhanced SCSI adapter, and upgrades ECC memory from 16MB to 32MB. This feature is only field installable.

IBM ESCON ADAPTER FEATURE (FC 2800)

This IBM ESCON adapter feature allows the 3172 Model 3 to attach directly to an ESCON channel (10MB or 17MB), providing fiber optic links using LED technology, and attach to ESCON Directors to allow for large numbers of connections.

Only one IBM ESCON adapter can be installed when a S/390 parallel channel adapter is not installed. This feature can be shipped from factory or field installed. ***When this feature is ordered through MES, it may only be installed on machines which have serial numbers greater than 23-60291 in the US or greater than 77-F0078 for World Trade countries.***

16MB ECC MEMORY UPGRADE (FC 2810)

This feature is only supported with Hardware Package1 and Hardware Package2 features. With Hardware Package1, or Hardware Package2, the maximum memory capacity of the system board is 64MB. A minimum of zero or a maximum of three 16MB ECC Memory Upgrades can be supported with Hardware Package1. A minimum of zero or a maximum of two 16MB ECC memory upgrades can be supported with Hardware Package2. This feature is factory or field installable.

50 MHz 80486DX PROCESSOR CARD (FC 2830)

This feature replaces the 25 MHz 80486SX processor in the standard base hardware. This feature is mandatory hardware for Hardware Package1 (FC 2710), Hardware Package2 (FC 2720), Hardware Package1 Upgrade from Base 3172 Model 3 (FC 2711), and Hardware Package1 Upgrade from TCP/IP Offload 3172 Model 3 (FC 2712) features. This feature is factory or field installable.

66 MHz PENTIUM PROCESSOR CARD (FC 2850)

The Pentium 66 MHz processor features a 64-bit data bus and 32-bit address bus capability. This feature replaces the 25 MHz or 50 MHz Intel 3 80486 processor cards. This feature is not available with FC 2710, FC 2711, FC 2712, FC 2720 or FC 2721.

X.21 WIDE AREA CONNECTOR ADAPTER (FC 2900)

This feature is an X.21 version of the WAC adapter which contains the WAC common card, a 5-meter cable, and an X.21 interface card which requires an external CSU/DSU. The mandatory features with FC 2900 are TCP/IP Offload Hardware (FC 2700), and Offload for VM (FC 3000 for TCP/IP VM) or Offload for MVS (FC 3010 for TCP/IP MVS). This feature cannot exist together with the V.35 Wide Area Connector or RS-422/449 Wide Area Connector and is not supported with Hardware Package1, Hardware Package2, 16MB ECC Memory Upgrade feature and IBM token-ring 16/4 adapter (FC 2215). The X.21 WAC feature is supported with either 25 MHz 80486SX or 50 MHz 80486DX processor. A maximum of one or a minimum of zero X.21 WAC features are supported. This feature is factory or field installable. For field installation, any other WAC adapter must be removed.

X.21 WIDE AREA CONNECTOR INTERFACE (FC 2901)

This feature provides an ITU-T WAC electrical interface board (EIB), which adds a second WAC interface port to a WAC adapter (FC 2900, FC 2910, FC 2920). The X.21 EIB supports line speeds up to 64 Kbps as a second interface. A 5-meter cable and wrap plug are shipped with the feature. This feature is only supported by the SNA Communications Program. At least one WAC adapter must be installed for attachment of this feature. A maximum of one WAC interface (FC 2901, FC 2911, FC 2921, FC 2922) is supported per adapter. Two WAC adapters and their respective interfaces are supported per 3172 Model 3.

V.35 WIDE AREA CONNECTOR ADAPTER (FC 2910)

This feature is the V.35 version of the WAC adapter. It contains the WAC common card, a 5-meter cable, a V.35 interface card which requires an external CSU/DSU. The mandatory features with FC 2910 are TCP/IP Offload Hardware (FC 2700), and either Offload for VM (FC 3000 for TCP/IP VM), or Offload for MVS (FC 3010 for TCP/IP MVS). This feature cannot exist together with X.21 Wide Area Connector, and RS-422/449 Wide Area Connector, and is not supported with Hardware Package1, Hardware Package2, 16MB ECC Memory Upgrade feature, or the IBM token-ring 16/4 adapter (FC 2215). The V.35 WAC feature is supported with either 25 MHz 80486SX or 50 MHz 80486DX processor. A maximum of one V.35 WAC feature is supported. This feature is factory or field installable. For field installation, any other WAC adapter must be removed.

V.35 WIDE AREA CONNECTOR INTERFACE (FC 2911)

This feature provides an ITU-T WAC electrical interface board (EIB), which adds a second WAC interface port to a WAC adapter (FC 2900, FC 2910, FC 2920). The V.35 EIB supports line speeds up to 64 Kbps as a second interface. A 5-meter cable and wrap plug are shipped with the feature. This feature is only supported by the SNA Communications Program. At least one WAC adapter must be installed for attachment of this feature. A maximum of one WAC interface (FC 2901, FC 2911, FC 2921, FC 2922) is supported per adapter. Two WAC adapters and their respective interfaces are supported per 3172 Model 3.

RS-422/449 WIDE AREA CONNECTOR ADAPTER (FC 2920)

This feature consists of the WAC common card, an EIA RS-422/449 electrical interface board (EIB), a 5-meter cable and a wrap plug. The RS-422/449 EIB supports speeds up to E1 (2.048 Mbps). This feature requires either the

Multiprotocol Environment or the SNA Communications Program. When using MPE (FC 3000 or 3010) only one WAC adapter is supported. When using SNA Communications Program (FC 3020, FC 3040, FC 3041) up to two WAC adapters (FC 2900, 2910, 2920) are supported. When using MPE with this feature the following features are not supported: Hardware Package1, Hardware Package2, 16MB ECC Memory Upgrade and IBM token-ring 16/4 adapter (FC 2215). This feature is factory or field installable.

RS-422/449 WIDE AREA CONNECTOR INTERFACE (FC 2921)

This feature provides an ITU-T WAC electrical interface board (EIB), which adds a second WAC interface port to a WAC adapter (FC 2900, FC 2910, FC 2920). The RS-422/449 EIB supports line speeds up to 64 Kbps as a second interface. A 5-meter cable and wrap plug are shipped with the feature. This feature is only supported by the SNA Communications Program. At least one WAC adapter must be installed for attachment of this feature. A maximum of one WAC interface (FC 2901, FC 2911, FC 2921, FC 2922) is supported per adapter. Two WAC adapters and their respective interfaces are supported per 3172 Model 3.

RS-232D WIDE AREA CONNECTOR INTERFACE (FC 2922)

This feature provides an ITU-T WAC electrical interface board (EIB), which adds a second WAC interface port to a WAC adapter (FC 2900, FC 2910, FC 2920). The RS-232D EIB supports line speeds up to 19.2 Kbps as a second interface. A 5-meter cable and wrap plug are shipped with the feature. This feature is only supported by the SNA Communications Program. At least one WAC adapter must be installed for attachment of this feature. A maximum of one WAC interface (FC 2901, FC 2911, FC 2921, FC 2922) is supported per adapter. Two WAC adapters and their respective interfaces are supported per 3172 Model 3.

ARTIC PORTMASTER RS-232 (FC 2930)

This feature is A Real Time Interface Co-processor (ARTIC) card for Micro Channel bus systems. The 1 MB version of the base card, one RS-232D electrical interface board (EIB), the cable between the EIB and the interface box are shipped with this feature. The wrap plug and cable for the external communications unit are not included with this feature. This adapter offers busmaster capability, reduced processor utilization and better line speed performance for up to eight ports. The RS-232D EIB provides up to eight external interfaces at full-duplex rates of up to 38.4 Kbps on each port. This feature is only supported by the SNA Communications Program. A maximum of four ARTIC Portmaster Adapters is supported per 3172 Model 3 and 9309-002 rack.

ARTIC PORTMASTER X.21 (FC 2940)

This feature is A Real Time Interface Co-processor (ARTIC) card for Micro Channel bus systems. The 1 MB version of the base card, one X.21 electrical interface board (EIB), the cable between the EIB and the interface box are shipped with this feature. The wrap plug and cable for the external communications unit are not included with this feature. This adapter offers busmaster capability, reduced processor utilization and better line speed performance for up to eight ports. The X.21 EIB provides up to six external interfaces at full-duplex rates of up to 256 Kbps on each port or up to E1 (2.048 Mbps) on a single port. This feature is only supported by the SNA Communications Program. A maximum of four ARTIC Portmaster Adapters is supported per 3172 Model 3 and 9309-002 rack.

ARTIC PORTMASTER V.35 (FC 2950)

This feature is A Real Time Interface Co-processor (ARTIC) card for Micro Channel bus systems. The 1 MB version of the base card, one V.35 electrical interface board (EIB), the cable between the EIB and the interface box are shipped with this feature. The wrap plug and cable for the external communications unit are not included with this feature. This adapter offers busmaster capability, reduced processor utilization and better line speed performance for up to eight ports. The V.35 EIB provides up to six external interfaces at full-duplex rates of up to 64 Kbps on each port or up to E1 (2.048 Mbps) on a single port. This feature is only supported by the SNA Communications Program. A maximum of four ARTIC Portmaster Adapters is supported per 3172 Model 3 and 9309-002 rack.

ARTIC PORTMASTER RS-422 (FC 2960)

This feature is A Real Time Interface Co-processor (ARTIC) card for Micro Channel bus systems. The 1 MB version of the base card, one RS-422 electrical interface board (EIB), the cable between the EIB and the interface box are shipped with this feature. The wrap plug and cable for the external communications unit are not included with this feature. This adapter offers busmaster capability, reduced processor utilization and better line speed performance for up to eight ports. The RS-422 EIB provides up to eight external interfaces at full-duplex rates of up to 64 Kbps on each port or up to E1 (2.048 Mbps) on a single port. This feature is only supported by the SNA Communications Program. A maximum of four ARTIC Portmaster Adapters is supported per 3172 Model 3 and 9309-002 rack.

PRELOADED SOFTWARE FOR VM - MPE (FC 3000)

This feature is a preloaded software package installed in the 3172 Model 3 at the factory. It supports the use of a frame relay link by the 3172 when acting as a gateway running TCP/IP Offload of VM software. The same frame relay link may also be used to bridge SNA and NetBIOS concurrently to a token-ring network and simultaneously with the gateway function. The mandatory hardware features with Preloaded Software for VM are TCP/IP Offload Hardware, at least one X.21, V.35 or RS-422/449 Wide Area Connector adapters and one token-ring 16/4 adapter (FC 2210). This feature does not support Hardware Package1, Hardware Package2, 16MB ECC Memory Upgrade Feature and IBM token-ring 16/4 adapter (FC 2215). Preloaded Software for MVS is mutually exclusive. This feature is for factory installation only. The preload service is provided at no charge. The specified software programs must be ordered separately for billing and registration purposes.

PRELOADED SOFTWARE FOR MVS - MPE (FC 3010)

This feature is a preloaded software package installed in the 3172 Model 3 at the factory. It supports the use of a frame relay link by the 3172 when acting as a gateway running TCP/IP Offload of MVS software. The same frame relay link may also be used to bridge SNA and NetBIOS concurrently to a token-ring network and simultaneously with the gateway function. The mandatory hardware features with Preloaded Software for MVS are TCP/IP Offload Hardware, at least one X.21, V.35 or RS-422/449 Wide Area Connector adapters and one IBM token-ring 16/4 adapter (FC 2210). This feature does not support Hardware Package1, Hardware Package2, 16MB ECC Memory Upgrade Feature and IBM token-ring 16/4 adapter (FC 2215). The preload service is provided at no charge.

The specified software programs must be ordered separately for billing and registration purposes. Preloaded Software for VM is mutually exclusive. This feature is for factory installation only.

PRELOADED SOFTWARE - SNA COMMUNICATIONS PROGRAM (FC 3020)

This feature provides a service to preload the SNA Communications Program on the 3172 Model 3 hard disk at the factory. FC 2700 and FC 2705 are mandatory pre-requisites for this feature. The preload service is provided at no charge. The specified software programs must be ordered separately for billing and registration purposes.

PRELOADED SOFTWARE - TCP/IP VM OFFLOAD PRELOAD (FC 3030)

This feature provides a service to preload TCP/IP Offload for VM on the 3172 Model 3 hard disk at the factory. FC 2700 and FC 2705 are mandatory pre-requisites for this feature. The preload service is provided at no charge. The specified software programs must be ordered separately for billing and registration purposes.

PRELOADED SOFTWARE - TCP/IP MVS OFFLOAD PRELOAD (FC 3040)

This feature provides a service to preload TCP/IP Offload for MVS on the 3172 Model 3 hard disk at the factory. FC 2700 and FC 2705 are mandatory pre-requisites for this feature. The preload service is provided at no charge. The specified software programs must be ordered separately for billing and registration purposes.

PRELOADED SOFTWARE - SNA AND TCP/IP MVS OFFLOAD PRELOAD (FC 3041)

This feature provides a service to preload TCP/IP Offload for MVS and the SNA Communications Program on the 3172 Model 3 hard disk at the factory. FC 2700 and FC 2705 are mandatory pre-requisites for this feature. The preload service is provided at no charge. The specified software programs must be ordered separately for billing and registration purposes.

CABLE INFORMATION

Cable information is identified in the most recent edition of the *IBM System/360, System/390, 4300 and 9390 Processors Input/Output Equipment Installation Manual--Physical Planning* (GC22-7064).

Jumper cables are the responsibility of the customer and may be ordered from your local authorized IBM cabling distributor or by calling 1-800-IBM-2468 in the United States and 1-800-465-1234 in Canada. For EMEA customers, cables are available from Montpellier through CE offerings.

F.2.3 Available Features and Codes by Platform

The following table lists currently available Feature Codes for the 3172 Model 3 as of the publication date of this manual. A *Yes* indicates that a particular feature is supported by the software platform and is optional; *No* indicates that the feature is not supported by the software platform; *Req* indicates that the feature is required or mandatory to the selected software platform. A parenthetical number, for example (2), indicates an exception to the maximum feature codes that are supported by the platform. Features only available via MES are marked with an asterisk (*) and those only available on new machine orders are marked by a plus sign (+). Customers are advised to consult with their IBM representative for the current status of these features and potential enhancements to this table.

Feature Code	Description	Maximum	ICP	TCP/IP Offload	MPE	LFS/ LANRES	SNA/Comm	SNA/Comm & TCP/IP Offload
2210	Token-ring 16/4 Mbps Adapter	2	No	No	Req	No	No	No
2215	Token-ring 16/4 Mbps Adapter	4	Yes	Yes	No	Yes	Yes(*)	Yes(*)
2225	Ethernet Adapter	4	Yes	Yes	Yes(2)	Yes	Yes(*)	Yes(*)
2235	Auto LANStreamer MC32	4	Yes	Yes	Yes	No	Yes	Yes
2245	EtherStreamer MC32	4	Yes	Yes	Yes	No	Yes	Yes
2300	FDDI Adapter	1	Yes	Yes	Yes	Yes	Yes	Yes
2500	9309 Rack Mount Assembly	1	Yes	Yes	Yes	Req	Yes	Yes
2501	S/390 Parallel Channel Adapter	1	Yes(2)	Yes	Yes	Yes	Yes	Yes
2700	Offload Hardware Feature	1	No	Req	Req	No	Req	Req
2705	Mouse and Mouse Extension Kit	1	No	Req	Req	Yes	Req	Req
2710	Hardware Package1 (+)	1	No	No	No	Yes	No	No
2711	Hrdwe Pkg1 Upgd from Base 3172 (*)	1	No	No	No	Yes	No	No
2712	Hrdwe Pkg1 Upgd from TCP/IP Offload (*)	1	No	No	No	Yes	No	No
2720	Hardware Package2 (+)	1	No	No	No	Yes	No	No
2721	Hardware Package1 to 2 Upgrade (*)	1	No	No	No	Yes	No	No
2800	S/390 ESCON Adapter•	1	Yes	Yes	Yes	Yes	Yes	Yes
2810	16MB ECC Memory Upgrade	3	No	No	No	Yes	No	No
2830	50 MHz 80486DX Processor Card	1	Yes	Yes	Yes	Req	Yes	Yes
2850	66 MHz Pentium Processor Card	1	Yes	Yes	No	No	Yes	Yes
2900	X.21 Wide Area Connector Adapter	2	No	No	Yes(1)	No	Yes	Yes
2901	X.21 WAC Interface w/Cable	2	No	No	Yes(1)	No	Yes	Yes
2910	V.35 Wide Area Connector Adapter	2	No	No	Yes(1)	No	Yes	Yes
2911	V.35 WAC Interface w/Cable	2	No	No	No	No	Yes	Yes
2920	RS-422/449 Wide Area Connector Adapter	2	No	No	Yes(1)	No	Yes	Yes
2921	RS-422/449 WAC Interface w/Cable	2	No	No	No	No	Yes	Yes
2922	RS-232D WAC Interface w/Cable	2	No	No	No	No	Yes	Yes
2930	ARTIC Portmaster RS-232D Adapter	4	No	No	No	No	Yes	Yes
2940	ARTIC Portmaster X.21 Adapter	4	No	No	No	No	Yes	Yes
2950	ARTIC Portmaster V.35 Adapter	4	No	No	No	No	Yes	Yes
2960	ARTIC Portmaster RS-422 Adapter	4	No	No	No	No	Yes	Yes
3000	Preloaded Software for VM - MPE (+)	1	No	No	Yes	No	No	No
3010	Preloaded Software for MVS - MPE (+)	1	No	No	Yes	No	No	No
3020	Preloaded Software - SNA/Comm (+)	1	No	No	No	No	Req	No
3030	Preloaded Software - TCP/IP VM Offload (+)	1	No	Yes	No	No	No	No
3031	Preloaded Software - TCP/IP MVS Offload (+)	1	No	Yes	No	No	No	No
3040	Preloaded Software - FC 3020 & FC 3030 (+)	1	No	No	No	No	No	Yes
3041	Preloaded Software - FC 3020 & FC 3031 (+)	1	No	No	No	No	No	Yes

Table 18. Available Feature Codes by Platform

Note:

   •Requires a S/N greater than 23-60291 for field installation in the US or greater than 77-F0078 in World Trade countries.

F.3 Solutions, Guidelines and Limitations

F.3.1 Custom Package Solutions

The 3172 Model 3 provides unique packages to satisfy the requirements of various program products. The following pre-packaged configurations are offered:

1. IBM Interconnect Controller Program Version 3:

   Supports SNA/VTAM and TCP/IP protocols. FDDI, IBM token-ring, and Ethernet LAN adapters and IBM ESCON or PCA adapters are supported. The IBM ESCON adapter is mutually exclusive with PCA. Either the 50 MHz 80486DX processor or the 66 MHz Pentium processor is supported for TCP/IP MVS and VM, and they are mutually exclusive with the 25 MHz 80486SX standard processor.

2. Three OS/2 platforms are provided:

   - TCP/IP Offload for MVS and TCP/IP Offload for VM

     The first OS/2 application for the Model 3 is TCP/IP Offload. FDDI, IBM token-ring, and Ethernet LAN adapters and IBM or PCA adapters are supported. The IBM ESCON adapter is mutually exclusive with PCA. Either the 50 MHz 80486DX processor or the 66 MHz Pentium processor or the standard base 25 MHz 80486SX processor is supported for TCP/IP Offload for MVS and VM, and they are also mutually exclusive.

   - 3172 Multiprotocol Networking Software Solution Release 1.0:

     The second OS/2 application for the Model 3 provides TCP/IP Offload host gateway support for frame relay, SNA bridging and NetBIOS bridging. IBM Wide Area Connector adapters, TCP/IP Offload hardware, ESCON or PCA, Ethernet, Token-Ring, and 25 MHz Intel 80486SX or 50 MHz Intel 80486DX are supported with the 3172 Multiprotocol Networking Software Solution Release 1.0 application program. ESCON and PCA are mutually exclusive. Either the 66 MHz Intel Pentium processor or the 50 MHz Intel 80486DX is supported and is mutually exclusive with the 25 MHz 80486SX standard processor. MPE uses RXR/2 Version 1.0.

   - SNA Communications Program Version 1 Release 1

     The third OS/2 application for the Model 3 provides SNA/SDLC line concentration over LAN and WAN interfaces. IBM Wide Area Connector adapters, ARTIC adapters, TCP/IP Offload hardware, ESCON or PCA, Ethernet, Token-Ring, and 25 MHz Intel 80486SX or 50 MHz Intel 80486DX or 66 MHz Intel Pentium proccesors are supported with the SNA Communications Program. ESCON and PCA are mutually exclusive. 25 MHz Intel 80486SX and 50 MHz Intel 80486DX and 66 MHz Pentium processors are mutually exclusive. SNA/Comm may coexist with RXR/2 Version 2 and X.25 Xpander/2.

3. Hardware Package1:

   This package supports LFS/ESA, LANRES/VM and LANRES/MVS, and is recommended when minimal workstation data is stored on the 3172 Model 3. This feature provides 16MB Error Correcting Code (ECC) RAM, keyboard, XGA adapter and monitor. The 50 MHz 80486DX processor

feature is mandatory. The IBM PCA, ESCON, token-ring, Ethernet and FDDI adapters, as well as 16MB ECC memory upgrades up to 64MB are supported with Hardware Package1. PCA and IBM ESCON adapters are mutually exclusive.

4. Hardware Package2:

This package supports LFS/ESA, LANRES/VM, and LANRES/MVS, and is recommended when workstation data is stored on both the 3172 Model 3 and the host. This feature provides 32MB ECC RAM, 1GB DASD with enhanced SCSI adapter, keyboard, XGA adapter and monitor. The 50 MHz 80486DX processor is mandatory. The IBM PCA, ESCON, token-ring, Ethernet and FDDI adapters, as well as 16MB ECC memory upgrades up to 64MB are supported with Hardware Package2. PCA and IBM ESCON adapters are mutually exclusive.

F.3.2 Maximum Configuration Guidelines

The following is the maximum number of features that may be supported on a 3172 Model 3 by platform.

1. Interconnect Controller Program Version 3:

   • Two S/390 parallel channel adapters

   • One IBM ESCON adapter (PCA adapter is mutually exclusive with the ESCON adapter).

   • One 50 MHz 80486DX processor or one 66 MHz Pentium processor is optional and each is mutually exclusive with and replaces the standard base 25 MHz 80486SX processor

   • One FDDI adapter (with two other LAN adapters)

   • Any combination of token-ring and/or Ethernet adapters, up to a maximum of four (with no FDDI installed)

2. TCP/IP Offload for VM and MVS:

   • One S/390 parallel channel adapter (if a second adapter is ordered, it will not be used)

   • One IBM ESCON adapter (PCA adapter is mutually exclusive with ESCON adapter)

   • One 50 MHz 80486DX processor or one 66 MHz Pentium processor is optional and each is mutually exclusive with and replaces the standard base 25 MHz 80486SX processor

   • One FDDI adapter

   • Any combination of token-ring adapters and/or Ethernet adapters, up to a maximum of four (with no FDDI adapter installed)

   • One Offload hardware feature

3. 3172 Multiprotocol Networking Software Solution Release 1.0:

   • One S/390 parallel channel adapter (if second PCA adapter is ordered, it will not be used.)

   • One IBM ESCON adapter (PCA is mutually exclusive with ESCON adapter.)

   • One 50 MHz 80486DX processor is optional, and is mutually exclusive with the 25 MHz 80486SX processor

- One FDDI adapter

- One token-ring (FC 2210) adapter when a FDDI adapter is installed, and any combination of token-ring (FC 2210) and/or Ethernet adapters up to three when a FDDI is not installed (maximum of two token-ring (FC 2210) adapters are allowed).

- One of X.21, V.35, or RS-422/449 WAC adapters (FC 2900, FC 2910, FC 2920) is required; X.21, V.35, and RS-422/449 WAC adapters are mutually exclusive.

- One token-ring (FC 2210) is always required with either Preloaded Software for VM or Preloaded Software for MVS.

- One Preloaded Software for VM is always required for TCP/IP VM Offload environment.

- One Preloaded Software for MVS is always required for TCP/IP MVS Offload environment.

- One Offload Hardware Feature (FC 2700) for either Preloaded Software for VM or Preloaded Software for MVS.

- One Rack Mounting Assembly kit per machine.

4. LFS/ESA, LANRES/VM, and LANRES/MVS, when minimal workstation data is stored in the 3172 Model 3:

  - One Hardware Package1

  - One S/390 parallel channel adapter (if second adapter is ordered, it will not be used)

  - One IBM ESCON adapter (PCA adapter is mutually exclusive with the ESCON adapter)

  - One 50 MHz 80486DX processor (required)

  - One FDDI adapter

  - Any combination of token-ring and/or Ethernet adapters up to a maximum of two when an FDDI adapter is installed, or four when an FDDI is not installed

  - Three 16MB memory upgrades

  - One Rack Mounting Assembly kit per machine

5. LFS/ESA, LANRES/VM, and LANRES/MVS, when workstation data is stored on the 3172 Model 3 and on the host:

  - One Hardware Package2

  - One S/390 parallel channel adapter (if second adapter is ordered, it will not be used)

  - One IBM ESCON adapter (PCA adapter is mutually exclusive with the ESCON adapter)

  - One 50 MHz 80486DX Processor (required)

  - One FDDI adapter

  - Any combination of token-ring and/or Ethernet adapters up to a maximum of two when an FDDI adapter is installed, or four when an FDDI is not installed

  - Two 16MB memory upgrades

- One Rack Mounting Assembly kit per machine

6. SNA Communications Program Version 1 Release 1

  - One S/390 parallel channel adapter (if second PCA adapter is ordered, it will not be used)

  - One IBM ESCON adapter (PCA is mutually exclusive with ESCON adapter)

  - One 50 MHz 80486DX processor or one 66 MHz Pentium processor is recommended and each is mutually exclusive with and replaces the standard base 25 MHz 80486SX processor

  - One FDDI adapter

  - Any combination of token-ring and/or Ethernet adapters up to a maximum of four when a FDDI adapter or a WAN adapter is not installed.

  - Two of X.21, V.35, or RS-422/449 WAC adapters (FC 2900, FC 2910, FC 2920) are optional; X.21, V.35, and RS-422/449 WAC adapters may be intermingled.

  - Four of RS-232, X.21, V.35, or RS-422/449 ARTIC Portmaster adapters (FC 2930, FC 2940, FC 2950, FC 2960) are optional; RS-232, X.21, V.35, and RS-422/449 adapters may be intermingled. ARTIC and WAC adapters may be intermingled, however there can be no more than two WAC adapters and the maximum number of all adapters (LAN/WAN) may not exceed four.

  - One Preloaded Software for SNA Communications Program or one Preloaded Software for SNA Communications and TCP/IP Offload of VM or MVS

  - One Offload Hardware Feature (FC 2700) for either Preloaded Software for VM or Preloaded Software for MVS.

  - One Rack Mounting Assembly kit per machine.

F.3.3 Limitations

For the IBM Interconnect Controller Program Version 3.3, the following limitations apply:

- A maximum combination of four Ethernet and/or token-ring adapters are supported when an FDDI adapter is not installed. If an FDDI adapter is installed, a maximum of two Ethernet or two token-ring adapters can also be installed in any combination.

- A maximum of one FDDI adapter in a 3172 Model 3 is supported.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in a 9309-002 rack and in a computer room (Class A Environment).

- A maximum of two or a minimum of one PCA is supported when an IBM ESCON adapter is not installed.

- Only one IBM ESCON adapter is supported when PCA is not installed. PCA is mutually exclusive with an IBM ESCON adapter.

- Only one of either a 25 MHz 80486SX processor card or a 50 MHz 80486DX processor card or a 66 MHz Pentium processor card is supported. If the 50 MHz 80486DX or the 66 MHz processor cards are not ordered, the 25 MHz

80486SX processor card will be shipped as base 3172 Model 3 hardware from the factory.

For the TCP/IP Offload for VM and MVS, the following limitations apply:

- A maximum of four Ethernet and/or token-ring adapter cards are supported when an FDDI adapter is not installed. If an FDDI adapter is installed, a maximum of two Ethernet or token-ring adapters can also be installed in any combination.

- A maximum of one FDDI adapter is supported.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in a 9309-002 rack and in a computer room (Class A Environment).

- Only one S/390 PCA (if two channel adapters are installed, only one can be used with Offload) is supported when an IBM ESCON adapter is not installed.

- Only one IBM ESCON adapter is supported when a S/390 PCA is not installed. PCA is mutually exclusive with an IBM ESCON adapter.

- Only one of either a 25 MHz 80486SX processor card or a 50 MHz 80486DX processor card or a 66 MHz Pentium processor card is supported. If the 50 MHz 80486DX or the 66 MHz processor cards are not ordered, the 25 MHz 80486SX processor card will be shipped as base 3172 Model 3 hardware from the factory.

- Offload Feature (always required)

- The 3172 Model 3 is designed to be installed either in the IBM 9309-002 rack, or in an equivalent/compatible 19-inch standard original equipment manufacturer (OEM) rack. Three 3172 Model 3s can be installed in the same 9309-2 Rack Enclosure. Hardware Package1 and Hardware Package2 are supported only with the IBM 9309-002 rack.

For Multiprotocol Networking Software Solution Release 1.0, the following limitations apply:

- Preloaded Software for VM (FC 3000) is a mandatory feature for TCP/IP Offload of VM and Preloaded Software for MVS (FC 3010) is a mandatory feature for TCP/IP Offload of MVS. Preloaded Software for VM (FC 3000) and Preloaded Software for MVS (FC 3010) are mutually exclusive.

- Only one of X.21, V.35, or RS-422/449 Wide Area Connector adapters

- Only one TCP/IP Offload hardware (FC 2700)

- A maximum of two or minimum of one token-ring 16/4 adapters (FC 2210) - this adapter may only be ordered with either the Preloaded Software for VM (FC 3000) or the Preloaded Software for MVS (FC 3010) feature

- A maximum of two Ethernet adapters without FDDI installed

- No Ethernet adapters may be installed when FDDI adapters are present

- Only one token-ring adapter (FC 2210) may be installed when FDDI adapters are present

- A maximum of three or minimum of one LAN adapters, in any combination of token-ring (FC 2210) and Ethernet adapters without FDDI installed. For this configuration the maximum of token-ring (FC 2210) adapters is two and the minimum is one.

- Only one ESCON adapter is supported when a parallel channel adapter (PCA) is not installed.

- A maximum of two or minimum of one PCA adapter when an ESCON adapter is not installed. If the second PCA is ordered, it will not be used. IBM ESCON and PCA adapters are mutually exclusive.

- Only one of either a 25 MHz 80486SX processor card or a 50 MHz 80486DX processor card or a 66 MHz Pentium processor card is supported. If the 50 MHz 80486DX or the 66 MHz processor cards are not ordered, the 25 MHz 80486SX processor card will be shipped as base 3172 Model 3 hardware from the factory.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in 9309-002 rack and in a computer room (Class A Environment).

For LFS/ESA, LANRES/VM, and LANRES/MVS (for file server applications when no workstation data is stored on the 3172 Model 3), the following limitations apply:

- Hardware Package1 (16MB ECC RAM, keyboard, XGA adapter and monitor) is mandatory.

- A 50 MHz 80486DX processor is also mandatory. When ordering Hardware Package1 and a 50 MHz 80486DX with the base hardware, the 8MB memory in the base hardware will be replaced with the 16MB ECC RAM.

- A maximum of one FDDI adapter is supported.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in a 9309-002 rack and in a computer room (Class A Environment).

- A maximum of four LAN adapters without FDDI (either Ethernet or token-ring or a combination of token-ring and Ethernet) is supported.

- A maximum of two LAN adapters with FDDI (either Ethernet or token-ring, or a combination of token-ring and Ethernet) is supported.

- A maximum of two or minimum of one PCA is supported when an IBM ESCON adapter is not installed.

- Only one ESCON adapter is supported when a parallel channel adapter (PCA) is not installed.

- A maximum of three or minimum of zero 16MB memory upgrades are supported.

For LFS/ESA, LANRES/VM, and LANRES/MVS (file server applications when workstation data is stored on the 3172 Model 3 and on the host), the following limitations apply:

- Hardware Package2 is mandatory.

- A 50 MHz 80486DX processor is also mandatory. When ordering Hardware Package2 and 50 MHz 80486DX with the base hardware, the 8MB memory and basic DASD with SCSI adapter in the base hardware will be replaced with 32MB ECC RAM and a 1.0GB DASD with an enhanced SCSI adapter.

- A maximum of one FDDI adapter is supported.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in a 9309-002 rack and in a computer room (Class A Environment).

- A maximum of four LAN adapters without FDDI (either Ethernet or token-ring, or a combination of token-ring and Ethernet) is supported.

- A maximum of two LAN adapters with FDDI (either Ethernet or token-ring, or a combination of token-ring and Ethernet) is supported.

- A maximum of two or minimum of one PCA is supported when an IBM ESCON adapter is not installed.

- A maximum of one IBM ESCON adapter is supported when PCA is not installed.

- A maximum of two or minimum of zero 16MB memory upgrades are supported.

For SNA Communications Program Version 1 Release 1 the following limitations apply:

- Preloaded Software for SNA (FC 3020) is a mandatory feature.

- Only two of X.21, V.35, or RS-422/449 Wide Area Connector adapters are supported.

- Only one TCP/IP Offload hardware (FC 2700) is supported.

- A maximum of four LAN adapters without FDDI (either Ethernet or token-ring, or a combination of token-ring and Ethernet) is supported.

- If an FDDI adapter is installed the maximum number of WAN or LAN adapters that may be installed is two.

- Only one ESCON adapter is supported when a parallel channel adapter (PCA) is not installed.

- A maximum of two or minimum of one PCA adapter when ESCON adapter is not installed. If the second PCA is ordered, it will not be used. IBM ESCON and PCA adapters are mutually exclusive.

- Only one of either a 25 MHz 80486SX processor card or a 50 MHz 80486DX processor card or a 66 MHz Pentium processor card is supported. If the 50 MHz 80486DX or the 66 MHz processor cards are not ordered, the 25 MHz 80486SX processor card will be shipped as base 3172 Model 3 hardware from the factory.

- If an FDDI adapter card is used with the 3172 Model 3, the 3172 Model 3 must be installed in 9309-002 rack and in a computer room (Class A Environment).

F.4 Operating Platforms

F.4.1 IBM Interconnect Controller Program

The 3172 Model 3 operates with the IBM Interconnect Controller Program, Version 3.3 (5621-425), which contains the necessary support to control data flow from a given LAN to a channel adapter and/or from a channel to a LAN adapter.

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN interfaces:

MVS/ESA SP JES2 Release 3.1.3 (5685-001)

MVS/ESA SP JES3 Release 3.1.3 (5685-002)

MVS/ESA SP JES2 Release 4.2.0 (5695-047) or later

MVS/ESA SP JES3 Release 4.2.1 (5695-048) or later

VM/ESA Release 1.0 390 Feature, or VM/ESA Release 1.1 ESA Feature (5684-112) or later

Each ESCON or parallel channel-attached IBM host will require one or more of the following programs to support the 3172 Model 3 and workstations attached via the supported LAN interfaces:

IBM ACF/VTAM for Version 3.4 (or later) for MVS/ESA (5685-085), VM/ESA (5684-095), VM/SP (5664-280), and VSE/ESA (5666-00363)

IBM AIX/ESA Version 2 Release 1 (5756-112)

IBM TCP/IP for VM Version 2 Release 2 (5735-FAL)

IBM TCP/IP for MVS Version 2.2.1 (5735-HAL)

OSI/CS Release 1.1 for MVS (5685-014)

OSI/CS Release 1.1 for VM (5684-013)

ACF/VTAM 4.1 for MVS/ESA (5695-117)

Note: IBM AIX/ESA only supports S/390 parallel channel to LANs.

F.4.2 Offload of TCP/IP

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN interfaces:

MVS/ESA SP JES2 Release 3.1.3 (5685-001)

MVS/ESA SP JES3 Release 3.1.3 (5685-002)

MVS/ESA SP JES2 Release 4.2.0 (5695-047) or later

MVS/ESA SP JES3 Release 4.2.1 (5695-048) or later

VM/ESA Release 1.0 390 Feature, or VM/ESA Release 1.1 ESA Feature (5684-112) or later

Each ESCON or parallel channel-attached IBM host will require one or more of the following programs to support the 3172 Model 3 and workstations attached via the supported LAN interfaces for Offload of TCP/IP:

IBM TCP/IP for VM Version 2 Release 2 (5735-FAL)

IBM TCP/IP for MVS Version 2.2.1 (5735-HAL)

To operate the TCP/IP Offload of MVS or VM function, the following must be installed in the 3172 Model 3:

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

Network Transport Services/2 (5871-P01 FN 3787)

TCP/IP Version 2.0 for OS/2 (5875-P01 FN 5547)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

IBM Corrective Service Diskette for TCP/IP for OS/2 IBM Offload feature diskette for MVS and VM TCP/IP

F.4.3 Multiprotocol Networking Software Solution Release 1.0

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN and WAN interfaces.

MVS/ESA SP JES2 Release 3.1.3 (5685-001)

MVS/ESA SP JES3 Release 3.1.3 (5685-002)

MVS/ESA SP JES2 Release 4.2.0 (5695-047) or later

MVS/ESA SP JES3 Release 4.2.1 (5695-048) or later

VM/ESA Release 1.0 390 Feature, or VM/ESA Release 1.1 ESA Feature (5684-112) or later

Each channel-attached IBM host will require one of the following programs to support the 3172 Model 3 and workstations attached via the supported LAN and WAN interfaces for MPE:

IBM TCP/IP for VM Version 2 Release 2 (5735-FAL)

IBM TCP/IP for MVS Version 2.2.1 (5735-HAL)

To operate 3172 Multiprotocol Networking Software Solution Release 1.0 with Offload of TCP/IP for VM, Preloaded Software for VM (F/C 3000) must be ordered with the 3172 Interconnect Controller Model 3 from the factory and the following program products must be ordered for registration purposes along with the 3172 Multiprotocol Networking Software Solution Release 1.0:

TCP/IP Version 2.2 for VM (5735-FAL FN 1000)

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

RouteXpander/2 1.0 (5871-P01 FN 2902)

Network Transport Services/2 (5871-P01 FN 3787)

TCP/IP Version 2.0 for OS/2 (5875-P01 FN 5547)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

To operate 3172 Multiprotocol Networking Software Solution Release 1.0 with Offload of TCP/IP for MVS, Preloaded Software for MVS (FC 3010) must be ordered with the 3172 Interconnect Controller Model 3 from the factory and the following program products must be ordered for registration purposes along with the 3172 Multiprotocol Networking Software Solution Release 1.0:

TCP/IP Version 2.2 for MVS (5735-HAL FN 1001)

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

RouteXpander/2 1.0.1 (5871-P01 FN 7852)

Network Transport Services/2 (5871-P01 FN 3787)

TCP/IP Version 2.0 for OS/2 (5875-P01 FN 5547)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

F.4.4 LAN File Services/Enterprise Systems Architecture (LFS/ESA)

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN and WAN interfaces.

MVS/ESA SP JES2 Release 3.1.3 (5685-001)

MVS/ESA SP JES3 Release 3.1.3 (5685-002)

MVS/ESA SP JES2 Release 4.2.0 (5695-047) or later

MVS/ESA SP JES3 Release 4.2.1 (5695-048) or later

VM/ESA Release 1.0 390 Feature, or VM/ESA Release 1.1 ESA Feature (5684-112) or later

To operate LFS/ESA, one of the following must be installed in the host:

LFS/ESA Release Version 1 Release 1.1 (5648-039) for MVS or later

LFS/ESA Release Version 1 Release 1.1 (5648-039) for VM or later

To operate LFS/ESA, one of the following must be installed in the 3172 Model 3:

OS/2 Version 2.0 (5871-AAA part number 96F8414 or 96F8415) or higher

OS/2 Version J2.0 (5871-AAA part number 61G6203) or higher

To operate LFS/ESA, the following must be installed in the 3172 Model 3:

OS/2 LAN Server Advanced 3.0 (5871-AAA part number 96F8414) or higher

F.4.5 LAN Resource Extension Services/VM (LANRES/VM)

Each ESCON channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN interfaces for LANRES/VM:

VM/ESA Release 1.0 with ESA feature, or VM/ESA Release 1.1 (5684-112) or later

Each parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN interfaces for parallel channel connectivity for LANRES/VM:

VM/ESA Release 1.0 with the 390 or ESA feature, or Release 1.1 (5684-112) or later

VM/SP Release 5 (5664-163), with or without VM/SP HPO Release 5 (5664-173)

VM/XA SP Release 2.1 (5664-038)

VM/SP Release 6 (5664-173), with or without VM/SP HPO Release 6 (5664-173)

To operate LANRES/VM, the following must be installed in the host:

LANRES/VM Release 2.1 (5684-142) or later

To operate LANRES/VM, the following must be installed in the 3172 Model 3:

Novell NetWare Version 3.11 or higher or NetWare Version 3.11 or later from IBM, and any software required by NetWare

F.4.6 LAN Resource Extension Services/MVS (LANRES/MVS)

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN interfaces for LANRES/MVS:

MVS/ESA SP-JES2 Version 4 (5695-047) or later

MVS/ESA SP-JES3 Version 4 (5695-048) or later

MVS/ESA SP-JES2 Version 3.1.3 (5685-001) or later

MVS/ESA SP-JES3 Version 3.1.3 (5685-002) or later

To operate LANRES/MVS, the following must be installed in the host:

LANRES/MVS Release 2.0 (5684-142) or later

To operate LANRES/MVS, the following must be installed in the 3172 Model 3:

Novell NetWare Version 3.11 or higher or NetWare Version 3.11 or later from IBM, and any software required by NetWare

F.4.7 SNA Communications Program Version 1 Release 1

Each ESCON or parallel channel-attached IBM host will require one of the following operating systems to support the 3172 Model 3 and workstations attached via the supported LAN and WAN interfaces.

MVS/ESA SP JES2 Release 3.1.3 (5685-001)

MVS/ESA SP JES3 Release 3.1.3 (5685-002)

MVS/ESA SP JES2 Release 4.2.0 (5695-047) or later

MVS/ESA SP JES3 Release 4.2.1 (5695-048) or later

VM/ESA Release 1.0 390 Feature, or VM/ESA Release 1.1 (5684-112) or later

Each channel-attached IBM host will require one or more of the following programs as desired to support the 3172 Model 3 and workstations attached via the supported LAN and WAN interfaces:

IBM ACF/VTAM for Version 3.4 (or later) for MVS/ESA (5685-085), VM/ESA (5684-095), VM/SP (5664-280), and VSE/ESA (5666-00363)

IBM TCP/IP for VM Version 2 Release 2 (5735-FAL)

IBM TCP/IP for MVS Version 2.2.1 (5735-HAL)

To operate 3172 SNA Communications Program Version 1 Release 1 the following program products must be ordered for registration purposes along with the 3172 SNA Communications Program Version 1 Release 1:

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

Network Transport Services/2 (5871-P01 FN 3787)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

To operate 3172 SNA Communications Program Version 1 Release 1 and Offload of TCP/IP for MVS, Preloaded Software for SNA/Comm and Offload of TCP/IP for MVS (FC 3041) must be ordered with the 3172 Interconnect Controller Model 3 from the factory and the following program products must be ordered for registration purposes along with the 3172 SNA Communications Program Version 1 Release 1:

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

RouteXpander/2 V2.0 (5871-P01 FN 7588)

RouteXpander X.25 Xpander/2 Version 1 (5871-P01 FN 7605) (if X.25 support desired)

Network Transport Services/2 (5871-P01 FN 3787)

TCP/IP Version 2.0 for OS/2 (5875-P01 FN 5547)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

To operate 3172 SNA Communications Program Version 1 Release 1 and Offload of TCP/IP for VM, Preloaded Software for SNA/Comm and Offload of TCP/IP for VM (FC 3040) must be ordered with the 3172 Interconnect Controller Model 3 from the factory and the following program products must be ordered for registration purposes along with the 3172 SNA Communications Program Version 1 Release 1:

IBM OS/2 Version 2.1 (5871-P01 FN 4999)

RouteXpander/2 V2.0 (5871-P01 FN 7588)

RouteXpander X.25 Xpander/2 Version 1 (5871-P01 FN 7605) (if X.25 support desired)

Network Transport Services/2 (5871-P01 FN 3787)

TCP/IP Version 2.0 for OS/2 (5875-P01 FN 5547)

NetView Distribution Manager/2 2.0 Entry (5871-P01 FN 3220)

F.5 3172 Model 3 Characteristics

The following section outlines some of the details that are often useful when planning for a 3172.

Network	Interface	ICP 3.3	TCP/IP Offload	MPE	LFS/LANRES	SNA/Comm
802.3						
FC 2225	AUI	√	√	√	√	√
FC 2225	BNC	√	√	√	√	√
FC 2245	RJ45	√	√	√		√
802.5						
FC 2215	DB9	√	√	√	√	√
FC 2235	RJ45	√	√	√		√
WAN						
FC 2900, 2940	X.21			√		√
FC 2910, 2950	V.35			√		√
FC 2922, 2930	RS-232					√
FC 2920, 2960	RS-422/449			√		√
FDDI						
FC 2300	MIC	√	√	√	√	√
	Mini-BNC					
	ST					

Table 19. Supported Physical Interfaces by Platform

Category	Capacity
Min. Main Storage	8MB
Max. Main Storage	64MB
Min. Disk Storage	80MB
Max. Disk Storage	1GB
Max. LANs	4
Max. Channels	2

Table 20. Relative Capacities of the IBM 3172

Table 21. Physical Characteristics of the IBM 3172	
Measurements	**Dimensions**
Height (inches)	12.0
Width (inches)	19.0
Depth (inches)	19.1
Weight (lbs.)	31

Table 22. Environmental Characteristics of the IBM 3172	
Measurements	**Units**
BTUs per hour	850
KVA Consumption	.6
Power Supply	200-240 V, 50/60Hz, single phase
Min Humidity	8%
Max Humidity	80%
Min Operating Temperature	50 F
Max Operating Temperature	105 F

Note

The Model 3 is mounted in either an IBM or an IBM-equivalent 9309-2 rack. Up to three 3172s may be installed within the same rack. If only one 3172 is placed in a 9309-2, the IBM CE instructions are to install it in the middle slot for balance.

Host Channels: Attachment to host processors is via ESCON channels or PCA. Attachment via the 3044 Model 2 Fiber Optic Channel Extender and the 9034 ES Connection Converter is supported. The 3172 Model 3 attaches to Parallel channels of the IBM 4361, 4381, ES/3090, ES/9021, ES/9121, ES/9221, ES/9390, and to ESCON channels of ES/3090 Models 180J, 200J, 280J and above (ES/3090 J Models must have System EC 227574 or above installed), ES/3090-9000T all models, and ES/9000 processors. Attachment is also supported via the 9034 ESCON Converter.

Parallel channel attachment is supported on the following IBM or IBM PCM processors:

    4361

    9370

    4381

    3090

    ES/9000

Supported Arenas: The 3172 Model 3 is supported in the following arenas and across combinations thereof:

Table 23. 3172 Model 3 Supported Arenas		
LAN Topologies Supported:	**WAN interfaces Supported:**	**Protocols/Environments Supported:**
• Ethernet / IEEE 802.3 CSMA/CD • Ethernet / Version 2 DIX • IBM Token-Ring / IEEE 802.5 • FDDI / ANSI X3T9.5 / ISO 9314	• X.21 • V.35 • RS-232 • RS-422/449	• IBM VTAM for VM and MVS • TCP/IP for VM and MVS • IBM AIX/ESA • OSI/CS for VM and MVS • MVS/ESA, VM/ESA and VSE/ESA

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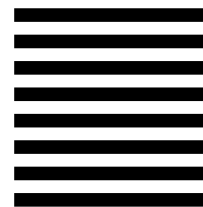Phone No.

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