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PC TOKEN-RING NETWORK AND NETBIOS APPLICATIONS

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PC TOKEN-RING NETWORK
AND NETBIOS APPLICATIONS

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This bulletin describes the NETBIOS interface, which was designed for the IBM
PC Network, but is also provided as one possible interface on the IBM Token-Ring
Network.

The implementation of this NETBIOS interface provides compatibility at the Ap-
plication level between the PC Network and the Token-Ring Network. Major ap-
plications using the NETBIOS interface like PC Network Program, PC Network SNA
3270 Emulation Program and Token-Ring Network/PC Network Interconnect Program
are discussed in this document.

Installation considerations for the Token-Ring environment and sample batch
files are also included.

The bulletin is intended primarily for the Systems Engineer that will help in
the assessment and installation of the products included in this release of the
Token-Ring Network.

Some knowledge is assumed on Local Area Networks, the Token-Ring protocols, and
the IBM Cabling System.

Also, familiarity is assumed with the IBM PC Network Program and the IBM PC
Network SNA 3270 Emulation Program.
WS CSYS   (90 pages)

DOCUMENT PURPOSE AND SCOPE

The purpose of this document is to:

1. Give an overview on the PC Network and the Token-Ring Network, particularly on their programming interfaces.

2. Describe the NETBIOS interface, underlining the differences in its implementation on the PC Network and on the Token-Ring Network.

3. Describe the NETBIOS products in the Token-Ring Network environment. They are:

   • The IBM PC Network Program

   • The IBM PC Network SNA 3270 Emulation Program

   • The IBM Token-Ring Network/PC Network Interconnect Program

4. Describe the major steps required to install and customize the NETBIOS programs on the Token-Ring Network.

5. Comment on the installation and testing experience on these products, including batch files used in the sample configurations. All the tests have been done in the following specific environment:

   PC and PC/XTs

   Preliminary version of the Token-Ring Network PC Adapter

   DOS 3.1

   PC Network Program

   PC Network SNA 3270 Emulation Program

   Preliminary version of the NETBIOS Program

   Preliminary version of the Token-Ring Network/PC Network Interconnect Program

ORGANIZATION

This document is organized as follows:

• The Introduction contains a briefing on PC Network and on the Token-Ring Network.

• Chapter 2 contains a description of the NETBIOS Interface on the Token-Ring Network.

• Chapter 3 describes the PC Network Program and its installation on the Token-Ring Network.

• Chapter 4 describes the PC Network SNA 3270 Emulation Program and its installation on the Token-Ring Network.

- Chapter 5 contains a description of the Token-Ring Network/PC Network Interconnect Program, the activities required to configure it and its Operator Interface.

- Appendix A describes the sample configuration used to test the PC Network Program and the PC Network SNA 3270 Emulation Program on the Token-Ring Network, along with sample batch files.

- Appendix B describes the sample configuration used to test the Token-Ring Network/PC Network Interconnect Program and sample batch files.

- Appendix C is a compendium of manuals and related reference information.

- Appendix D is a compendium of NETBIOS return codes.

- Appendix E is a description of the switch settings in order to configure the Token-Ring Network PC Adapter.

INFORMATION SOURCE AND RELATED DOCUMENTS

Several manuals specifically related to the PC Network and to the Token-Ring Network are mentioned in the applicable sections of this bulletin. A complete list of documents is provided in Appendix C.

1.1   OVERVIEW

On September 1984, IBM announced the interconnection of members of the Personal Computer family using the PC Network and the PC Network Program to provide server capabilities for file, print, and message functions.

The PC Network Program, which utilizes the IBM Personal Computer Disk Operating System (DOS), provides a consistent end-user interface and allows users to share information and resources among Personal Computers, Portable Personal Computers, Personal Computers XT, and Personal Computers AT. Most applications which run under DOS can take advantage of these server functions.

Later, SNA 3270 Emulation services were provided, in order to enable 3270 SDLC Communications to System/370 based applications for Personal Computers attached to the PC Network, using the PC Network 3270 Emulation Program.

IBM also provided a communication interface, Network Basic Input Output System (NETBIOS), for Personal Computer application programs.

At the same time, a Statement of Direction was announced indicating IBM's intent to provide support of the IBM PC Network Program, 3270 Emulation and the NETBIOS interface in other communications environments which include:

*   IBM Cabling System using the token-ring protocol.

*   3270 Personal Computers attached to selected models of the same 3270 Display Controller.

*   IBM Industrial local area network using the token-bus protocol.

Finally, IBM stated his intent to provide interconnection between a token-ring local area network using the IBM Cabling System and the IBM PC Network, as well as between a token-ring local area network using the IBM Cabling System and an IBM Industrial local area network.

1.2   IBM PC NETWORK

PC Network is a product which allows IBM PC's to be attached to a broadband tree structured Local Area Network. The PC attachment card contains support for an Application Program Interface, called the NETBIOS interface, and for the transmission support required to communicate across the network. The product was announced in September 1984 and offered a software product called the PC Network Program which provided general Server and Messenger functions for users of the network.

Another program running on PC Network is IBM PC Network 3270 Emulation Program. This program allows an IBM PC to establish a Host session on an SDLC link and allows other PC's to which it is attached, via a local area network, to establish Host sessions over the same link. Session data for each station on the local area network is channeled through the "Gateway" station. This product was announced for use on the PC Network. It is not, however, limited to the

PC Network. The local area network support is written at the NETBIOS level. Therefore, the local area network support within the product should function on any network with full NETBIOS support.

1.3 IBM TOKEN-RING LOCAL AREA NETWORK

The IBM Cabling System is a general purpose establishment wiring system supporting the attachment of the majority of IBM's information processing equipment. A local area network is supported on this media using a token-ring protocol which is consistent with the standards of the European Computer Manufacturers Associations (ECMA) and the Institute of Electrical and Electronic Engineers (IEEE). As stated in September 1984 Statements of Direction, networks an d establishments utilizing the IBM Cabling System and token-ring protocols can take advantage of the PC Network Program server functions between peer Personal Computers. Also, Personal Computers on a token-ring can access System/370 based applications using a 3270 data stream compatible interface.

This is possible because the NETBIOS interface, used by the previous programs, is provided also on the IBM Token Ring Local Area Network, and this guarantees compatibility with existing applications written for a PC Network environment and using NETBIOS.

1.3.1 IBM TOKEN RING ARCHITECTURAL OVERVIEW

IBM Token Ring Local Area network is actually based on a star wired ring topology.

A Ring is a circular path over which data travels. A station which resides on the circumference of this path receives data sent from its Nearest Active Upstream Neighbor (NAUN), copies the data from the medium to its internal memory if it is the intended recipient and retransmits the the data downstream. Otherwise, just retransmit the received information without copying it.

A Ring differs from a Loop in that a Loop uses centralized control while a Ring uses distributed control in which all active stations are peers. That is, access to the transmission media is not dependent on any type of primary-secondary relationship.

The star wired ring topology incorporates star-like characteristics with ring characteristics. That is, in a star wired ring data flows on a path which is circular, but the devices are interconnected at concentration points (called 'wiring concentrators'), where the access to the network or the bypass of faulty devices is controlled. The wiring concentrators are normally located in the wiring closets, so that the network acquires the shape of a star. The radial cable paths from the physical location of the work stations (called work areas) to the wiring concentrators actually implements two half circuits, using two wire pairs. These radial paths (called lobes) are terminated in the wiring concentrators by means of electromechanical circuitry that permits the control of access to the ring.

Figure 1 on page 3 , (in which "RS" represents a Ring Station) is a schematic representation of a wiring concentrator with four devices attached to it. Note that although the topology is star-like, the actual data path is a ring.
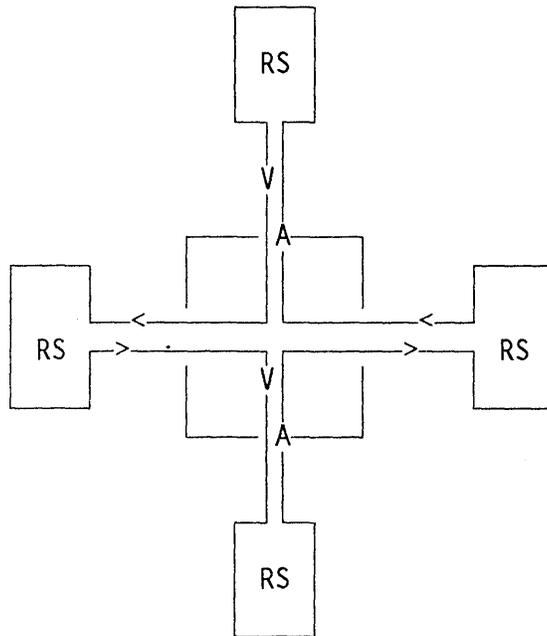
Figure 1.   Star-Wired Ring.

Several concentrators (each with devices attached to them) in the same or dif-
ferent wiring closets can be chained together in such a way that that the re-
sulting information path is still an unidirectional closed circuit, as shown
in Figure 2 on page 4.

In summary, the wiring concentrator provides the following functions in the star
wired ring approach:

*   It controls the terminal's access to the ring.

*   It joins all terminals connected to it in a serial link fashion. Therefore,
    all terminals connected to it are members of a contiguous ring.

*   It allows for movement of terminals. That is, terminals can be removed from
    the ring or inserted into it with no effect on the ring itself.

*   It can be chained together and all terminals attached to any member of the
    chain will be members of the ring.

In Release 2.1 of the IBM Token-Ring Network , the wiring concentrator is called
the 'Multistation Access Unit' (MAU).

Data transmission over the Token-Ring Network is performed using a Baseband
transmission technique, i.e., putting a signal directly on the transmission
media without carrier nor modulation involved.

Baseband transmitted digital signals must be regenerated at maximum predefined
distances according to the characteristics of the physical medium.
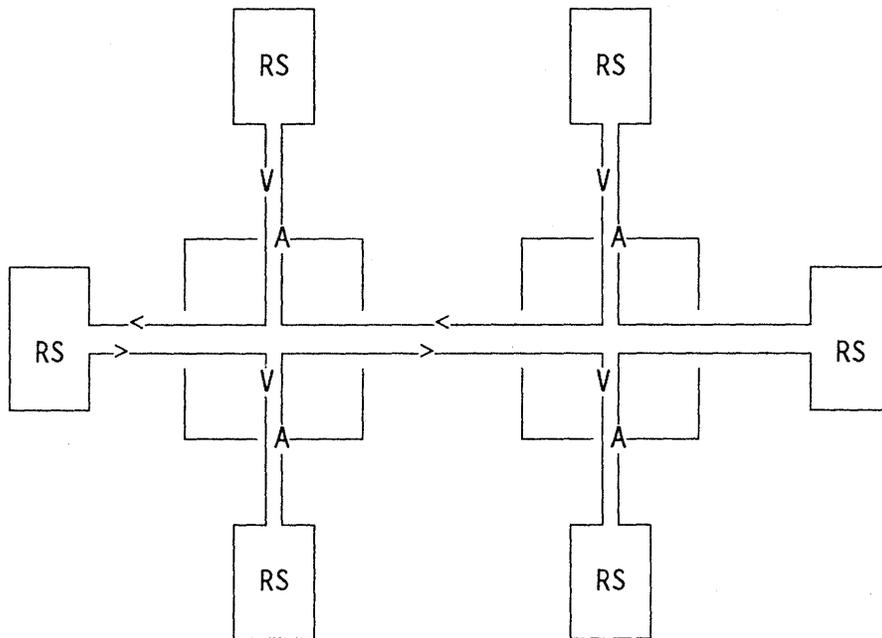
Figure 2. Star-Wired Ring with Two Wiring Concentrators.

The information flows along a single pipe or channel that eventually can be shared allocating time slices for different transmissions (i.e., using a Time Division Multiplexing technique).

Data rates can exceed 100 Megabits/sec, again depending on the physical medium. Currently, the standard IEEE 802.5 call for transmission speeds of 1 or 4 Megabits/sec. The products announced in Release 2.1 of the IBM Token-Ring Network support a 4 Megabits/sec speed.

1.3.2 OPEN SYSTEMS INTERCONNECTION (OSI) REFERENCE MODEL

The International Standards Organization (ISO) has developed a 7 layer model to provide a standard reference for intercommunication of computer systems through a network, by means of the implementation of common protocols.

This Model, depicted in Figure 3 on page 6 , became an International Standard in 1983. Each layer addresses a well defined section of the total architecture. The Layers of the OSI Reference Model are, from top to bottom:

*   Application. This layer gives the user access to all the lower OSI functions. The purpose of this layer is to deal only with the semantic exchanges between applications.

*   Presentation. This layer is concerned with the representation of user data. This includes necessary translations (for instance printer control characters), and code conversion (ASCII, EBCDIC,...).

*   Session. This layer provides the mechanisms for organizing and structuring the interaction between applications and/or devices.

- Transport. Provides transparent and reliable end to end data transfer, relying on lower layer functions for the handling peculiarities of the actual transfer medium.

- Network. The definitions contained in this layer provide the means to establish connections between networks. These standards also include procedures for the operational control of inter-network communications and for the routing of information through multiple networks.

- Data Link. Provides functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the physical layer.

- Physical. Provides the mechanical, electrical, functional and procedural standards to access the physical medium.

1.3.3 THE IEEE 802 PROJECT

In February,1980, The Institute of Electrical and Electronic Engineers Computer Society established a project whose goal was to draft standards for local area networks. Similar to the OSI approach to defining standards, the IEEE project created a reference model with 2 layers which correspond to the lower 2 layers of the OSI model. That is, the Data Link Layer and the Physical Layer. In the IEEE model, however, the Data Link layer is further divided into two sublayers:

- Logical Link Control

- Medium Access Control

Figure 3 on page 6 , shows the relationship between the two standards.

1.3.3.1 LOGICAL LINK CONTROL LAYER

This layer defines procedures for establishing, maintaining and terminating logical links, or sessions, between devices on the local area network. The objective of these control procedures is to provide reliable data transmission from one node to another, i.e., no data should be lost or duplicated. This is commonly called 'Connection Oriented' service. The primary characteristics of links complying with these standards are:

- Sessions are always Peer-to-peer.

- Multiple logical links can be established on one physical link.

- Groups of Logical links are controlled by a higher level entity called a 'Service Access Point' (SAP).

1.3.3.2 MEDIUM ACCESS CONTROL

The Medium Access Control layer is concerned with imposing order on the use of the transport medium so that conflicting transmissions which result in

```
              OSI
              Model

        ┌─────────────────────┐
        │   Application       │
        ├─────────────────────┤
        │   Presentation      │
        ├─────────────────────┤                    IEEE
        │   Session           │                   802 Model
        ├─────────────────────┤
        │   Transport         │
        ├─────────────────────┤
        │   Network           │        ┌──────────────────────────┐
        ├─────────────────────┤   ──>  │  Logical Link Control     │
        │   Data      <────┐  │        ├──────────────────────────┤
        │   Link           └──┼───>    │  Medium Access Control    │
        ├─────────────────────┤        │                          │
        │                     │        │                          │
        │   Physical  <───────┼──────> │  Physical Control         │
        └─────────────────────┘        └──────────────────────────┘
```
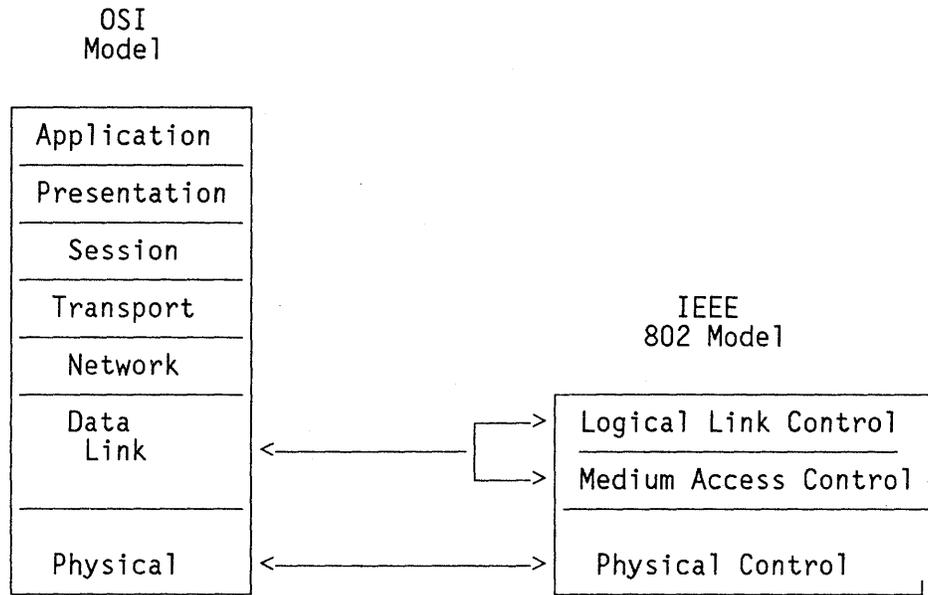
Figure 3. OSI Reference Model and IEEE 802 Local Model Relationship

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unintelligible data do not occur. Because of the various technically sounded
approaches possible for the Local Area Networks, the IEEE project 802 decided
to draft standards for the various possible implementations. Therefore, there
are standards for the following media access control techniques:

• CSMA/CD

• Token Bus

• Token Ring

• Metropolitan Area Network

The commonly used names for these standards is derived from the project's ini-
tial designation of '802'. Hence, we have:

    IEEE 802.1 - Higher level interface standard

    IEEE 802.2 - Logical Link Control standard

    IEEE 802.3 - CSMA/CD standard

    IEEE 802.4 - Token Bus standard

    IEEE 802.5 - Token Ring standard

    IEEE 802.6 - Metropolitan Area Network standard

1.3.4   IEEE 802.5 - THE TOKEN RING STANDARD

The token passing technique for ring access control is based on a pre-defined
bit pattern, called a "token", which continually circles the ring.   When a

station wishes to transmit, it waits until the token is detected. By virtue of receiving the token, the station can begin transmission. The transmitting station changes the token's bit pattern and inserts information, transforming the token into a "frame" that, among other fields, contain destination and origin addresses.

No token is circulating the ring while the frame is being transmitted, so that no other station will attempt to transmit. The frame is received and re-transmitted by all stations on the ring. Only the station for whom the frame is intended will copy the data to its internal memory in addition to re-transmitting it. Ultimately, the frame will be received by the station which sent it. When this occurs, that station will remove the frame from the ring and transmit a new token.

A defined "Monitor" function is charged with the responsibility to check for and recover from error conditions that will affect the functioning of the ring. Conditions such as no free token or frames not removed are detected and corrected by the monitor. The active monitor is not necessarily always the same station on the ring, but one that is "elected" among the active stations. Furthermore, all stations on the ring have the ability to perform these monitor functions. However, only one monitor is active at any given time. All other (non-monitor) stations on the ring are called "standby monitors". If the monitor station fails, one of the standby monitors becomes the active monitor.

1.3.5   ERROR DETECTION AND RECOVERY ON THE TOKEN-RING NETWORK

Soft errors are intermittent faults that temporarily degrade the performance of the Token-Ring Network; they are normally tolerated by error recovery procedures. Soft errors are indicated by architectural inconsistencies, such as CRC's or time-outs, in received or repeated frames.

Hard errors are permanent faults that cause the ring to stop operating within the normal Token Ring protocols.

When a hard failure is detected, the cause of this failure must be isolated in order to restore proper operation of the Token Ring network. The ring station that has detected this hard error transmits a "Beacon" MAC frame with an all-stations address to its ring only, and is therefore called a "beaconing" station. All other stations that receive the Beacon MAC frame enter "Beacon repeat mode".

In that Beacon MAC frame, the address of the Nearest Active Upstream Neighbor (NAUN) is stated. When the beaconing station's NAUN has copied eight of these Beacon MAC frames, the NAUN removes itself from the ring and tests itself. If the test is successful, the NAUN reattaches to the ring, otherwise the NAUN remains unattached.

If the ring does not recover after the NAUN tests itself, the beaconing station removes itself from the ring and tests itself. If the test is successful, the beaconing station reattaches to the ring, otherwise it remains unattached.

If the ring does not recover after both the NAUN and the beaconing station have tested, the error cannot be repaired using automatic recovery; manual intervention is required.

2.1 NETBIOS IMPLEMENTATIONS

On September 1984, when IBM announced the PC Network and its related products, it also provided a software interface, called NETBIOS, in order to allow communication between application programs running on different computer systems in the Network.

This interface, described in the PC Network Technical Reference manual, was designed with the intent to give applications a high-level interface so that they do not have to deal with network protocol details and can instead address only the services required from the network.

The NETBIOS executes the heavy burden of transmission protocol. Specifically, NETBIOS covers level 1 to 5 of the OSI protocol (see Introduction for details), and that means that NETBIOS provides all levels which are Operating System independent.

With use of NETBIOS, station on the network are not known by their physical address, but by their logical name at a Session level. NETBIOS performs session services, i.e., two stations are linked together and may communicate. NETBIOS also provides datagram services, i.e., two stations can exchange messages without having a session.

In the next topics a brief discussion follows on how NETBIOS is implemented on the PC Network and on the Token-Ring Network.

2.1.1 IBM PC NETWORK ADAPTER

The IBM PC Network adapter is the hardware element that has to be installed in a PC in order to have the PC participate in a PC Network. It may be installed in a PC, PC/XT, Portable PC and PC/AT, and occupies one full size slot.

The Network adapter card is made up by several hardware components, each of which carries out a specific function. Refer to the 'PC Network Technical Reference' manual for a complete description of the Adapter. For the scope of this document it is enough to know that PC Network Adapter contains an 8 Kb. ROM, namely NETBIOS, to provide the applications with routines for accessing all network functions.

Therefore in a PC Network, all NETBIOS which runs the network protocol is resident in an 8 Kb. ROM on the PC Network adapter.

2.1.2 IBM TOKEN-RING NETWORK ADAPTER

As with PC Network, an hardware card is required for each PC in order to participate in a token-ring network. The token-ring adapter may be installed, as PC Network, in a PC, PC/XT, Portable PC and PC/AT and requires one full size slot.

The adapter must be customized by setting its DIP switches that control inter-
communications conventions between the adapter and the PC. These switches
define:

- Shared RAM address for exchanging of control blocks between the adapter and
  the PC.

- Interrupt level used by the adapter. Interrupt level 2, 3, 6, 7 may be set,
  although interrupt level 6 SHOULD NOT be selected because it is used by the
  diskette adapter, and the token-ring adapter will not share its interrupt
  level with any other adapter.

- The presence of one or two adapters and their primary/secondary role. Note
  that also one PC Network adapter and one token-ring adapter combination may
  be installed.

See Appendix E for a description of the switch setting.

In order to communicate over a token-ring network, an application program must
conform to one of the several interfaces available. Some of these programming
interfaces provide a high-level communication with the application, while oth-
ers provide a more detailed control of the adapter at a low-level.

Whatever the interface used, there is a set functions provided by the adapter
that are implemented partly by the microcode and hardware of the adapter itself
and partly by the Adapter Support Interface, running in the PC. This Adapter
Support is supplied along with the Adapter Diagnostic diskette and must be
loaded into PC Memory before communicating over the network.

The next section describes the various interfaces available with the token-ring
adapter. For a complete discussion refer to the 'Token-Ring Network PC Adapter
Technical Reference' manual.

As we will see, one of these interfaces is defined as NETBIOS interface. It
should be observed since now that, differently than PC Network, NETBIOS Program
IS NOT RESIDENT in a ROM on the token-ring adapter; instead it has to be loaded
in addition to the Adapter Interface Support and will run in the PC.

2.2   INTERFACES ON THE TOKEN-RING NETWORK ADAPTER

The Adapter Support Interface is supplied in the Adapter Diagnostic diskette
that is packaged along with the PC token-ring Adapter. It must be loaded after
DOS but prior to any communication over the network, since it will perform also
adapter initialization when required.

After the Adapter Support Interface is loaded, two levels of interface are
available on the   token-ring network : the DLC Interface, and the Direct
Interface. The application program can then use the adapter by providing con-
trol blocks in PC memory (called Common Command Blocks, or CCB) and calling the
Adapter Support Interface with an interrupt x'5C' instruction. As an immediate
result of this approach, the application program is freed from the burden of
communicating with the shared RAM on the adapter and from handling interrupts
coming from the adapter itself.

In order to have a high-level interface available for applications on the
token-ring network, a separate program must be purchased and loaded in PC Memory

along with the Adapter Support Interface. In this category of interfaces are the NETBIOS Program and the APPC/PC Program.

Figure 4 on page 12 shows the software levels that are required when using any of the interfaces.

In the next topics a short description of token-ring interfaces other than NETBIOS follows. NETBIOS is then discussed in the following section.

2.2.1 DLC INTERFACE

This level of interface permits an application to use the Logical Link Control (LLC) sublayer of Data Link Control protocol. Much of communication functions are provided by the adapter hardware and the Adapter Support Interface which permit simple application programming using control blocks (CCB) and an interrupt instruction.

Details on use of the DLC interface are described in the 'Token-Ring Network PC Adapter Technical Reference' manual.

2.2.2 DIRECT INTERFACE

The direct interface permits control functions to be performed on the adapter using standard control blocks (CCB) and an interrupt instruction to call the Adapter Support Interface; then it permits transmission of frames over the network.

There are some control functions that can be performed **ONLY** through this level of interface, regardless the actual interface (DLC, NETBIOS) used by the application. Among these functions are:

• Initialize

• Open

• Close

• Get status information

In the case of NETBIOS interface, this means that the NETBIOS program itself has the duty to issue the above commands, using the Direct interface protocol, so that an application can communicate over the adapter using NETBIOS.

Details on use of the Direct interface are described in the 'Token-Ring Network PC Adapter Technical Reference' manual.

2.2.3 APPC/PC INTERFACE

The Advanced Program to Program Communication interface (APPC) offers to application program the capability to communicate over a token-ring network using a LU 6.2 protocol.

```
    |   | High Level
    |   | Interfaces
    |   |
    |   | APPC   |
    V   |        | NETBIOS   | LLC Level
 _____     |           | Interface
|///////|        |           |
|///////|        V           | (DLC)    | MAC Level
|///////|  _____       |          | Interface
|///////| |///////|          |          |
|///////| |///////|          V          | (Direct)
|_____| |_____|                     |
 _____  V          PC
|                                     |____         A
|        Adapter  Support Interface        |        |
|_____|        |
|                                          |        |
|                  D O S                   |        |
|                                          |        V
|_____|     ADAPTER
        HARDWARE INTERFACE
    _____
   |                               |
   |                               |
   |    PC TOKEN-RING  ADAPTER      |
   |                               |
   |_____|
```
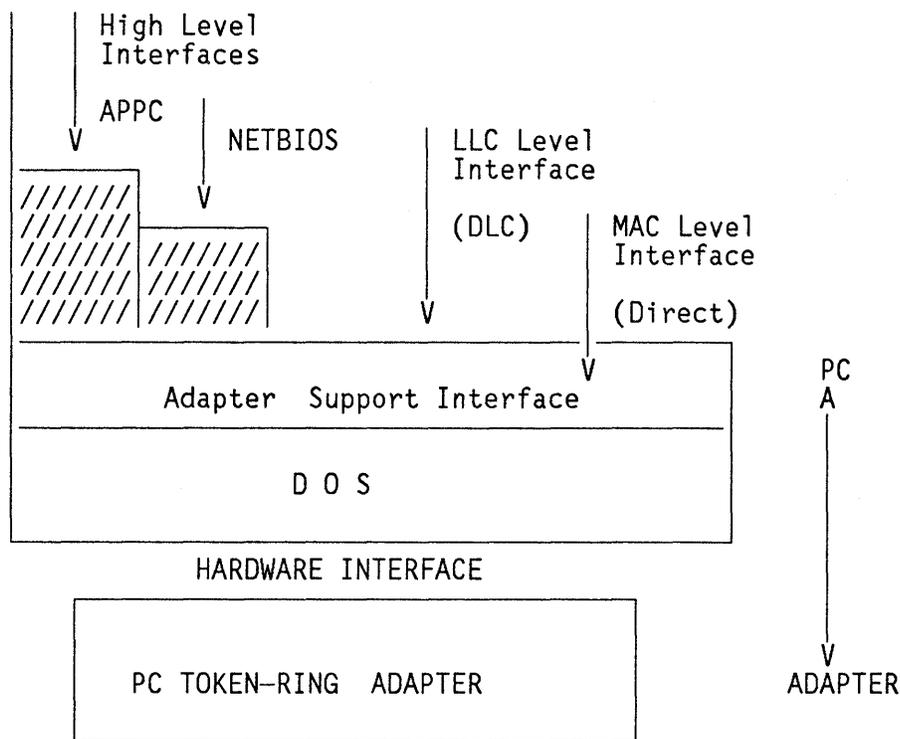
Figure 4. Token-ring Interface Levels

Refer to the 'APPC/PC Programming Guide' for details about this high-level
interface.

2.3 NETBIOS INTERFACE

The NETBIOS interface is implemented on the token-ring network by means of the
NETBIOS Program. All the communication functions from the physical layer to
the session layer are handled by the token-ring network adapter, the NETBIOS
program and the Adapter Support Interface.

Thus the NETBIOS Program is a software interface that provides high level ser-
vices for an application program. Most of the responsibility for operating the
token-ring adapter is assumed by the NETBIOS Program when it is used.

The implementation of NETBIOS for the IBM Token-Ring Network is a superset of
that available for the PC Network. The descriptions which follow will identify
the additional commands which are not available on the PC Network Adapter.
Therefore, from a NETBIOS perspective, any program which runs correctly on a
PC Network will also run correctly on the Token Ring Network. However, the
converse is not necessarily true.

To have access to this interface, you must load the Token Ring adapter handler
and then the NETBIOS Interface Program. The relation to PC DOS and to the user's
application program then looks as shown in Figure 5 on page 13. The program
sizes are rough approximations and are included only to give some perspective.

```
             ┌─────────────────────────┐
             │    User Application     │
             │        Program          │
             │                         │
             │      (INT '5C')         │
             │         │ │             │
             │         V V             │
             ├─────────────────────────┤
      44K    │    NETBIOS Program      │
             │                         │
             ├─────────────────────────┤
             │    Adapter Support      │         ┌──────────────┐
      6K     │      Interface          │  <────> │  Token Ring  │
             │                         │         │   Adapter    │
             ├─────────────────────────┤         └──────────────┘
      40K    │        PC DOS           │
             │                         │
             └─────────────────────────┘
```
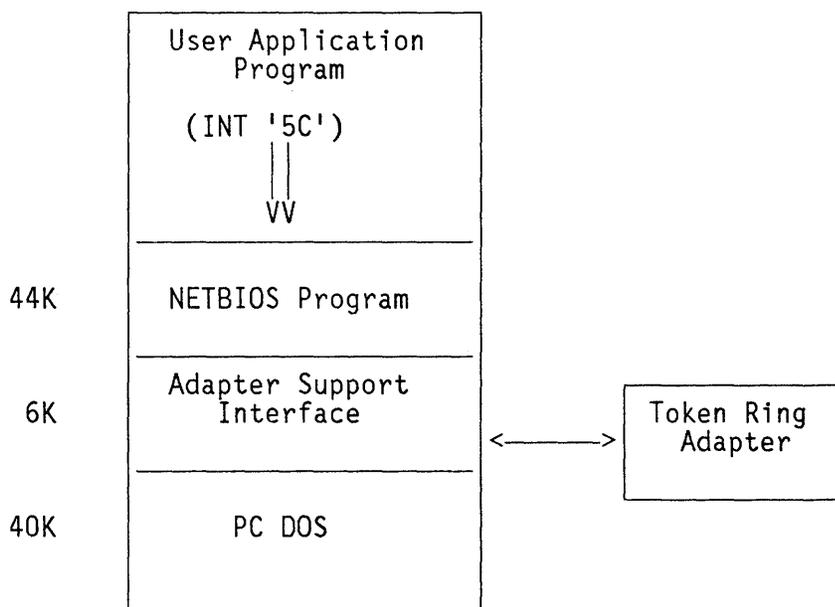
Figure 5. NETBIOS Interface structure

2.3.1 NETBIOS PROGRAMMING

As stated in "Interfaces on the Token-Ring Network Adapter" on page 10, when
using any of the token-ring interfaces (except APPC/PC), a program must assemble
a control block, load some PC registers and issue an interrupt x'5C' instruc-
tion. The control block is called a Common Command Block (CCB) when used for
the Direct or the DLC interface. When the NETBIOS interface is used, the con-
trol block is called a Message Command Block (MCB). This MCB has the same format
and field contents as the Network Control Block (NCB) in PC Network.

Since NETBIOS interface is implemented using Message Command Blocks, it is also
called Message interface. The first field of a Control Block (CCB or MCB) in-
dicates to the Adapter Support Interface which type of interface the application
program wishes to use. If it contains a byte less or equal x'03', then the block
must be a CCB and Direct or DLC interface is being used. Conversely, if it
contains a byte greater than x'03', the NETBIOS interface is being used and the
block is an MCB.

If a command is sent to the adapter through the NETBIOS interface, and the
adapter has not yet been initialized by previous commands, then the NETBIOS
program will provide these functions automatically using default values for
the token-ring adapter parameters (timer values, ring priority, Max. names, Max.
sessions, ...). If these are not acceptable by the application, then it will
have to initialize the adapter by itself using the Direct interface, i.e., is-
suing the commands to:

• Initialize

• Open

the adapter.

The process described above is called "Implicit initialization", and in order to have it performed, the application that issues the NETBIOS command must properly address the adapter number (primary or secondary).

2.3.1.1 COMMAND COMPLETION AND RETURN CODES

There are two methods of becoming aware of command completion:

1. The "Wait" option. When using this option of issuing NETBIOS commands, the user program is put in a wait state until the command has completed. This is not an operating system controlled state. The interface just doesn't return control to the application program until all of its processing is finished. At that time, the user may check the return code found in the control block and direct further processing as appropriate.

2. The "No wait" option. This option is taken when the program wishes to continue execution in parallel with the NETBIOS processing. In this case, return codes are received by the application program at two different times:

    *   Immediately after the command is issued (after the INT X'5C').

        The purpose of this immediate code is to inform the issuing program whether or not the command has actually started. That is, if the interface is busy or the command is invalid, processing will not start.

    *   When all command processing has completed.

        There are two methods by which the user program can obtain this return code. It can request that the adapter interrupt it when processing is complete or it can request that the adapter not interrupt when processing is complete. In the former case, a user appendage must be supplied to handle the interrupt. In the latter case, the user program is responsible for determining when processing is complete. In either case, the final return code is found in the MCB.

The return code values returned by the NETBIOS Program are described in the 'Token-Ring Network PC Adapter Technical Reference' manual. Some of them are standard NETBIOS return codes (same as in the PC Network), while some others are unique for the token-ring network. Specifically:

*   Return code x'00' indicates successful completion of the command.

*   Return codes of x'01' through x'3F' indicates terminations that are described with the commands.

*   Return codes of x'40' through x'4F' indicates user errors that are described with the commands. These error codes are unique for the token-ring network.

*   Return codes of x'50' through x'FE' indicates PC errors or an adapter error and are described with the commands. Also these error codes are unique for the token-ring network.

*   Return code x'FF' indicates that the command has not yet completed.

A compendium of NETBIOS Return Codes is provided in Appendix D.

Also refer to the 'Token-Ring Network PC Adapter Technical Reference' manual for a complete description of MCB format and NETBIOS Interface on the token-ring.

2.3.2 NETBIOS ARCHITECTURE

The NETBIOS interface on the token-ring network consists of five basic services:

- General control services.

- Name support services.

- Session support services.

- Datagram support services.

- Debugging support services.

2.3.2.1 GENERAL CONTROL SERVICES

These services allow the program to request status information, stop operations for a given Name or reset the complete NETBIOS interface.

- Reset - This command terminates all sessions and clears both the session and name tables. Depending on how the adapter has been initialized, the maximum number of sessions and command blocks (names) are set with the values supplied with this command or remain unchanged in respect to their previous value. The last situation, that is not possible on PC Network, can be achieved by initializing the adapter "explicitly" (i.e., with a Direct interface command) and by setting off a Bit Option parameter associated with the Open command.

- Status - This command requests that the general status data stored in the adapter be transferred to the user's program area. The program can request status for any active adapter. The status data is always preceded by the node address of the adapter to which the information applies.

- Cancel - This command requests that a command associated with a given Message Command Block (MCB) be cancelled. Some commands may not be terminated with a 'CANCEL'.

- Unlink - This command is provided only for NETBIOS compatibility. In the PC Network it drops the session for Remote Program Load. Since this feature is not available on the token-ring PC Adapter, the command will be treated by the NETBIOS program as a "no-operation".

2.3.2.2 NAME SUPPORT SERVICES

Communications on the network is done using names. A "Name" is a NETBIOS identifier for a logical entity in which all "session" level communication activity is centered. That is, a Name can request that a session be established

with another Name. Subsequently, information can be exchanged over that session between the two Names. A program may create multiple Names and therefore multiple sessions may exist between two stations on the ring.

The NETBIOS Program maintains a table of names. These names are provided to the NETBIOS Program by the application programs. Each adapter can hold up to 16 selectable names and one permanent node name (burned-in address).

The Name Support services allow the program to manage user assigned Names. Recall that the NETBIOS interface resides in PC memory and therefore these Names are not related to the adapter's Node address.

The Name functions available are:

• Add Name - This command adds a new name to the memory resident Name table. The interface will check with all active stations to insure that the Name is unique.

• Add Group Name - A 'Group Name' is a mechanism for allowing more than one station to have the same Name. Sending a message to a subset of the ring is the type of operation which requires a Group Name.

• Delete Name - Removes a Name from the memory resident Name table. A name will not be removed from the table if it is involved in an active session.

• Find Name - This command is used to determine whether a given Name is known on the ring. When issued, all stations having the given name registered will respond with an indication of how they have the name registered (unique/group) and with their routing information (address).

  This is a new NETBIOS command, i.e., it is not available on the PC Network adapter (remember that implementation of NETBIOS on the token-ring is a superset of NETBIOS on PC Network).

2.3.2.3 SESSION SUPPORT SERVICES

A "Session" is a logical connection between two Names which supports peer to peer communications. The interface maintains statistics on a session basis. A Name can be in simultaneous sessions with more than one remote partner. The available commands are:

• CALL - Call is the method of opening a session with another Name on the ring. The main requirement for a successful call is that the intended session partner has a 'LISTEN' outstanding.

• LISTEN - This command enables a session to be established between the name which issued the LISTEN and any name on the ring which issues a CALL. The object of a LISTEN can be a specific name or any name on the ring.

• HANG UP - This command closes a session between two names. Either session partner may issue the command to end the session. If the target name of the HANG UP is in the process of transmitting when the command is received, the session will not be closed until the operation has completed.

• SEND - This command is used to transmit data between two session partners. The maximum message size is 64K (65,535) bytes. Buffers containing data to be sent may be logically chained together and a CHAIN SEND command used.

In either case, however, the limit of 64K bytes for a single message applies. In order to maintain data integrity, if a SEND command fails, the session is closed.

- RECEIVE - This command receives data sent over a specified session or over any open session. To specify a specific session, a session number is used. To specify any open session, a RECEIVE ANY is used.

- SESSION STATUS - Since a name can have many open sessions, a method of checking on the status of these sessions is desirable. The SESSION STATUS provides this function. The command will return the status of all sessions for a given Name or, optionally, the status of all sessions for all names in the interface Name table. The type of information provided includes both error statistics and current parameter values.

2.3.2.4 DATAGRAM SUPPORT SERVICES

This feature of the NETBIOS interface allows for non-reliable data transmission. That is, when Datagrams are sent, the receiver's adapter does not acknowledge the reception, so the sender and the receiver must agree on their own protocol. This is known as 'connectionless' service and should be contrasted with the 'connection oriented' services offered by the Name support commands. Note also that the message size for Datagrams is limited to 512 bytes.

- SEND DATAGRAM - A user program may send a DATAGRAM to a specific name, to a group name, or to any station which has a RECEIVE BROADCAST DATAGRAM outstanding.

- RECEIVE DATAGRAM - A station must use this command (or the related RECEIVE BROADCAST DATAGRAM) to receive DATAGRAMS.

2.3.2.5 DEBUGGING SUPPORT SERVICES

In the token-ring implementation of NETBIOS there is a new command, TRACE, that permits to activate a trace of all the MCBs issued to NETBIOS by the application program and some of the CCBs issued by NETBIOS to the Adapter Support interface. The "implicit" adapter open function will not operate if this is the first MCB issued to NETBIOS, therefore the adapter must have been opened in some way (implicitly or explicitly) before issuing this command.

The TRACE function is a new NETBIOS function that is not available on PC Network implementation of NETBIOS.

2.4 COEXISTENCE OF SEVERAL ADAPTERS

There may be either one or two token-ring PC adapters installed in a given PC. Further, if there is only one token-ring adapter, then also a PC Network adapter may be present.

2.4.1 TWO TOKEN-RING ADAPTERS

If two token-ring adapters are installed in the PC, then they must be individually addressable. Each NETBIOS MCB issued by the application will have a field (MCB_LANA_NUM) containing the code of the adapter (0 or 1) which the command is addressed to.

In order to properly receive the commands, each adapter must have been installed with its DIP switches set in the correct way. These DIP switches define for each adapter:

• The shared RAM address for exchanging of control blocks between the adapter and the PC. The two adapters **must** have different addresses.

• The interrupt level used by the adapter. The two adapters **must** use different interrupt levels. Interrupt level 2, 3, 6, 7 may be set for each adapter, although interrupt level 6 SHOULD NOT be selected because it is used by the diskette adapter, and the token-ring adapter **will not share** its interrupt level with any other adapter.

• The primary/secondary role. One adapter must be primary and the other must be secondary.

See Appendix E for a description of the switch setting.

2.4.2 ONE TOKEN-RING ADAPTER AND ONE PC NETWORK ADAPTER

This combination of adapters is necessary when one PC is a member of both a PC Network and a token-ring network.

Again, as in the previous case, each of them must be individually addressable. The NETBIOS MCB issued by the application will have a field (MCB_LANA_NUM) containing the code of the adapter (0 or 1) which the command is addresses to.

The token-ring adapter must have been installed with its DIP switches set in the correct way to avoid conflicts with the PC Network and other adapters.

As in the previous case, these switches define:

• The shared RAM address for exchanging of control blocks between the adapter and the PC.

• The interrupt level used by the adapter. Again, the two adapters **must** use different interrupt levels.

• The primary/secondary role.

See Appendix E for a description of the switch setting.

The sharing of the x'5C' interrupt vector between the PC Network Adapter and the NETBIOS program for the token-ring is handled by the Adapter Support Interface. When the Adapter Support Interface is loaded by DOS, it checks the X'5C' interrupt vector for a non-zero condition. If a non-zero value is found, the assumption is made that also a PC Network adapter is installed. The following steps are taken:

1. The address at the X'5C' location is saved. It will be used to route future requests to the PC Network adapter.

2. The Physical address of the PC Network card is checked to determine if it is jumpered as a primary or secondary adapter. This setting is also saved.

Whether or not a PC Network adapter is installed, the Adapter Support Interface sets the X'5C' vector to itself so that it receives control when this interrupt is issued by a user program.

When a user program issues the X'5C' interrupt, the adapter will examine the control block that is passed with the interrupt. If it is a NETBIOS call and if it is for the PC Network adapter, it uses the stored interrupt address to pass the interrupt to the NETBIOS microcode on the PC Network adapter. If it is a NETBIOS call and it is for the Token Ring adapter, it will pass control to the Token Ring NETBIOS interface module which is resident in memory.

If the command in the control block is a DLC or Direct command, the handler will move the block to the shared RAM area so that the contents are available for the adapter microcode.

Finally, the handler will issue an interrupt to start the process handling of the requested function within the adapter.

2.5 INSTALLATION OF NETBIOS ON THE TOKEN-RING NETWORK

In order to use the NETBIOS interface on the token-ring Network, all the PCs that will be part of the network must perform the following steps:

1. Load in PC memory the Adapter Support Interface. This module, called TOKREUI.COM is supplied with the Adapter diagnostics diskette.

2. Load in PC memory the NETBIOS Program. This program, that must be purchased separately, is called NETBEUI.COM .

These two steps may also be performed together, for instance including in a batch file the sequence of commands:

        TOKREUI

        NETBEUI

See the batch files reported in the Appendixes for examples of how to include these commands in AUTOEXECs files.

Also notice that both the Adapter Support Interface and the NETBIOS program are resident in PC memory, with a consequent usage of about 50 Kb. , as shown in Figure 5 on page 13. This must be considered in the memory requirements for applications that were written for the PC Network and that are migrated to a token-ring network.

2.6 RAS CONSIDERATIONS

One of the most significant features of the token-ring network is its Reliability, Availability and Serviceability (RAS) capability. These characteristics are strictly related to the ring architecture and the token-passing protocol.

Since the NETBIOS program uses the native interfaces of the adapter, then all NETBIOS applications will benefit from the RAS capabilities of the network.

2.6.1 TOKEN-RING ADAPTER DIAGNOSTICS

When the PC is powered on or reset, an adapter self test is executed immediately. This test executes in a stand-alone environment, and verifies the adapter's capability to properly detect all errors in received frames.

Then, prior to the ring insertion process (the OPEN adapter process), a lobe test is performed to insure integrity of the lobe. If the test is successful, the OPEN command completes and the PC may communicate over the network.

2.6.2 THE RING DIAGNOSTIC PROGRAM

This program has three major functions:

*   Initialize and Open an adapter which is attached to the MAU.

*   Test the adapter's ability to function on the ring.

*   Monitor the ring for error reports and display, and optionally print them.

The program is designed to be used both at installation time for testing a new or repaired adapter and as a continually running ring monitor. In the last case, it will receive all the status changes and errors reported by all the adapters and display them in the form of brief messages.

The Ring Diagnostic program does not operate in background, therefore a station on the ring must be dedicated for this purpose, if required.

Refer to the 'Token-Ring Network Problem Determination Guide' for further information on how to use this program.

2.7 PERFORMANCE CONSIDERATIONS

From a performance point of view some testing has been done, and it has been found out that there is almost no difference in the times required to perform the same functions on a PC Network and on a token-ring network in applications that use the NETBIOS interface.

Indeed, performances on a PC or PC/XT on the Token-Ring are very close to those on a PC Network, while on a PC/AT the Token-Ring network is faster than the PC Network (because the NETBIOS program in the PC/AT executes on a 80286).

The only difference that has been registered is in the initialization process of the adapter, i.e., the token-ring network takes some more time to initialize than the PC Network. This could be explained if you consider the initial intensive adapter and ring testing that is performed in order to insure a high level of RAS capability in the network (see the RAS Considerations).

Generally speaking, performances are not usually limited by the performance of the adapters or the network itself, but rather by the performance of the Servers (mainly I/O activities, disk accesses). This consideration applies both to the Token-Ring Network and to the PC Network.

Additional performance considerations on the token-ring network and PC Network are discussed in the following sections of this bulletin. The configuration used during our tests consisted of PC and PC/XTs.

The IBM PC Network program enables multiple IBM personal computers to be used in a local area network configuration. The PC Network program supports the interconnection of Personal Computers (PC, PC/XT, Portable PC and PC/AT).

In the PC Network environment, each PC requires a PC Network adapter in order to communicate over the network. However, as a NETBIOS application, the PC Network Program is compatible with a token-ring network and then can be run on it, provided that each PC participating to the network has installed and properly configured the Token-ring network PC adapter.

The purpose of this chapter is to describe how the PC Network program is suitable to work on the token-ring network and what considerations should be taken compared to the PC Network environment.

Refer to the 'PC Network Program User's Guide' for a complete description of the PC Network Program.

3.1 OVERVIEW AND MEMORY REQUIREMENTS

The PC Network Program provides a range of configurations for users who need different levels of function. It also provides three levels of interface to these functions:

• A full-screen menu oriented interface.

• A DOS command line interface.

• An application program interface.

The software required is DOS 3.1 or later releases.

The PC Network program resides in each Personal Computer on the network and can be configured in four different ways:

• Server

    A server can share its own devices such as disks or printers with other PCs. Servers must have a fixed disk (even if they are used for printer sharing only) and at least 384 KB of random access memory (RAM) if they use the menus.

    NOTE: This RAM value is larger than the one required for the PC Network because it must include also the Adapter Support Interface for the token-ring network and the NETBIOS Program.

    A PC equipped with 384 KB of RAM has very little memory left for applications (about 80 Kb.) or for the menu interface. Server PCs, which are not to be dedicated to the server function, should therefore have 448 KB at least.

- Messenger

  A messenger is allowed to do all but one of the server's capabilities: It
  can't share its resources among other network users. To be a messenger on
  the token-ring network and using menus, requires at least 320 KB of RAM.
  About 85 Kb. of RAM are left for application (or for the menu interface)
  in a 320 Kb. PC after the messenger's functions are installed.

- Receiver

  A receiver lacks the RESIDENT full screen interface to message functions
  that the server or messenger has, but it shares the ability to route mes-
  sages to the screen, a printer or a file while an application is running
  ('Message Logging Facility'). Around 60 KB of processor's memory is
  available after the receiver has been installed in an 192 KB PC.

- Redirector

  The only function a redirector has is to share a servers disks and/or
  printers and to send messages. Around 64 KB of main memory is available
  for applications after the redirector is installed in an 192 KB PC.

  Again note that the minimum RAM required is larger than for the PC Network.
  For instance, if you try to run the menus in a Redirector with only 128 Kb.
  (and you can do it on a PC Network), you will get the message:

        NET202: Not enough storage to use menus

Figure 6 on page 25 summarizes the abilities and memory requirements of the
various network configurations in a token-ring network. Note that we used a
preliminary version of the NETBIOS program, and these memory sizes may be dif-
ferent in the shipped version. They are included as an indication of rough size
only, and should not be used for detailed planning.

3.2 TOKEN-RING ADAPTER HARDWARE REQUIREMENTS

In order to run the PC Network Program on the token-ring network, you must have
previously installed the token-ring PC adapter.

The adapter must have been configured as PRIMARY, because when the PC Network
Program issues the first NETBIOS command, it sets the MCB_LANA_NUM field to 0
and then the NETBIOS program "implicitly" initializes it.

If the adapter has not been so defined, you will get an error message

        NET041: Network adapter card not installed or not functioning

The interrupt level on the token-ring adapter may be set to 2, 3 or 7.

See Appendix E for a description of how to configure the adapter.

Configuration	Memory Required	Available Tasks
Redirector	114 Kb	Use shared network devices Send messages
Receiver	120 Kb	Redirector's tasks plus : Log messages to file or printer Receive messages

Messenger	236 Kb	Receiver's tasks plus :
		Receive messages on behalf of
		    another PC
		Allow another PC (Messenger or Server)
		    to receive own messages
		Use the Network Request Key
		    (Ctrl-Alt-Break)

Server	304 Kb	Messenger's tasks plus : Share own devices (disks and printers) with other PC's

Figure 6. PC Network Program Configurations: Memory requirements are in-
clusive of DOS 3.1, NETBIOS Program, and Adapter Support Inter-
face. However they do not include the storage required to run
the menus.

3.3 INSTALLATION OF THE PC NETWORK PROGRAM

The PC Network program is installed on a token-ring network in the same way it
is installed on the PC Network. Refer to the 'PC Network Program User's Guide'
for a complete description of the installation process.

In this chapter we point out the differences to consider in order to install
the PC Network Program on servers and remote users (Redirectors, Messengers)
in a token-ring network. A sample configuration of a token-ring network is
included, and sample batch files for this configuration are included in Appendix
A.

3.3.1 INSTALLING THE TOKEN-RING SUPPORT

The first step to perform on a token-ring network is to install the appropriate
support for NETBIOS. In order to do that you should copy the files from the
original diskettes to the hard disk or diskette:

* PC with hard disk

    Format the hard disk with DOS 3.1

        A>FORMAT C:/S

Copy the Adapter Support Interface from the token-ring adapter diagnostic diskette to the hard disk

        A>COPY A:TOKREUI.COM C:

Then copy the NETBIOS Program from the diskette that contains it to the hard disk

        A>COPY A:NETBEUI.COM C:

• PC without hard disk

    Since the NETBIOS support for the token-ring network requires about 50 Kb.
    of diskette storage to contain it, it will not fit on the same diskette used
    to install the PC Network Program and DOS. Then, supposing that PC Network
    program will be run from drive A:, NETBIOS support should be installed on
    a separate diskette, previously formatted, by means of the following
    commands:

        A>COPY A:TOKREUI.COM B:
        A>COPY A:NETBEUI.COM B:

    assuming that TOKREUI.COM and NETBEUI.COM have been copied from their re-
    spective diskettes (with manual swap of diskettes). Also, a two-diskette
    drives PC was supposed to be available.

    The diskette which these two files are copied to may have been formatted
    without DOS on it, supposing that DOS has been installed on the diskette
    that contains the PC Network program (IPL'able diskette).

3.3.2 INSTALLING AND CONFIGURING THE SERVER

Figure 7 on page 27 shows the sample configuration that has been used to install
and test PC Network program on the token-ring network.

Installation of the PC Network program on the Server (LANSERV) can be performed
using the Network Installation Aid (NIA). This aid is used in the same way
as on the PC Network, so refer to the 'PC Network Program User's Guide' for
details.

The Network Installation Aid defines a specific directory structure. It also
prints information for each remote user so they know how to access their disks
and applications.

The steps to install a server using NIA are:

1. Load Network Installation Aid and select "Install your IBM applications".
    You will see the "Installing applications" menu.

2. Select 'DOS' installation, providing a name for the server (LANSERV in our
    example), a drive specifier for remote users to access applications ('K'
    in our example) and insert DOS diskette in drive A:.

3. After DOS has been installed, select installation of "PC Network Program".

```
        ┌─────────────────┐              ┌──────────────┐
        │    LANSERV      │──────────────│   NETPRT1    │
        │(Disk & Print Srv.)│            │  (Printer)   │
        └─────────────────┘              └──────────────┘
                 │
┌──────────────┐ │  ┌─────────────┐
│    GRACE     │────│   M.A.U.    │
│ (Redirector) │────│             │
└──────────────┘    └─────────────┘
                           │
                    ┌─────────────┐
                    │   ALBERT    │
                    │ (Messenger) │
                    └─────────────┘
                           │
                      ┌─────────┐
                      │ Printer │
                      └─────────┘
```
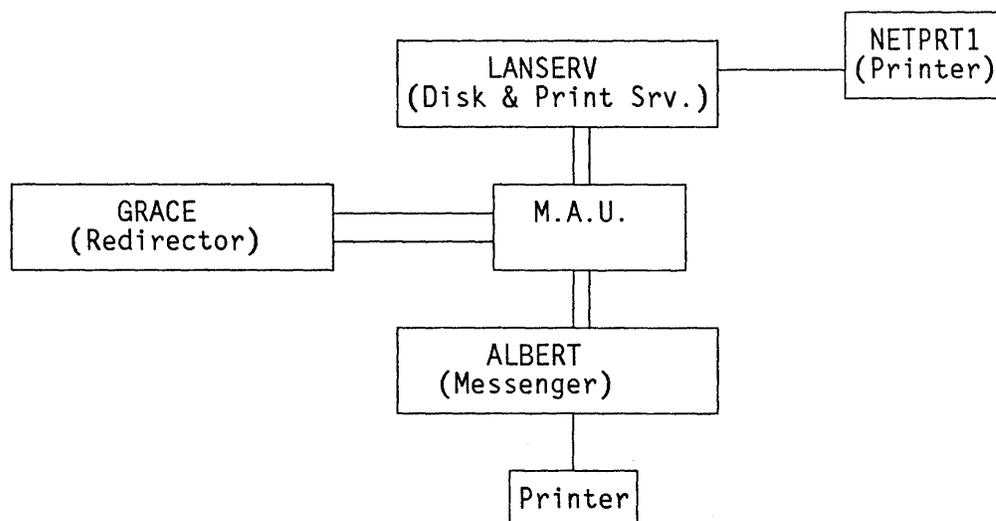
Figure 7. Sample PC Network Configuration

---

4. After 'PC Network Program' has been installed, select installation of all applications you want to install (not all IBM applications are supported by NIA).

5. Go back to Main Menu and select "Name the network users who can use your application". Enter the names of users who will have access access to your applications. Also each of them will have a private directory created on the server (in our example ALBERT and GRACE).

6. Select "Display information about installed applications" and print it. It will show where each program is installed and how to start it.

7. Select "Display how network users can use your applications" and print it.

NIA creates also an AUTOEXEC.BAT file with a PATH to all directories to be accessed by the server, and a CONFIG.SYS file in the root directory. If this file already exists, NIA creates a CONFIG.NIA file, and you have to manually merge them so that the Network program can be correctly initialized when you start the network.

After the Network program has been installed by NIA, it should be configured and this configuration must be saved:

1. Load the token-ring and NETBIOS support

        C>TOKREUI
        C>NETBEUI

2. Make NETWORK be the current directory

        C>CD NETWORK

3. Run the PC Network Program with the menus

        C>NET

4. Select the tasks that allow you to share your devices. Share the APPS directory giving a network name of your choice, the private directories (ALBERT, GRACE), and the network printers. In our example, LPT1 is shared with a network name of NETPRT1.

5. Save this configuration.

When the configuration is saved, the Network Program creates an AUTOEXEC.BAT file with the commands required to start the network, so that you can automatically start it when you power on the PC. The previous AUTOEXEC.BAT file is renamed AUTOUSER.BAT and a AUTOUSER line in inserted as the last line in AUTOEXEC to concatenate it.

YOU MUST EDIT the AUTOEXEC.BAT file created by the Network Program in order to include the token-ring and NETBIOS support. This can be done with any editor, for instance EDLIN. Two lines must be included,

1. TOKREUI

2. NETBEUI

You must include these two lines in the user area of the AUTOEXEC file, i.e., between the first two lines delimited by

    : *** Network Batch File ***

    : ***

because the next time you save the PC Network Program configuration, only this area will not be overwritten.

3.3.3 INSTALLING AND CONFIGURING THE REMOTE USERS

The installation of PC Network program on a remote user's fixed disk or diskette is done by means of INSTALL.BAT on the PC Network Program diskette.

INSTALL.BAT creates

*   A CONFIG.SYS file with the line 'LASTDRIVE=N' (or appends to it if the file already exists), in order to make the shared directories on the server accessible.

*   A subdirectory NETWORK, which contains the PC Network Program (on the main directory if there is no hard disk).

After the Network program has been installed, it should be configured and this configuration must be saved. Again, as with the server, the following steps can be performed:

1. Load the token-ring and NETBIOS support from the disk or the diskette where it has been installed.

              C>TOKREUI
              C>NETBEUI

2. Make NETWORK be the current directory (if a hard disk is present).

```
                   C>CD NETWORK
```

3. Run the PC Network Program with the menus.

```
                   C>NET
```

4. Select the tasks that allow you to use the shared devices. "Use" the APPS
    directory giving the network name assigned by the server, your private di-
    rectory (ALBERT or GRACE), and the network printers.

    NOTE: The server must start before you do this task, otherwise you will not
    be able to "Use" the network devices.

5. Save this configuration.

Again, the Network Program creates an AUTOEXEC.BAT file with the commands re-
quired to start the network; the previous AUTOEXEC.BAT file is renamed
AUTOUSER.BAT.

YOU MUST EDIT the AUTOEXEC.BAT file created by the Network Program in order
to include the token-ring and NETBIOS support. Again, two lines must be in-
cluded,

```
             TOKREUI
             NETBEUI
```

IN THE USER AREA of the AUTOEXEC.BAT file. Then the next time you save the PC
Network Program configuration they will not be deleted.

In a PC configuration with no hard disk, these two lines may be instead

```
             B:TOKREUI
             B:NETBEUI
```

assuming a PC with two diskette drives and that both commands are on the
diskette in drive B:

Finally, you have to include a PATH and an APPEND command in the AUTOUSER file
so you can access the server's disk. See an example in Appendix A.

3.4 USING PC NETWORK PROGRAM

The PC Network Program provides a number of tasks to be performed. Basically
they are:

•   Message tasks

•   Printer tasks

•   Directory tasks

•   Network status tasks

•   Pause and continue tasks

•   Save or cancel the network setup

All these tasks may be started by the menus or by NET commands as well.

They have been run on a token-ring network and no difference has been found in their behavior compared with PC Network.

3.4.1 MESSAGE TASKS

These tasks allow one to:

- Send a message to another network name.

- Broadcast a message to all network computers
  (the message is sent once for each computer, not for each name).

- Receive a message from another network computer (except for a Redirector).

- Save received messages in a file.

- Receive messages for another network name (up to the number of alternate names defined in NET START command).

- Forward messages to another computer.

No difference has been found in the way these tasks work compared to PC Network.

3.4.2 PRINTER TASKS

These tasks allow one to:

- Share a printer over the network and stop sharing it (servers only).

- Use a shared network printer.

- Print a file on a shared printer.

- Change the print size on a shared printer (80 or 132 char/line).

- Print separator pages.

No difference has been found with respect to PC Network.

3.4.3 DIRECTORY TASKS

These tasks allow one to

- Share a disk or directory and stop sharing it (servers only).

- Use a shared disk or directory and stop using it.

No difference has been found with respect to PC Network.

Also, a rough comparison has been done while copying files from a server to a redirector. The time required is the same in PC Network and in token-ring network environments, varying from about 2 sec. for transfer of small files (200-300 bytes) up to 4-5 sec. for larger files (50,000 bytes). This leads us to say that the NETBIOS program on the token-ring does not have any impact on performance, that is related, instead, to the I/O operations on the disks.

3.4.4 NETWORK STATUS TASKS

These tasks allow one to:

- Check and change a print queue.

- Display the network devices shared (servers only).

- Display the network devices being in use.

- Display the names that can receive messages (except redirectors).

All the functions perform the same way with respect to PC Network.

3.4.5 PAUSE AND CONTINUE TASKS

These tasks allow one to pause and continue:

- Sharing the network devices (servers only).

- Using the network devices.

- Receiving messages (except redirectors).

- Printing files on a shared printer (servers only).

Again, no difference has been found compared to PC Network.

3.4.6 SAVE OR CANCEL THE NETWORK SETUP

These tasks allow one to save the current setup of the PC Network program. This is the way that the PC Network configuration is saved the first time after installation (see "Installation of the PC Network Program" on page 25).

3.5 PERFORMANCE CONSIDERATIONS

As stated before, very few differences have been noted from a performance point of view between PC Network and token-ring network.

The main difference is in the initialization time required to bring up the network. On the PC Network it requires about 15 seconds to execute the first NET command, that is the one which initializes the adapter.

Differently, on the token-ring network it requires much more time, about 60 seconds, and this can be explained if we consider that when the first NET command is issued, the NETBIOS program initializes the token-ring adapter, and this process is much more complex than in the PC Network. Also a lot of connecting tests are performed on the ring in order to insure that the network will work correctly.

However, the time required to perform any network function (send messages, copy or print files) does not differ from that on the PC Network, as was observed in the previous section.

3.6 RAS CONSIDERATIONS

Some scenarios have been tested in order to see what are the differences from PC Network when some critical situation is registered. Also, on the token-ring network, a Ring Diagnostic Program is available to monitor the status of the network. This problem determination tool can give to the operator the address of 2 contiguous stations in case of error.

3.6.1 POWERING OFF A PC

If a PC suffers an undesired power off situation (due, for instance to a drop in current), two cases are possible:

1. The PC is a Server

   When it is powered on and shares its devices again, also the remote users (Redirectors, messengers) will have to restart the Network Program in order to "use" these devices.

2. The PC is a remote user

   Only the remote user must be restarted to "use" the network devices.

This behavior is common to the PC Network and the token-ring network. But, if you run the Ring Diagnostic Program to monitor this situation, you may see (by enabling the full error report function) that each time a PC is powered off and then on, you get the message:

    DFIPD106I Ring error report

and that means that a soft error has been reported and recovered from. However this is a very normal situation, because when a PC inserts itself on the ring, there is a DC signal that is sent by the adapter to act on the relay that physically connects the token-ring cable to the MAU port. This DC signal disrupts the circulation of the token on the network, thus generating a soft error that is recovered by the active monitor by retransmitting a new token.

3.6.2 PHYSICAL DISCONNECTION OF A PC FROM THE MAU

If the token-ring cable between a station and the MAU is physically detached from the MAU, the Ring Diagnostic Program will report a soft error situation, if the token was flowing into the "disconnected" PC at that time.

The PC Network Program "feels" that it can no longer communicate over the network and, at the next NET command you get the message:

    NET807: Network adapter hardware error

Even if you reconnect the cable you cannot recover from this situation; you must restart the Network Program (and if a server, also all remote users must restart their own).

3.6.3 NETWORK WITH MULTIPLE MAU'S AND WITHOUT BACKUP RING

As shown in the Introduction (see Figure 2 on page 4), multiple MAU's may be chained together to allow more stations to be part of a token-ring network. This is possible by connecting the "Ring-out" port of a MAU to the "Ring-in" port of the next MAU.

Running the PC Network program, if the cable connecting two MAU's is detached, you will have two sub-networks that can still work in their "domains", even if, obviously, the whole network is no more available. After manual recovery, the remote users in the other domain than the server must be restarted to "use" the shared network devices.

3.6.4 NETWORK WITH BACKUP RING

If you have a Network with multiple MAU's, the "Ring-out" port of the first MAU and the "Ring-in" port of the last MAU may be connected. This will implement a backup ring, so that, for instance, if a connector in a MAU's connecting cable fails, the backup ring will be automatically activated.

Backup is automatic in most cases, but not always. For instance, if a cable connecting two MAU's is physically broken (i.e., the malfunction is not on the connector to the MAU but on the cable itself), there will be no automatic recovery. In this case manual intervention is required.

Running the PC Network program, we experimented that if a cable between two MAU's is detached, all the servers and network users will continue to work as before, and even the Ring Diagnostic Program will not report any error. Indeed, an automatic hardware recovery has occurred.

4.0 PC NETWORK SNA 3270 EMULATION PROGRAM ON THE TOKEN-RING NETWORK

The IBM PC Network SNA 3270 Emulation Program (from now on called PCN 3270) is a communication program that enables an IBM personal computer to emulate some of the functions of the 3270 terminals and the 3287 printers. The program also enables a PC to emulate some of the functions of a 3274 Control Unit, thereby providing a communication gateway between the Host and other PC's that are connected via a local area network.

The PC, PC/XT, PC/AT and Portable PC are supported by PCN 3270.

PCN 3270 was announced for the PC Network. However, as a NETBIOS application, it is compatible with the token-ring network. The purpose of this chapter is to describe how PCN 3270 can work on the token-ring network and what considerations should be done compared to PC Network.

4.1 OVERVIEW AND MEMORY REQUIREMENTS

The IBM PC Network SNA 3270 Emulation Program (P/N 6322526) can be configured in 4 ways:

*   STAND-ALONE

    A Stand-alone remote station emulating a 3274 with a 3278/9 and 3287 attached. It is not part of the token-ring network and we will not discuss it anymore.

*   COMMUNICATIONS GATEWAY

    A PC emulating a 3274 and providing 'Gateway' functions to other PC's connected to the network.

*   NETWORK STATION

    A Network Station emulates a 3278 (or a 3279) and a 3287 attached to the Network and using another 'Gateway' PC to connect to the host.

*   COMBINED COMMUNICATION GATEWAY AND NETWORK STATION

    This configuration enables a PC to serve as both the 'Gateway' and an individual Network Station.

At setup time you give PCN 3270 certain information that correspond to the configuration you select.

There may be more than one Gateway on the Network and each is capable of configuring 32 SNA sessions. A network station can have a maximum of 1 display session and 1 printer session and can only be attached to 1 Gateway at a time. If multiple Gateways attempt to send data to the same Network station, unpredictable results may occur.

A DOS Alternate Task mode can be used via a 'hot key'. Well behaved DOS applications can be run in this alternate task without ending the 3270 task.

PCN 3270 runs directly at the NETBIOS interface and then can be used on the token-ring network **IN THE SAME WAY** as on PC Network.

NETBIOS functions include bringing up a session between the gateway and a network station, maintaining the session, terminating it and recovering the session. PCN 3270 uses the following NETBIOS commands:

* General commands

    Reset (used only if the adapter status indicates that it is not already in use by another application)

    Cancel

    Adapter status

* Name support commands

    Add Name

    Delete Name

* Session support commands

    Call (gateway only)

    Listen (network station only)

    Hang-up

    Send

    Receive (network station only)

    Receive any (gateway only)

All the configurations require DOS 2.1 as a minimum release (PC AT requires DOS 3.0). If also the PC Network Program is run, DOS 3.1 is required.

  NOTE:Only the Redirector/Network Station combination is supported.

Memory requirements on the token-ring network are larger than on PC Network, since you have to load RESIDENT the Adapter Support Interface and the NETBIOS program. Figure 8 on page 37 summarizes the memory requirements of the various configurations on a token-ring network, including 50 Kb. for the NETBIOS support. Note that we used a preliminary version of the NETBIOS program, and these memory sizes may be different in the shipped version. If an application is required to run as an Alternate task, you should also add the memory required by this application.

The PCN 3270 maximum sizes include:

* File Transfer Support (15000 bytes)

* Dir key support (5500 bytes)

* Print support (11000 bytes)

* Alternate task support (7000 bytes)

	PCN 3270		DOS & T-R	PC Network Redirect.	SDLC Card
	Min.	Max.			
Network Station	156	194	284	310	N
Gateway − 8 Sessions	193	206	296	N/A	Y
− 16 Sessions	224	236	326	N/A	
− 24 Sessions	255	267	357	N/A	
− 32 Sessions	285	298	388	N/A	
G/way + N/S − 8 Sessions	222	260	350	N/A	Y
− 16 Sessions	253	291	381	N/A	
− 24 Sessions	284	322	412	N/A	
− 32 Sessions	314	352	442	N/A	

Figure 8. PC Network 3270 Requirements: These memory sizes are expressed in thousand bytes ('000s not K). The DOS & T-R figure is the sum of the maximum support for PCN 3270 plus 90000 bytes for DOS 3.1 and NETBIOS support. The Redirector figure also presumes all PCN 3270 functions available. (N/A = Not Applicable)

4.2 TOKEN-RING ADAPTER HARDWARE REQUIREMENTS

Depending on the configuration of PCN 3270, you must install the necessary adapters in the PC.

• Gateway (w or w/o N/S)

You must install the SDLC Adapter (P/N 1502090 or P/N 1501205; the latest one is required for PC/AT). It will use interrupt levels 3 and 4.

Also you must install a token-ring adapter, configured as PRIMARY and with INTERRUPT LEVEL 2.

• Network Station

You must install only a token-ring adapter, configured as PRIMARY and with INTERRUPT LEVEL 2 OR 3.

In either case the token-ring adapter must be configured as primary, because when PCN 3270 issues the NETBIOS commands to the adapter, it sets the MCB_LANA_NUM field to 0. This is true for the initialization process ("implicitly" performed by the NETBIOS program if the adapter is not already in use) and for the execution of the communication functions.

Regarding the interrupt level, PCN 3270 is designed to support ONLY interrupt levels 2 and 3 for the network adapter, while the token-ring adapter can support interrupt levels 2, 3, 6 or 7. Therefore you must configure the token-ring adapter for interrupt level 2 in the Gateway (to avoid a conflict with the SDLC card), and to interrupt level 2 or 3 for in the Network Stations.

NOTE: Differently from PCN 3270, PC Network Program allows also interrupt level 7.

Refer to Appendix E for a description of how to configure the adapter.

4.3 INSTALLATION AND CONFIGURATION OF PCN 3270

PCN 3270 is installed on the token-ring network in the same way as on the PC Network. Refer to the 'PC Network SNA 3270 Emulation Program Reference' manual for a detailed description.

As with the PC Network Program, in this chapter we point out the differences to consider in order to install PCN 3270 on the token-ring network.

A sample configuration of a the token-ring network used is included, and sample batch files are included in Appendix A. Note that the configuration here included is slightly different to that reported in Appendix A, and this is for sake of simplicity.

4.3.1 INSTALLING THE TOKEN-RING SUPPORT

In order to run PCN 3270 on a token-ring network, you must have the support for NETBIOS. You should copy the Adapter Support Interface and th NETBIOS program from their original diskettes to the hard disk or diskette, previously formatted with DOS on it. For instance:

```
A>COPY A:TOKREUI.COM C:
A>COPY A:NETBEUI.COM C:
```

assuming a hard disk is available and that manual swapping of diskettes in drive A: is done.

4.3.2 INSTALLING PCN 3270

Figure 9 on page 39 shows the sample configuration that has been used to install and test PC Network program on the token-ring network.

PCN 3270 may be installed on a disk or diskette only system in the same way as on the PC Network. However, if you use the SETUP program for a diskette based system, it will prompt you for a blank diskette to format, and on which it will put the PCN 3270 files; in this case copy the Token-Ring support programs (see above) only after you have run SETUP.

•   Diskette based system

1. Run SETUP; it will format and create a DOS load diskette with the following files:

COMMAND.COM

MODE.COM
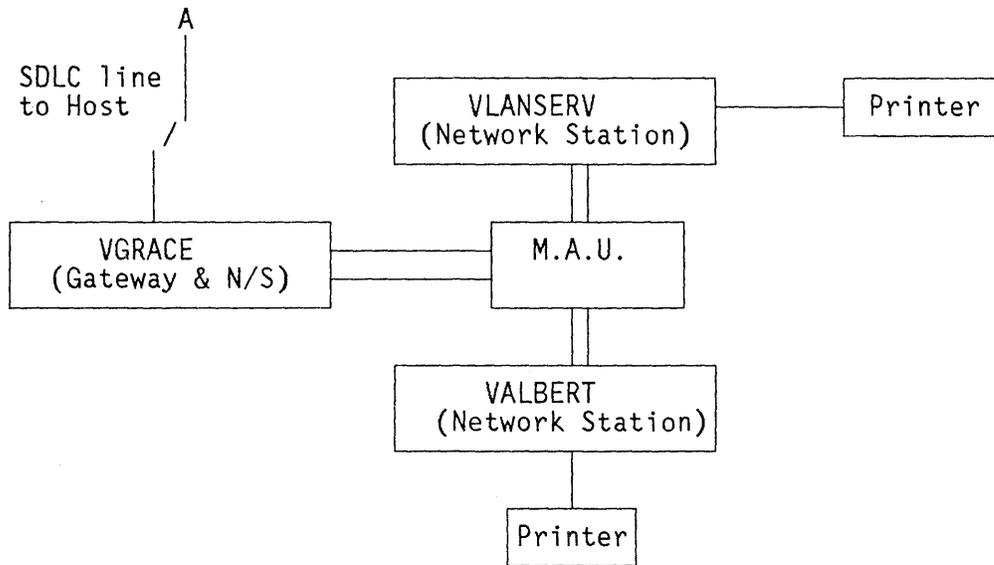
Figure 9. Sample PCN 3270 Configuration

   PCN 3270 diskette contents (except SETUP.COM)

   PSC.BAT to start PCN 3270 from drive A

2.   Copy on the diskette the TOKREUI.COM and NETBEUI.COM modules

3.   Edit the AUTOEXEC.BAT file to include

   TOKREUI

   NETBEUI

   as the first two lines, and eventually PSC if you want to start automatically PCN 3270.

- Disk based system

1.   Run SETUP; it will prompt you for a sub-directory to copy the PCN 3270 files into (default is root directory). The directory must be created before entering SETUP. SETUP will also create a PSC.BAT file to start PCN 3270 from this subdirectory.

2.   Make sure that you have copied on the disk the TOKREUI.COM and NETBEUI.COM modules and edit the AUTOEXEC.BAT file to include

   TOKREUI

   NETBEUI

   as the first two lines; eventually add PSC (assuming a PATH is available to the sub-directory) if you want to start automatically PCN 3270.

PC Network SNA 3270 Emulation Program on the Token-Ring Network   39

You can also install PCN 3270 without using SETUP, by copying all the program files to disk or diskette, then creating a PSC.BAT file as described on the PSC 3270 Reference manual (make sure that there is a PATH available to MODE.COM).

If you want to remap the keyboard, just follow the instructions in the Reference manual; there is no difference compared to PC Network.

Finally, if you want to install also the PC Network program, remember that:

• Only the Network Station and Redirector combination is supported.

• The PC Network installation Aid does not support PCN 3270.

• The PC Network program need to be started before PCN 3270.

4.3.3 CUSTOMIZING PCN 3270

All the PC's on the network must be customized before they are used. Usually one PC is configured as a Gateway and the other PC's as Network Stations.

Since the customizing process does not involve communication on the network, there is no difference compared to PC Network.

Depending on what configuration you choose, you will be prompted for answers through the Communication Profile panel sequence.

• Gateway

  Will define

      Modem and line characteristics

      Its Network name

      The names of the Network Stations it controls

• Network Station

  Will define

      The optional features selected (Num. lock, File transfer, Printer support)

      Its Network name

  Note that the Network Station doesn't know the name of the Gateway: PCN 3270 posts a generic LISTEN command to establish the session with the gateway.

In our sample configuration we defined a Gateway(VGRACE), and three network stations (VLANSERV, VALBERT and VGRACE again), as shown in Figure 9 on page 39. Note that the names used are unique across the network, so that on the Network Station PC also a Redirector can be run.

4.4 USING PCN 3270

You use PCN 3270 in order to communicate with 3270 applications in an host system. There are also some other features available.

Most of the functions have been run on a token-ring network and no difference has been found compared to PC Network.

4.4.1 3270 EMULATION

You start this task by selecting "Communicate" in the task selection panel. At this time the token-ring adapter is initialized, if another NETBIOS application is not using it. This process requires some more time than on the PC Network for the Gateway (45 sec. instead of 30 sec.), while it is the same (20 sec.) for the Network Stations.

You can load either the gateway or the network station first; if a network station is started before the gateway it will display the message

    XX Wait - Gateway has not activated Network Station

until the gateway is started and begins to poll it.

Remember that if you run also the Redirector function on a Network Station, you must start the Redirector first, otherwise the Network Program will find the token-ring adapter already initialized and display the message

    NET074: Cannot start; network adapter already started

No difference has been found in 3270 Emulation compared to PC Network.

4.4.2 EMULATION PROGRAM FEATURES

PCN 3270 has several features besides the 3270 emulation. These features have been tested on the token-ring network.

*   Host file transfer

    You can transfer files from and to VM/CMS, TSO or CICS. The host support required is 3270-PC File Transfer Program.

    File transfer is started by network stations only. No difference in the time required to perform it compared to PC Network.

*   Keyboard remapping

    Using this feature you can redefine the position of keyboard keys.

*   Display the status of the network stations

    The Gateway can monitor the status of the controlled network stations.

*   Trace function

A SNA trace for monitoring the session with the host.

* Screen save to disk

  A network station user can save host screens to a predefined disk file.

* Alternate task

  A "well behaved" application can run in an alternate partition. You can switch between them via the Alt-Esc "Hot-key".

  The Redirector function of the PC Network Program has successfully been tested as an example of an alternate task in a configuration as Figure 9 on page 39 but in which a Server (LANSERV) is used instead of VLANSERV.

* Printer support

  You can get a hard-copy on the attached printer, or even on a shared network printer if you "use" it.

  You can also have a 3270 direct print from the host to the PC printer. This function has been tested by printing a file from a host system to a redirected printer in the network.

4.5 PERFORMANCE CONSIDERATIONS

Very few differences have been noted from a performance point of view between PC Network and token-ring network.

The main one is in the initialization time required to bring up the Gateway. On the PC Network it requires about 30 seconds, while on the token-ring network it requires about 45 seconds, since the process is more complex and connecting tests are performed on the ring in order to insure that the network will work correctly.

The time required to perform the 3270 emulation (response time) and the other functions does not differ from that on the PC Network, as was observed in the previous section.

4.6 RAS CONSIDERATIONS

Some scenarios have been tested in order to find out any differences from PC Network when critical situations are registered. Also, the Ring Diagnostic Program was used to monitor the status of the network.

4.6.1 POWERING OFF A PC

PCN 3270 has an automatic session recovery feature. That is, if a network station goes down, then comes back up, the program restarts the session with no operator intervention. Also, if the gateway goes down all the network stations will display

XX Wait - Gateway has not activated Network Station

and when it then comes back up, it will restart the sessions with all the pending network stations. Of course, if you were in session with an application you have to reconnect to it, for instance you must Logon again.

This behavior is the same than on PC Network. Additionally, each time a PC is powered off and then on, the Ring Diagnostic Program displays the message:

DFIPD106I Ring error report

and that means that a soft error has been reported and recovered from.

4.6.2 PHYSICAL DISCONNECTION OF A PC FROM THE MAU

If the token-ring cable is physically detached from the MAU, the Ring Diagnostic Program will report a soft error situation, if the token was flowing into the "disconnected" PC at that time.

If it is the Gateway that has been disconnected, PCN 3270 will display the message:

Error on PC network

and the network stations will lose the sessions:

XX Wait - Gateway has not activated Network Station

Even if you reconnect the cable you cannot recover from this situation; you must restart PCN 3270 on the gateway.

If it is the Network Station that has been disconnected, instead, it will be the only one to be affected, and, when reconnected, PCN 3270 must be restarted as in the previous case. That is, there is no automatic recovery for a physical PC disconnection.

4.6.3 NETWORK WITH MULTIPLE MAU'S AND WITHOUT BACKUP RING

Running PCN 3270 in such an environment, if the cable connecting two MAU's is detached, you will have a sub-network that can still work, and you will lose only the network stations that are in a different "domain" to the Gateway. The other network stations will continue to work as well.

After the MAU's are reconnected, all the "lost" network stations will automatically restart their session with the gateway.

4.6.4 NETWORK WITH BACKUP RING

Running PCN 3270 on a token-ring network with a backup ring (the "Ring-out" port of the first MAU and the "Ring-in" port of the last MAU connected together), we experimented that if a cable between two MAU's is detached (simulating a

failure of a connector) the gateway and all the network stations will usually continue to work as before, and even the Ring Diagnostic Program will not report any error.

As with the PC Network program, an automatic hardware recovery has occurred. This is true in most cases, but not always (for instance, if the cable itself is broken, which requires manual intervention).

5.0 THE IBM TOKEN-RING NETWORK / PC NETWORK INTERCONNECT PROGRAM

5.1 INTRODUCTION

The Token-Ring Network/PC Network Interconnect Program (from now on called 'Interconnect') is a software product which provides a connection between a Token-Ring Network and a PC Network, acting as a gateway between them.

The purpose of this chapter is to give an introduction of the Interconnect and a description of the functions.

Refer to the 'Token-Ring Network/PC Network Interconnect User's Guide' for further information.

5.1.1 COEXISTENCE OF TWO DIFFERENT NETWORKS

The Interconnect is the program that implements the 'Gateway' between the PC Network and the Token-Ring Network, as in September 1984 Statements of Directions.

As stated in "NETBIOS Interface on the Token-Ring Network" on page 9, two network adapters may be installed in a PC that is part of a token-ring network, and one of them may be a PC Network adapter. The PC that runs the Interconnect program must be equipped with both cards in order to provide a connection between the two networks.

Once the Interconnect is correctly installed, network application programs using the NETBIOS communication protocol, will be able to communicate with applications on the other network. Many programs that operate with NETBIOS interface will operate across both networks.

A PC Network Redirector can access programs and data that are on a Server physically belonging to the other network. Also, a PCN 3270 Network Station can communicate with the host through a Gateway that is on the other network. The Interconnect will carry out what is necessary for doing it.

5.1.2 IMPLEMENTATION OF THE INTERCONNECT PROGRAM

The Interconnect is a NETBIOS based product. It uses the NETBIOS interface for transmitting and receiving messages to and from the networks. Thus, the programs running on the network which it interconnects must be NETBIOS based programs. Among these we have tested:

• PC Network Program

• PC Network SNA 3270 Emulation Program

When a program wants to establish a session with another one in the other network, the request is intercepted by the Interconnect, which creates two sessions, one for each network. There is a limit of 32 active sessions.

Also, senders are isolated from the receivers since they actually talk to the Interconnect, which then talks to the ultimate targets. That is, there is no more an end-to-end delivery protocol between the users; instead, the Interconnect manages the conversations and actively 'bridges' the flow of messages.

As a consequence of that, the programs must be aware that responses received from messages which are destined for a "remote" partner are returned by the Interconnect. Therefore a program may receive a positive acknowledgement by its 'remote' partner even if the message has not been successfully received, and this may alter its operational characteristics.

The end users requesting a "cross-network" communication must be known to the Interconnect through their NETBIOS names. These names must be unique across the networks and must be manually configured with the Configuration facility of the Interconnect; they will be added to the NETBIOS name table for each adapter. Note that the names definition is static, so applications that perform dynamic addition or deletion of names will not work through the Interconnect (this is the case of the Message Forwarding task in the PC Network Program).

The maximum number of names per adapter is 16, being limited to the constraints of the PC Network adapter. Some applications require the use of multiple names. For instance in the PC Network program, a Server requires 3 names and a messenger requires 2 names.

5.2   INSTALLING THE INTERCONNECT PROGRAM

5.2.1   HARDWARE REQUIREMENTS

The Interconnect program requires a PC XT or a PC AT. It must have enough memory (see later), a diskette drive and a monochrome or color display.

A token-ring network adapter and a PC Network adapter must be installed in the PC running the Interconnect.

- PC Network Adapter

  Must be configured as PRIMARY and use interrupt level 2.   This is the standard adapter jumper setting and should not be altered.

- Token-Ring Network PC Adapter

  Must be configured as SECONDARY and use interrupt level 3. See Appendix E for a description of the switch setting.

The Interconnect must "own" both the adapters, that is no other application using any of the adapters may work concurrently with the Interconnect.

Then, by these adapter settings, if you plan to use the same PC (at a different time) for another NETBIOS application such as PC Network program or PCN 3270, that support only a primary adapter, you should choose the 'Interconnect Machine' on the PC Network side.

Memory requirements by the Interconnect are the sum of a fixed amount and a variable one.

- Fixed requirement: About 51 Kb.

- The variable memory requirement is a function of the following factors:

    Maximum message size

    Number of "cross-network" names defined

    Number of extra buffers allocated

    Logging buffer size

    These values are provided at configuration time (see later section).

Optionally 76 kb. are required to run for the Operator Interface (this is recommended).

Finally you have to add the requirements for DOS (39 Kb.), for token-ring Adapter Support Interface (6 Kb.) and for NETBIOS (44 Kb.).

As a guideline, the following formula applies:

```
Memory = (51 + (Message size)x(total number of names + extra buffers)
             + logging buffer size
             + 39 + 6 + 44 ) Kb.

             + (optionally) 76 Kb.
```

For instance, a medium configuration with 15 names, 2 extra buffers and 9 Kb. maximum message size requires about 369 Kb.. However note that we used a preliminary version of NETBIOS and of the Interconnect, therefore these memory sizes may be different in the shipped version. They are included as an indication of rough size, and should not be used for detailed planning.

Finally, if you need to run other PC programs (not using the network adapters) on the Interconnect machine, you should add the memory required by them. However, be aware that the only co-resident program supported is the Operator Interface.

5.2.2 SOFTWARE INSTALLATION

The Interconnect has the following software requirements:

- DOS at the current release

- NETBIOS Program

The Interconnect program diskette contains the following files:

File	Size	Contents
NIIMAIN.EXE	42560	Command to start the Interconnect
NIIINIT.OVY	6160	Initialization overlay code
NIIINIT.MSG	4080	" messages
CONFIG.BAT	80	Batch file to start the Configurator
NIICNFG.EXE	13360	The Configurator program
NIICNFG.SCN	25440	Configurator screens
NIICNFG.MSG	2160	" messages
OPER.BAT	80	Batch file to start the Operator Interface
NIIOPER.EXE	33280	The Operator Interface program
NIIOPER.HLP	23440	Operator interface help panels
NIIOPER.SCN	35920	" " screens
NIIOPER.MSG	2960	" " messages
NIIOPER.ERR	1440	" " request error screen
GOODCHR.DAT	1040	Valid key tables
ADM.COM	34080	Display manager for CONFIG and OPER

Figure 10.   Interconnect Program Diskette Contents

In addition to the above supplied files, the Interconnect creates the following two files during operation:

NIIPARMS.DAT: The configuration file created by CONFIG

NIILOG.DAT: The LOG Buffer contents saved by OPER

In order to run the Interconnect you should copy the Program Diskette content to your fixed disk. Assuming that the fixed disk is already formatted with DOS, follow these steps (swap manually the required diskettes):

*   Copy the token-ring Adapter Support Interface to the hard disk

        A>COPY A:TOKREUI.COM C:

*   Copy the NETBIOS program

```
A>COPY A:NETBEUI.COM C:
```

- Copy the all the Interconnect diskette files

```
A>COPY A:*.* C:
```

- Create (or edit) an AUTOEXEC.BAT file these lines on top

```
TOKREUI
NETBEUI
```

  If you also want to start automatically the Interconnect, add

```
NIIMAIN
```

5.3 CONFIGURING THE INTERCONNECT PROGRAM

```
                    ┌─────────────┐
                    │ TRANSLATOR  │
          ┌─────────┤    UNIT     │
          │    ┌────┤             │                              A
          │    │    └─────────────┘              SDLC line       │
          │    │                                 to Host         │
  ┌───────┴─┐ ┌┴────────┐  ┌──────────────┐                      │
  │  MAC    │ │ VGERARD │  │ INTERCONNECT │                     /
  │(Server) │ │  (N/S)  │  │              │                      │
  └────┬────┘ └────┬────┘  └──────┬───────┘                      │
       │           │              │                              │
  ┌────┴────┐ ┌────┴────┐         │          ┌───────────────────┴─┐
  │ Printer │ │ Printer │  ┌──────┴───────┐  │      VGRACE          │
  └─────────┘ └─────────┘  │   M.A.U.     ├──┤  (Gateway & N/S)     │
                           │              ├──┤                      │
                           └──────┬───────┘  └──────────────────────┘
                                  │
                           ┌──────┴───────┐
                           │   ALBERT     │
                           │ (Redirector) │
                           └──────┬───────┘
                                  │
                           ┌──────┴───────┐
                           │   Printer    │
                           └──────────────┘
```
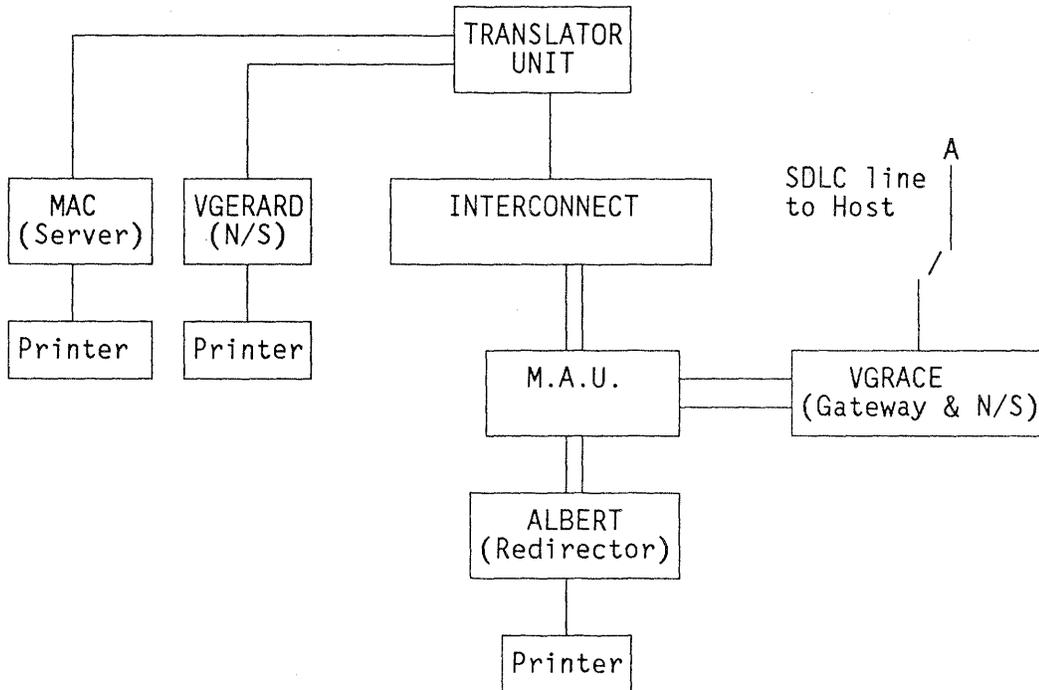
Figure 11.   Sample Interconnect Configuration

The configuration phase of the Interconnect is used to identify the devices on each network that will be known on the other network. You must define all these devices and these only by providing their NETBIOS names.

Do not define to the Interconnect those names that are not involved in "cross-network" communication.

An off-line utility (CONFIG) is provided with the product. It is a menu driven program which tailors the Interconnect for its specific environment by building a configuration file (NIIPARMS.DAT) based on user input.

In addition to producing the configuration file, CONFIG estimates the amount of memory needed, following the rules indicated in "Hardware requirements" on page 46.

The above figure shows a sample configuration that we used to Configure and run the Interconnect. See also Appendix B for the definitions of all the stations.

```
                              Network Titles
   Title for network connected to Adapter 0 .............. PCNET
   Title for network connected to Adapter 1 .............. TRNET
                            Conversation Support
   Maximum message size (1 - 64 Kbytes) ..........................  9 Kbytes
   Maximum number of names on Adapter 0 (1 - 16) .................  3
   Maximum number of names on Adapter 1 (1 - 16) .................  5
   Number of sessions to support (1 - 32) ........................ 16
   Number of extra session buffers (0 - 99) ......................  2
   Send time-out value (0 - 127) ................................. 60 seconds
                             Logging Support
   Logging buffer size (1 - 63) ..................................  1 Kbytes
   Logging active at initialization time (Y/N) ................... Y
   Stop logging when buffer is full (Y/N) ........................ N
                            Memory Requirements
   Memory required for the above configuration ...........  145040 bytes
   Memory required for the Operator and screen manager ...   77737 bytes
   Total memory required ................................   222777 bytes
```

1Help   2Save   3Quit   4   5Update 6   7   8Forward9   0

Figure 12. Configuration Panel 1

To start the Configurator program simply enter

        CONFIG

The first panel allows you to configure the system parameters for the Interconnect.

Network Titles give you a way to assign meaningful names (up to 16 characters) to the two separate networks.

Maximum message size configures the size for session communication buffers. This value must be consistent with the message size used by the NETBIOS application, because the Interconnect stores a complete message from one network before sending it to the other network. In our tests we used a value of 9 Kb., 1 Kb. above the default message size used by the PC Network Program, which in the current version, is 8 Kb. (you can also override the default, by setting explicitly the /RQB parameter in the NET START command for a Server). If you run only PCN 3270 sessions, a 2 Kb. message size is adequate. However it must be above the largest value required by all the different "cross-network" applications. This value affects the memory requirements of the Interconnect (see "Hardware requirements" on page 46).

Maximum number of names configures the total number of names that each side of the Interconnect will support. One message buffer is reserved for each name and then all buffers are pooled for all names. You may configure more names

than you add with the Configurator to reserve room for adding additional names
later added by the Operator Interface. The maximum number of names is 16 for
each adapter. Also consider that some applications require more than one name
per device; for instance PC Network Program requires 3 names for a Server and
2 names for a Messenger.

Number of sessions to support defines how the Interconnect will initialize the
Adapters and then many concurrent conversations will be supported. This number
must be greater than or equal to the number of names configured for either side
of the Interconnect and less than 32. Some applications require multiple ses-
sions. For instance, a Server in the PC Network program require a permanent
session for an outstanding LISTEN to be reserved in addition to each conversa-
tion that it carries.

Number of extra session buffers configures additional communication buffers.
This is recommended when there is heavy traffic across the Interconnect, and
an application receives messages at a slower rate than the sending application
sends them. This allows for a multiple thread mode of operation even in heavy
traffic conditions (buffers are pooled for all sessions). A minimum value of
1 is recommended.

Send time-out value defines the number of seconds before a send command will
time out. A finite time-out value (we used 60) is recommended to prevent com-
munication resources from being tied up too long by a malfunctioning station
on the network. Send will not time-out if this value is set to 0. However some
programs may have very large message servicing time, in which case the 0
time-out option can be used to prevent a SEND timeout and drop the session.

Logging buffer size defines the amount of memory to set aside for logging ses-
sion and datagram activity. Each log entry requires 16 bytes.

Logging active at initialization time allows you to activate the logging func-
tion as soon as the Interconnect is started. Otherwise, you can activate it
later by using the Operator Interface.

Stop logging when buffer is full allows you to stop logging automatically when
the log buffer is full. If this option is not selected, the log buffer will
act as a circular or wrap-around buffer which will contain only the latest en-
tries.

The Configurator calculates the memory required for the configuration with the
given parameters. It also indicates the memory required for the Operator
Interface.

Total memory required is the sum of these two figures. The total does not in-
clude the memory required for DOS, token-ring Adapter Support Interface and
NETBIOS.

You can recalculate and display the memory requirements for the configuration
defined by current values of the input fields by pressing the F5 key (Update).

Then you can go to the second panel of the Configuration program by pressing
the F8 key (Forward).

```
┌─────────────────────────────────┐  ┌─────────────────────────────────┐
│ Network Names from TRNET         │  │ Network Names from PCNET         │
│   Adapter 0 is on PCNET          │  │   Adapter 1 is on TRNET          │
│ ┌──────────────┬──────────────┐  │  │ ┌──────────────┬──────────────┐  │
│ │ VGRACE       │              │  │  │ │ MAC          │              │  │
│ │ ALBERT       │              │  │  │ │ ── Reserved ──             │  │
│ │              │              │  │  │ │ ── Reserved ──             │  │
│ │              │              │  │  │ │ VGERARD      │              │  │
│ │              │              │  │  │ │              │              │  │
│ └──────────────┴──────────────┘  │  │ └──────────────┴──────────────┘  │
└─────────────────────────────────┘  └─────────────────────────────────┘
```

Parameters   Name Types

Network Name .... VGERARD

Adapter Number (0/1) 1

Name Type (1-5) 5

   NETBIOS Parameters (Only for Name Type 5)

Listen Specific Name ...... *

Group Name (Y/N) .... N

```
┌──────────────────────────┐
│ 1 – Redirector           │
│ 2 – Messenger/Receiver   │
│ 3 – Server               │
│ 4 – Additional           │
│ 5 – NETBIOS Only         │
└──────────────────────────┘
```

1Help   2Save   3Quit   4Select 5   6   7Backwrd8   9Delete 0Add

Figure 13. Configuration Panel 2

The second panel of the Configuration program allows you to configure the Interconnect with the names necessary to support the desired communication. Each table in this panel represents one side of the Interconnect and the names that have been configured onto that side. The lower section of the screen contains the input fields used to add names to the tables.

To add a name, enter the parameters for that name in the input fields and press F10 (Add). You should add names from one network to the adapter connected to the other network, because the Interconnect will simulate the desired name towards it. To move across the input fields use the 'tab' key.

Network Name: Up to 16 characters. Names cannot start with an * or a null character. PC Network Program names must be 15 characters maximum, and all characters will be translated to uppercase. However NETBIOS names are not translated to uppercase and must be entered exactly with capitalization on the desired characters. If you need to add NETBIOS names containing characters that cannot be typed with the keyboard, you have an hexadecimal editing facility on the name field that can be activated through the Alt-F10 key.

Adapter Number (0 or 1) indicates which table a name will be added to in the top of this screen.

Name type indicates what type of name is being added. Types 1-4 are PC Network Program names and the configurator will automatically reserve the necessary additional names required.

The following table shows the number of names required by the PC Network program, depending on the type of the name. Also NETBIOS names requirements are

shown.   Each name type requires a number of NETBIOS NCB's (or MCB's); this
number is shown in the 'Commands' column.

NOTE: Type Name 4 (Additional) is a PC Network Program name for sending and
receiving message to alternate names.

	Name Type	Names	Commands
1 -	Redirector	1	1
2 -	Messenger/Receiver	2	3
3 -	Server	3	5
4 -	Additional	1	1
5 -	NETBIOS with listen	1	2
	NETBIOS without listen	1	1

The following fields only apply to name type 5 (NETBIOS only).

Listen specific name indicates what name will be placed in the call name field
when a LISTEN is posted.   A blank in this field means that a listen will not
be posted for this name.   An '*' means that a LISTEN ANY will be posted.   This
is the case for PCN 3270 names, because the Network Stations don't know the
Gateway's name and the Gateway must LISTEN to all the Network Stations.

Group name indicates whether the name is to be added as a group name (answer
"Y") or as a unique name (answer "N").   "N" must be answered for PCN 3270 names.

After you have defined all the names, check that the total number is less than
or equal to 16.   Also check that the total number of Commands (MCB) required
is not greater than 28.   This is a maximum also.

You can save your current configuration by pressing the F2 key (Save).   The
Configurator will write it on the NIIPARMS.DAT file.   Then to exit the
Configurator press F3 (Quit).

If you want to modify an existing configuration there are other useful function
keys.   After having start CONFIG , F4 (Select) selects an existing name and
sets the input fields to display the current parameters.   Use F9 (Delete) to
remove the name from the name table, then modify the input fields and re-add
it with F10 (Add).

Note that any modification you make on your configuration will become effective
the next time you restart the Interconnect; in order to do it you have to re-IPL
the PC, because when you start the Interconnect it checks if it is already
RESIDENT and, if so, it doesn't reload.

5.4   RUNNING THE INTERCONNECT PROGRAM

The operational phase of the Interconnect receives messages from one network
and forwards them to the other network.

You start the Interconnect by typing

        NIIMAIN

if this line was not previously included in the AUTOEXEC.BAT file.

The loading module will display the following messages:

Preliminary Checkout Successful
--One moment please, attaching adapters to the networks...
--One moment please, adding network names...
Initialization Completed: NII is installed and operational

The Interconnect requires that the adapters are not already initialized by some
other application, or initialization will not complete and you will get an
"Interconnect installation ABORTED" message; the Interconnect doesn't allow to
share the adapters with any other network application.

Note that the Translator Unit of the PC Network must be already powered on when
you start the Interconnect, or the initialization will fail. This is due to
the fact that when requesting the status of the PC Network adapter, the command
cannot complete if the Translator Unit has not been activated.

The Interconnect program has been successfully run in the configuration shown
in Figure 11 on page 50.

A Redirector station (ALBERT) could "use" the network devices (disk files and
printer) shared by a Server (MAC) in the "other" network, and also send messages
to him.

A Network Station (VGERARD) could run PCN 3270 to access an host system through
a Gateway (VGRACE) in the "other" network, and also successfully perform file
transfers and direct printing from the host to the attached PC printer, emu-
lating a 3287 printer.

You must start the Interconnect before PC Network Program, otherwise the Redi-
rectors cannot access the "cross-network" Servers even if the Servers are
started first (as should be). This limitation does not apply with PCN 3270,
since the Network Stations can remain in "Wait" status until the connection with
the Gateway is established.

See Appendix B for a description of the definitions used.

5.5 THE OPERATOR INTERFACE

The Operator Interface is an application that allows the operator to monitor
the Interconnect activities and check the status of the sessions and of all the
adapters in both networks. Also a display logging facility is provided.

The Operator Interface is the only application concurrently supported with the
Interconnect and it requires that the Interconnect has started first.

To start the Operator Interface enter

        OPER

The main panel allows you to reconfigure and query the Interconnect while it
is running. The layout of the screen and the meaning of the input fields are
the same as on the second panel of the Configurator program (see Figure 13 on
page 53).

```
01/01/80 00:28:33          CURRENT NAMES CONFIGURATION
```

Network Names from TRNET Adapter 0 is on PCNET		Network Names from PCNET Adapter 1 is on TRNET	
VGRACE ALBERT		MAC —— Reserved —— —— Reserved —— VGERARD	

```
                Parameters                                     Name Types
Network Name .............. VGERARD
Adapter Number (0/1) ...... 1
Name Type (1-5) ........... 5              ┌───────────────────────────────┐
                                           │ 1 — Redirector                │
   NETBIOS Parameters (Only for Name Type 5)│ 2 — Messenger/Receiver       │
Listen Specific Name ...... *              │ 3 — Server                    │
Group Name (Y/N) .......... N              │ 4 — Additional                │
                                           │ 5 — NETBIOS Only              │
                                           └───────────────────────────────┘
```

```
1Help    2Save    3Quit    4Select 5IntStat6AdStat 7SsnStat8Logging9Delete  0Add
```

Figure 14. Operator Interface Main Panel

You will use the function keys to perform the reconfiguration and the query functions.

The changes that you make will become a part of the current operational environment and are in effect for as long as the Interconnect remains running. These changes have no effect on the parameter file created by the Configurator program, unless you press F2 (Save) to replace the parameter file; otherwise the next time the Interconnect is started, they will not be present.

5.5.1 INTERCONNECT SESSION STATUS

To query the current conversations between the network names, press F5 from the
main panel. A graph will be displayed which allows you to see "who is talking
to who" and the number of active sessions between every pair of names. See
Figure 15.

```
                              INTERCONNECT SESSION STATUS
     TRNET            ->  ┌──────── MAC
                          │ ┌────── MAC          @ ┌
     PCNET              │ │ │ ┌──── MAC            │ ┌
                        │ │ │ │ ┌─ VGERARD         │ │ ┌
                        ▼ │ │ │ │                  │ │ │ ┌
                        V V V V                    V V V V
     VGRACE           ->  0 0 0 2 ................
     ALBERT           ->  0 0 1 0 ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
                      ->          ................
```
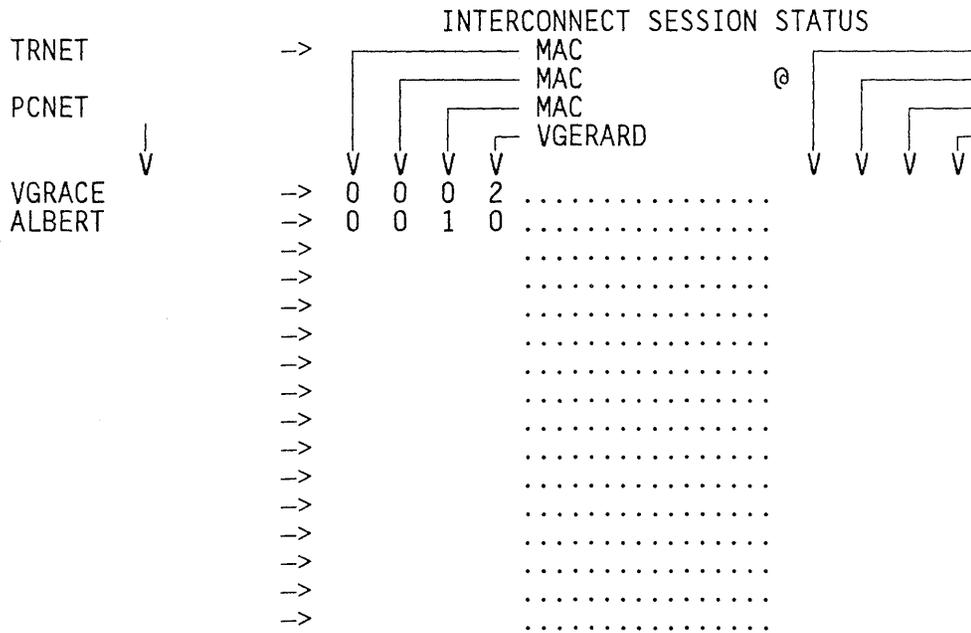
1Help   2   3Quit   4Select 5Refresh6Traffic7Switch 8   9   0

Figure 15.   Interconnect Session Status: The top axis can only display
             eight names at a time, so you must use the F7 Switch key to view
             any other names on adapter 0.

You can have a display of the number of bytes and NETBIOS messages that have
been exchanged for a specific name in each session and in both directions by
pressing F4 (Select) and then F6 (Traffic) from the Interconnect Session Status
screen. You scroll from the display of one session for the selected name to
the previous or next one by pressing the F7 or F8 keys. See Figure 16.

01/01/80 00:33:24   SESSION TRAFFIC STATISTICS   Conversation number   3


```
                                 ┌─────────────────────┐
                                 │  Messages        9  │
                                 └──────────>──────────┘
                              ┌─────────────────────────┐
                              │  Bytes         450       │
                              │                          │
   ALBERT          >>─────────┤       Interconnect       ├────>> MAC
   on                         │                          │        on
   TRNET           <<─────────┤                          ├──<< PCNET
                              │  Messages        9       │
                              └──────────<──────────────┘
                                 ┌─────────────────────┐
                                 │  Bytes         340  │
                                 └─────────────────────┘
```
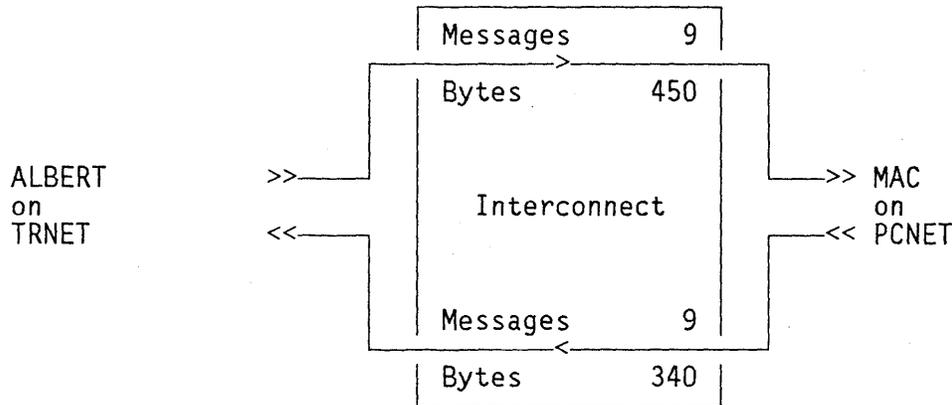
1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 16.   Session Traffic Statistics: The conversation number corre-
              sponds to the number displayed in the log panel. Messages are
              NETBIOS messages.

5.5.2 ADAPTER STATUS

You can obtain the status of any adapter on either network or of the adapters
installed in the Interconnect machine. Fill in the Network Name and Adapter
Number fields on the main menu then press F6 (AdStat). The Interconnect will
issue a NETBIOS Adapter Status command and display the formatted results.

If the requested name is on the indicated adapter (or it is * or blank), then
a local adapter status will be returned. Otherwise the command is sent out on
the selected (by its adapter number) network and if there is an adapter with
that name on it, then a remote adapter status will be returned; otherwise, an
error message will be displayed.

An easy way to do a remote adapter status for one of the configured names is
to use the F4 (Select) key to select the desired name, then change the adapter
number to the other adapter. Pressing F6 will display a remote adapter status.

Note that only the Operator can query the status of a remote adapter. If a station requests the status from an adapter which is on the "other" network, the response will be the status for the Interconnect's adapter.

Since the token-ring adapter and the PC Network adapter report different types of status, there are two different sequences and formats of screens to display these information. The PC Network Adapter status results in 3 screens while the Token-Ring Adapter status results in 4.

See the following figures for a example of adapter status information. The field labels are taken from the 'PC Network Technical Reference' and the 'Token-Ring Network PC Adapter Technical Reference' manuals.

01/01/80 00:26:57   LOCAL ADAPTER STATUS   Panel 1 of 3

            Adapter status command was issued to Adapter 0 for VGRACE

```
┌─────────────────────────────────────────────────────────────────┐
│    Unit identification number ..................... 00000101B7DE  │
│    External jumper status: Jumper W1 ....................... ON   │
│                            Jumper W2 ....................... ON   │
│    Results of last self-test ............................... 80   │
│    Software version:  Major version number .................  1   │
│                       Minor version number ................. 23   │
├─────────────────────────────────────────────────────────────────┤
│                   Traffic and Error Statistics                    │
│    Duration of reporting period (in minutes) ............. 24     │
│    CRC errors received ....................................  0     │
│    Alignment errors received ..............................  0     │
│    Collisions encountered .................................  0     │
│    Aborted transmissions ..................................  0     │
│    Successfully transmitted packets ................ 117          │
│    Successfully received packets ...................  81          │
│    Retransmissions ........................................  0     │
│    Number of times receiver exhausted resources ..........  0     │
└─────────────────────────────────────────────────────────────────┘
```

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 17.   Adapter Status Panel: This is the first panel for a PC Network
             Adapter only

IBM Token-Ring Adapter Status

Adapter status command was issued to Adapter 1 for MAC

```
Adapter's burned-in address .................... 2501005A0010
Software level number ................................ 65

               Traffic and Error Statistics

Duration of reporting period (in minutes) .............  133
FRMR frames received ..................................    0
FRMR frames transmitted ..............................    0
I-frames received in error ...........................    0
Aborted transmissions ................................    0
Successfully transmitted packets .................      48
Successfully received packets ....................      45
I-frames transmitted in error .......................     0
Lost data (out of SAP buffers) .......................    0
```

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 18. Adapter Status Panel: This is the first panel for a token-ring
            PC Adapter only

Adapter Resource Statistics

```
        Free command blocks ...............................   27
        Configured maximum command blocks .................   32
        Maximum number of free command blocks .............   32
        Pending sessions ..................................    2
        Configured maximum pending sessions ...............   16
        Possible maximum pending sessions ................   32
        Maximum session data packet size .................  594
```

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 19. Adapter Status Panel: This panel is common to both the PC
            Adapter and the token-ring PC Adapter

Name	Type	Status	Name	Type	Status
VGRACE	UNIQUE	4			
ALBERT	UNIQUE	4			

                        Name Status Codes:
        0 .... Trying to register a name
        4 .... A registered name
        5 .... A de-registered name
        6 .... A detected duplicate name
        7 . A detected duplicate with de-register pending

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 20.   Adapter Status Panel: This panel is common to both the PC
             Adapter and the token-ring PC Adapter

```
    INITIALIZE bring-up error code ......................... 0000
    OPEN ADAPTER error code ............................... 0000
    Latest ring status ..................................... 2000
    Latest adapter check reason-code ....................... 0000
    Latest PC-detected error ............................... 0000
    Latest operational error code (4X or 5X) ................. 15
    System timeout value (in half-seconds) .................. 0
```

                           Adapter Counters
```
    Line errors ..........    0    Receive congestion .....    0
    Internal errors ......    0    Frame copied errors ....    0
    Burst errors .........    0    Frequency errors .......    0
    ARI/FCI delimiters ...    0    Token errors ..........    0
    Abort delimiters .....    0    DMA bus errors ........    0
    Lost frames ..........    0    DMA parity errors ......    0
    DLC T1 timer expired .    0    Local station busy .....    0
    DLC TI timer expired .    0    Maximum DG packet size .  514
```

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 21.   Adapter Status Panel: This panel is for a token-ring PC
             Adapter only

5.5.3 SESSION STATUS

To query the status of all sessions (active or pending) for a name on a selected adapter, fill in the Network Name and Adapter Number fields on the main menu, then press F7 (SsnStat). The Interconnect will issue a NETBIOS Session Status command and display the formatted results.

If the name is blank or is an '*', then all sessions for that adapter will be displayed. The information for each session will be displayed on a separate screen with paging forward and backward to view the different sessions.

See Figure 22 for an example. The field labels are taken from the PC Network Technical Reference manual.

01/01/80 00:37:26   SESSION STATUS   Panel   2 of 2

Adapter Specific Information

```
┌──────────────────────────────────────────────────────────────────────┐
│   Name number being reported ............................... 255       │
│   Sessions with this name .................................   2        │
│   Outstanding RECEIVE DATAGRAM and                                      │
│       RECEIVE BROADCAST DATAGRAM commands ..................   2        │
│   Outstanding RECEIVE ANY commands .........................   1        │
└──────────────────────────────────────────────────────────────────────┘
```

Session Specific Information

```
┌──────────────────────────────────────────────────────────────────────┐
│   Local session number .....................................   3        │
│   State of the session ........................ Established              │
│   Local name ................................... ALBERT                  │
│   Remote name .................................. MAC                     │
│   RECEIVE commands outstanding .............................   0        │
│   SEND and CHAIN SEND commands outstanding .................   0        │
└──────────────────────────────────────────────────────────────────────┘
```

1Help   2   3Quit   4   5   6   7Backwrd8Forward9   0

Figure 22.   Session Status Panel

5.5.4 LOGGING

You can obtain the logging screen by pressing F8 (Logging) from the Operator Interface main panel. Events that are logged consist of:

- Start of a session

- End of a session

- Forward of a datagram

- Broadcast of a datagram

All logged data is time stamped.

Logging is automatically started if you have configured the Interconnect to do so (see Figure 12 on page 51).

The logging screen also allows you to CLEAR the log, turn logging ON or OFF, or SAVE the current contents of the logging buffer to a file called NIILOG.DAT (if it doesn't exist, it will be created). The buffer is cleared after a successful save operation.

There is an additional feature which will display the logging of events in real time. This capability is useful for problem determination; however, it adversely affects the performance of the Interconnect during heavy traffic activity.

See Figure 23 on page 64 for an example of a logging screen. In this figure:

- Time is the time that the entry was added to the log buffer.

- Type indicates what the entry in the log represents.

- Num corresponds to the conversation number of a session entry (blank for datagram entries). It is the same number that is displayed on the Session Status screen, and can be used to correlate session start to session end entries.

- From Name indicates either the sender for datagram entries, the caller for session start entries, or the name that closed the session for session end entries.

- To Name indicates the receiver for datagrams or the name being called.

- Msgs and bytes show the number of messages and bytes transmitted.

- RC shows the NETBIOS return code from the command causing the log entry. The only exception is when a Session End entry was made because the originator's name was not configured in the Interconnect; in this case RC is forced to x'14' ('Cannot find name called or no answer') and the "From Name" field is nulled out.

  NETBIOS return codes are explained in the PC Network Technical reference manual. A compendium is also provided in Appendix D.

Note that there are two sessions between the Gateway (VGRACE) and the Network Station (VGERARD) running PCN 3270, one for the display and one for the printer

emulation. Also there is a session between a redirector (ALBERT) and a Server (MAC).

01/01/80 00:43:03			LOG BUFFER DISPLAY				
Time	Type	Num	From Name	To Name	Msgs	Bytes	RC
00:16:10	SS	1	VGRACE	VGERARD			00
00:16:10	SS	2	VGRACE	VGERARD			00
00:26:25	SS	3	ALBERT	MAC			00
00:35:17	BDG		ALBERT		1	75	00

Types: SS = Session Start, SE = Session End, (B)DG = (Broadcast) Datagram

Logging is On   Real-Time mode is Off   Stop when buffer is full is Off
1Help   2Save   3Quit   4Clear   5Log   6Realtim7Backwrd8Forward9   0

Figure 23. Logging Panel

5.5.5   OTHER FUNCTIONS OF THE OPERATOR INTERFACE

Other functions may be activated from the main panel of the Operator Interface.

Alt-F1 displays a system or network error screen if a software or network error has been detected. This occurs when a NETBIOS return code greater than x'40' has been returned by any of the adapters. When such a non-recoverable error has been detected, the Interconnect will automatically terminate. However some Adapter and NETBIOS information will be saved to allow later display with the Operator program.

Alt-F10 allows you to perform hexadecimal editing of the name field in order to place characters that cannot be typed with the keyboard (for NETBIOS names only), and is the same as the one described in the Configuration section.

5.6   PERFORMANCE CONSIDERATIONS

Due to the "non end-to-end" protocol implemented by the Interconnect, it takes longer for a user on the "other" network to receive data from a sender than it would take if both the sender and the receiver were on the same network. Time

is increased because the Interconnect uses a "store and forward" technique to forward NETBIOS messages.

For instance, in the configuration we used (see Appendix B), we found that it takes about 3 seconds more, in order to transfer a medium size file (45000 bytes) through the Interconnect from a Server to a redirector, compared to the time required if the server and the redirector were on the same network.

As a consequence of that, application that have timeouts may need them to be increased.

Performances are affected by the Number of Session parameter set when configuring the Interconnect. The more sessions configured, the slower the performance will be. However, having a large number of sessions, the Interconnect can support more simultaneous "cross-network" conversations. An intermediate number, such as 16, should be adequate if there is only a limited number of names.

Limiting the maximum message size (if the applications allow it) results in less delay for transferring large amounts of data, since the storing and forwarding of multiple messages can be overlapped if enough buffers are available. Also, this reduces the RAM requirements (see "Hardware requirements" on page 46).

The PC Network program message size is determined by the /RQB parameter of the NET START command at the server. The default value in the current version is 8 Kb.. Note that it cannot be modified with the menus, instead you have to manually edit the AUTOEXEC.BAT file.

Finally, the logging facility of the Operator Interface affects the performance of the Interconnect, especially if the real time option is chosen during heavy traffic activity.

5.7 RAS CONSIDERATIONS

5.7.1 GENERAL CONSIDERATIONS

The Operator Interface is a set of tools available for problem determination. It allows you to display detailed information about the sessions status and the adapters status.

Also, the logging facility is very useful since it provides information about operational errors through NETBIOS return codes that can be easily interpreted with the PC Network Technical reference manual. See "The Operator Interface" on page 55.

5.7.2 RAS WITH PC NETWORK PROGRAM

Some situations have been observed in order to see how the RAS capability of the PC Network Program are modified by the presence of the Interconnect between a server and a redirector.

1. If a Server goes down, also all the redirectors have to be restarted. This is the same behavior as without the Interconnect.

2. If a Redirector goes down, it will not be "served" until it is restarted (it is not sufficient to "NET USE" again the devices). Also this is the same behavior as without the Interconnect.

3. If the Interconnect itself goes down, then all the redirectors have to be restarted, as if it were the server to lose contact. Indeed, the Interconnect simulates the server's name towards the "cross-network" redirectors.

5.7.3 RAS WITH PCN 3270

Similar situations have also been observed with PCN 3270.

1. As without the Interconnect, if the Gateway or a "cross-network" Station goes down, as soon as it is restarted, it re-establishes the lost connection: PCN 3270 doesn't modify its recovery capability.

2. If the Interconnect itself goes down, all "cross-network" connections are lost. However, when it is restarted, all pending sessions are automatically recovered, again due to PCN 3270 capabilities. This can also be shown through the Operator Interface logging facility.

5.8 MULTIPLE INTERCONNECTIONS

It is possible to configure more than one Interconnect, each of them being attached to a Token-Ring Network on one side and to a PC Network on the other.

```
        ┌─────────┐   ┌─────────┐   ┌─────────┐   ┌─────────┐   ┌─────────┐
        │    PC   │   │  INTER  │   │   T/R   │   │  INTER  │   │    PC   │
....────┤ NETWORK ├───┤ CONNECT ├───┤ NETWORK ├───┤ CONNECT ├───┤ NETWORK ├── ....
        └─────────┘   └─────────┘   └─────────┘   └─────────┘   └─────────┘
```
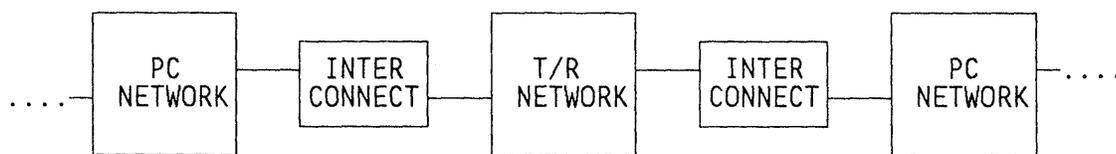
Figure 24. Multiple network interconnections

The only configuration supported is the one where non-broadcast traffic flows through one and only one Interconnect. This is called "simple interconnect"; several networks can be linked in a "chain" fashion, alternating PC Networks and Token-Ring Networks. See Figure 24.

A more general topology allowing for parallel Interconnect between the same two networks is not supported, even though the token-ring architecture is designed to permit such a configuration.

A.1   CONFIGURATION

The following configuration was used to install and test the PC Network Program and PC Network SNA 3270 Emulation Program on a Token-Ring Network.

Since these programs are incompatible with each other, (except for the Redirector/Network Station combination), some modifications have been introduced in the AUTOUSER.BAT files in order to avoid any conflict.

Figure 25.   Sample Token-Ring Configuration
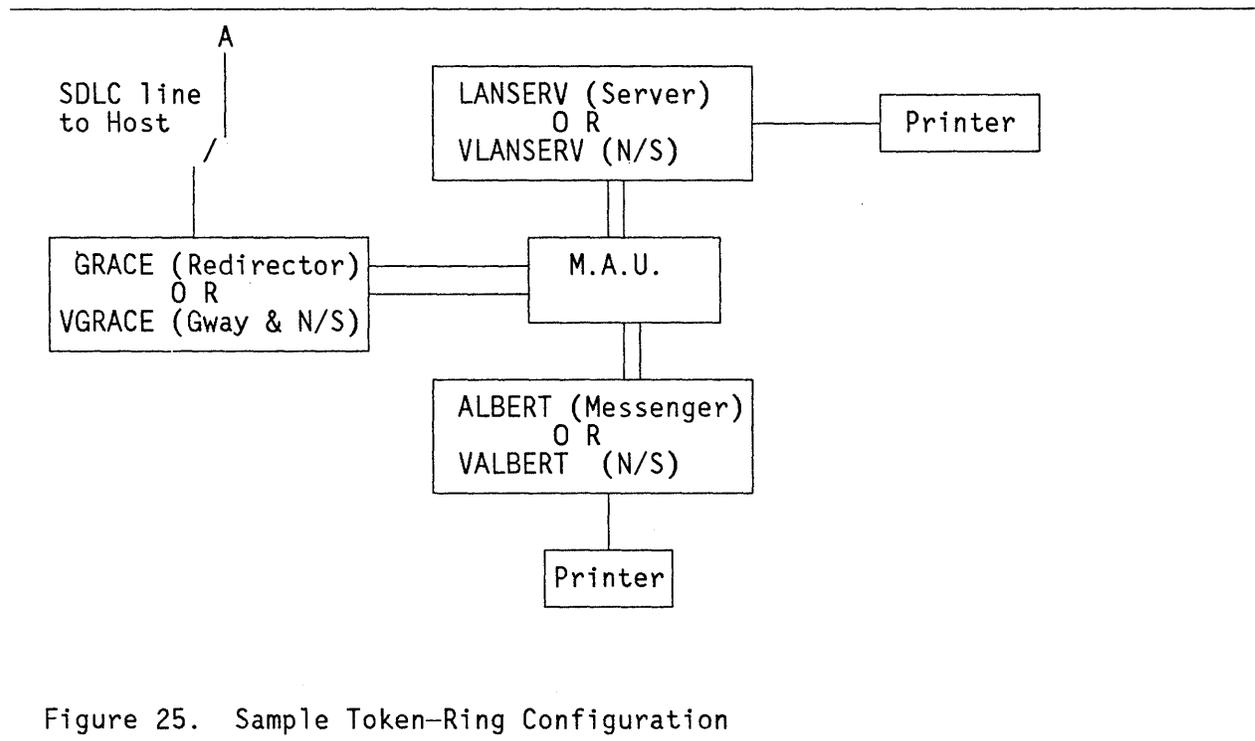
A.2 LANSERV AND VLANSERV

This station is a PC XT, with 384 Kb. of memory, one 360 Kb. diskette, one 10 Mb. hard disk and a printer. It has the PC Network Program running in Server mode (as LANSERV).

PCN 3270 is not supported on this configuration but is installed for use by this station (as VLANSERV) when it is not running as a disk or print server.

The fixed disk has the following disk structure, created by the PC Network Installation Aid:

```
                              ┌──────┐
                              │ C:\  │
                              └──────┘
                                 │
   ┌─────────┬─────────┬─────────┼─────────┬─────────┬──────────┐
┌──────┐ ┌──────┐ ┌─────────┐ ┌────────┐ ┌────────┐ ┌─────────┐  other
│BATCH │ │ APPS │ │ NETWORK │ │PROFILES│ │PCN3270 │ │USER.MDL │  User
└──────┘ └──────┘ └─────────┘ └────────┘ └────────┘ └─────────┘  Directories
              │                                          │
   ┌──────┬───┴────┬─────────┐                           │       ( ALBERT
┌──────┐ ┌─────┐ ┌─────────┐ ┌──────┐                    │          and
│BATCH │ │ DOS │ │ NETWORK │ │ TEXT │               ┌────┴────┐     GRACE )
└──────┘ └─────┘ └─────────┘ └──────┘          ┌─────────┐ ┌─────────┐
                                               │  BATCH  │ │PROFILES │
                                               └─────────┘ └─────────┘
```
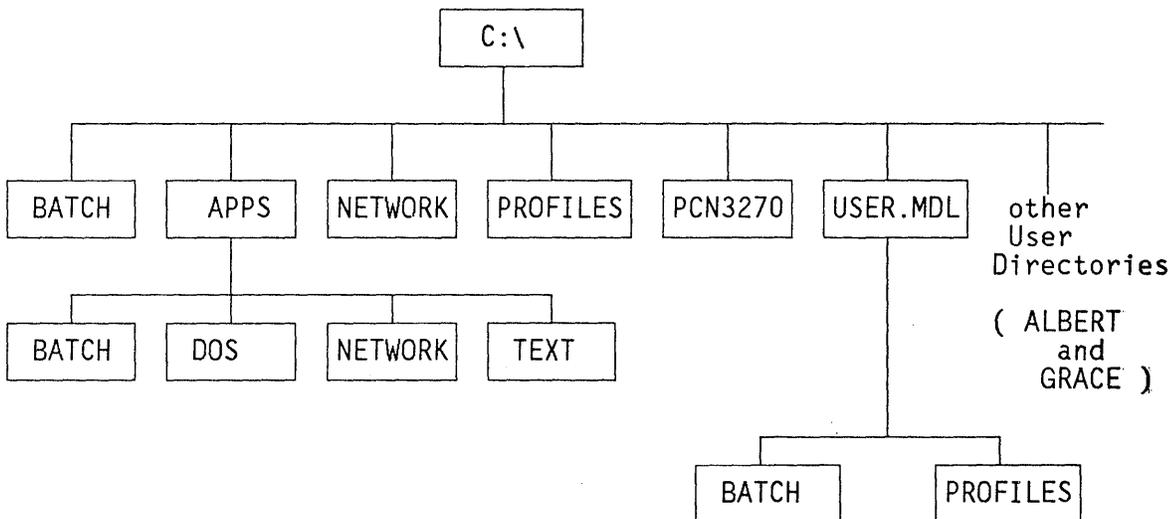
   Figure 26.   PC Network Server Disk Structure

The PCN3270 was created later and PCN 3270 was installed without the Installation Aid (which doesn't support it).

1.   The ROOT directory contains:

   • COMMAND.COM

   • TOKREUI.COM, NETBEUI.COM

   • CONFIG.SYS, RMPKB.SYS, VDISK.SYS, ANSI.SYS

   • AUTOEXEC.BAT created by the PC Network Menu SAVE option and manually edited to include NETBIOS support in the user area:

```
: *** Network Batch File ***
TOKREUI
NETBEUI
: ***
ECHO OFF
PATH C:\NETWORK
YNPROMPT Y N 39 Do you want to start the network (Y/N)?
IF ERRORLEVEL 1 GOTO A
ECHO ON
NET START SRV LANSERV /SRV:5 /MBI:1600 /SHR:10 /SES:18
NET SHARE APPLS=C:\APPS /R
```

```
NET SHARE ALBERT=C:\ALBERT
NET SHARE GRACE=C:\GRACE
NET SHARE NETPRT1=LPT1
ECHO OFF
GOTO B
:A
PATH \
:B
ECHO ON
AUTOUSER.BAT
```

- AUTOUSER.BAT as follows:

```
Echo off
PROMPT $P$G
PATH=C:\NETWORK
DATE
TIME
YNPROMPT Y N 38 Have you started the PC Network (Y/N)?
IF ERRORLEVEL 1 GOTO NONET
:NET
PATH=C:\BATCH;C:\APPS\TEXT;C:\APPS\DOS;C:\NETWORK;C:\;\
APPEND \
GOTO EXIT
:NONET
YNPROMPT Y N 55 Do you want to start the PC Network 3270 session (Y/N)?
IF ERRORLEVEL 1 GOTO NOGWST
:GWST
PATH=C:\BATCH;C:\APPS\DOS;C:\NETWORK;C:\PCN3270;C:\;\
CD PCN3270
REMAPKEY C:\PCN3270\REMAP.KEY
PSC
:NOGWST
PATH=C:\BATCH;C:\APPS\DOS;C:\NETWORK;C:\PCN3270;C:\;\
:EXIT
```

2. The BATCH directory contains BAT files for use by the Server. Some of these are created by the PC Network Installation Aid when an application is installed.

3. The APPS directory structure is created by the PC Network Installation Aid. It contains:

   - A BATCH directory with BAT files for use by the PC Network Stations using this disk server.

   - A DOS directory containing DOS 3.1 for use by the Server and the Network users.

   - A NETWORK Directory for the Network users.

   - A TEXT directory for TEXT editors and applications such as the Displaywrite programs.

4. The C:\NETWORK directory contains the PC Network programs for use by the Server.

5. The C:\PCN3270 directory contains the PCN 3270 programs for use by the Server and the REMAP.KEY file (see later).

6. The PROFILES directory can be used for Application profiles such as Editor default settings and help text.

7. The USER.MDL directory contains a model for the user directories created by the PC Network Installation Aid. The User's defined (ALBERT and GRACE) each have their own directory with a BATCH and PROFILES subdirectory and a NETPATH.BAT file containing a PATH statement to the APPS shared directory.

8. The Server shares the APPS directory in Read/Only mode and each station has their own Read/Write/Create directory as described above.

9. REMAP.KEY, the input file for remapping the 3270 Keys is as follows:

```
alt f1 = f4 1
alt f2 = f4 2
alt f3 = f4 3
alt f4 = f4 4
alt f5 = f4 5
alt f6 = f4 6
alt f7 = f4 7
alt f8 = f4 8
alt f9 = f4 9
alt f10 = f4 0
shft f1 = f4 -
shft f2 = f4 =
```

and it remaps the keyboard so that the 3270 PF keys are mapped to the ALT(Shft)/Fn combinations.

A.3 GRACE AND VGRACE

This station is a PC XT, with 512 Kb. of memory, one 360 Kb. diskette and one 10 Mb. hard disk. It runs in 2 different configurations, mutually exclusive, GRACE and VGRACE.

GRACE is a PC Network Redirector, while VGRACE runs PCN 3270 in the 'Gateway with Network Station' configuration. The Gateway has also defined VLANSERV and VALBERT as Network Stations names (with the Gateway Setup task of PCN 3270). An SDLC card is installed to provide such capability through a switched connection to host.

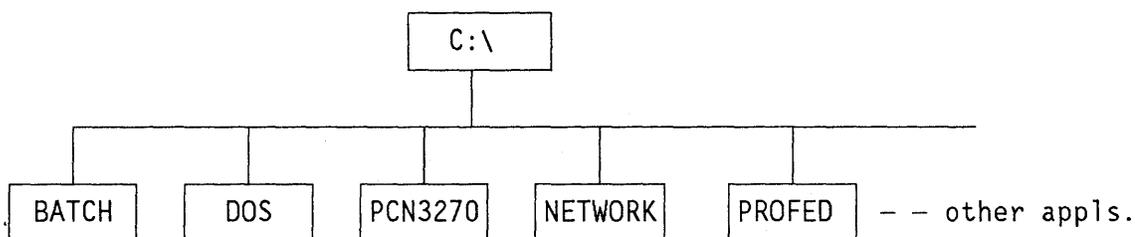The fixed disk has the following disk structure:

```
                         ┌──────────┐
                         │   C:\    │
                         └────┬─────┘
        ┌───────────┬─────────┼─────────┬───────────┐
   ┌────────┐  ┌────────┐ ┌─────────┐ ┌─────────┐ ┌────────┐
   │ BATCH  │  │  DOS   │ │ PCN3270 │ │ NETWORK │ │ PROFED │  - - other appls.
   └────────┘  └────────┘ └─────────┘ └─────────┘ └────────┘
```

Figure 27.   Gateway Disk Structure

1. The ROOT directory contains:

    *   COMMAND.COM

    *   TOKREUI.COM, NETBEUI.COM

    *   CONFIG.SYS, RMPKB.SYS, VDISK.SYS, ANSI.SYS

    *   AUTOEXEC.BAT created by the PC Network Menu SAVE option and manually edited to include NETBIOS support in the user area

        ```
        : *** Network Batch File ***
        TOKREUI
        NETBEUI
        : ***
        ECHO OFF
        PATH C:\NETWORK
        YNPROMPT Y N 39 Do you want to start the network (Y/N)?
        IF ERRORLEVEL 1 GOTO A
        ECHO ON
        NET START RDR GRACE /SRV:5
        NET USE D: \\LANSERV\GRACE
        NET USE K: \\LANSERV\APPLS
        NET USE LPT1 \\LANSERV\NETPRT1
        ECHO OFF
        GOTO B
        :A
        PATH \
        :B
        ```

```
ECHO ON
AUTOUSER.BAT
```

- AUTOUSER.BAT as follows:

```
Echo off
PROMPT $P$G
PATH=C:\NETWORK
DATE
TIME
YNPROMPT Y N 38 Have you started the PC Network (Y/N)?
IF ERRORLEVEL 1 GOTO NONET
:NET
PATH=K:\BATCH;K:\TEXT;K:\DOS;C:\NETWORK;C:\BATCH;C:\;\
APPEND \
GOTO EXIT
:NONET
YNPROMPT Y N 55 Do you want to start the PC Network 3270 session (Y/N)?
IF ERRORLEVEL 1 GOTO NOGWST
:GWST
PATH=C:\NETWORK;C:\BATCH;C:\DOS;C:\PCN3270;C:\;\
CD PCN3270
REMAPKEY C:\PCN3270\REMAP.KEY
PSC
:NOGWST
PATH=C:\NETWORK;C:\BATCH;C:\DOS;C:\PCN3270;C:\;\
:EXIT
```

2. The BATCH Directory contains:

    - PSC.BAT to start PCN 3270

      ```
      ECHO OFF
      REM RELEASE 1.0
      MODE LPT1:
      MODE MONO
      C:PSCPG C:\pcn3270
      ```

    - Other applications Batch files are also placed here.

3. The DOS directory contains the DOS (in this case 3.1) files apart from the VDISK.SYS, ANSI.SYS, CONFIG.SYS and COMMAND.COM files which are in the C:\ root directory.

4. The PCN3270 directory contains:

    - PCN 3270 code

    - REMAPKEY command and REMAP.KEY input file as listed in VLANSERV configuration

5. The NETWORK directory contains the PC Network programs installed by the INSTALL C: FD command. These programs can only be used when the PCN 3270 Gateway software is not running.

6. Other applications for use by DOS (some in the Alternate Partition) are installed in their own subdirectories.

A.4 ALBERT AND VALBERT

This station is a diskette based PC, with 512 Kb. of memory, two 360 Kb. diskettes and one printer. It runs in 2 different configurations, mutually exclusive, ALBERT and VALBERT.

ALBERT is a PC Network Messenger, while VALBERT runs PCN 3270 in the 'Network Station' configuration.

Two diskettes have been used:

1. The first diskette, in drive A: contains:

    *   COMMAND.COM

    *   CONFIG.SYS,RMPKB.SYS

    *   The PC Network Program files

    *   AUTOEXEC.BAT created by the PC Network Menu SAVE function and manually edited to include NETBIOS support in the user area
        ```
        : *** Network Batch File ***
        PAUSE Insert Diskette containing NETBIOS interface in drive B:
        B:TOKREUI
        B:NETBEUI
        : ***
        ECHO OFF
        PATH A:\
        YNPROMPT Y N 39 Do you want to start the network (Y/N)?
        IF ERRORLEVEL 1 GOTO A
        ECHO ON
        NET START MSG ALBERT /SRV:5 /MBI:1600
        NET USE C: \\LANSERV\ALBERT
        NET USE K: \\LANSERV\APPLS
        NET USE LPT1 \\LANSERV\NETPRT1
        ECHO OFF
        GOTO B
        :A
        PATH \
        :B
        ECHO ON
        AUTOUSER.BAT
        ```

    *   AUTOUSER.BAT as follows:
        ```
        Echo off
        PROMPT $P$G
        PATH=A:\
        DATE
        TIME
        YNPROMPT Y N 38 Have you started the PC Network (Y/N)?
        IF ERRORLEVEL 1 GOTO NONET
        :NET
        PATH=K:\BATCH;K:\TEXT;K:\DOS;K:\NETWORK;C:\BATCH;C:\;\
        APPEND \
        GOTO EXIT
        :NONET
        YNPROMPT Y N 55 Do you want to start the PC Network 3270 session (Y/N)?
        IF ERRORLEVEL 1 GOTO NONETST
        ```

```
:NETST
ECHO Insert Diskette containing PCN3270 in drive B:
PAUSE
PATH=B:\;\
REMAPKEY B:REMAP.KEY
PSC
:NONETST
PATH=\
:EXIT
```

2. The second diskette, in drive B: contains:

    *   TOKREUI.COM, NETBEUI.COM

    *   MODE.COM

    *   PCN 3270 program files

    *   PSC.BAT to start PCN 3270

        ```
        ECHO OFF
        REM RELEASE 1.0
        MODE LPT1:
        MODE MONO
        B:PSCPG B:
        A:
        ```

    *   REMAPKEY command and REMAP.KEY input file as listed in VLANSERV con-
        figuration

Note that the TOKREUI.COM and NETBEUI.COM cannot reside on the same diskette
with PC Network Program since it leaves only 10 Kb. free, which is not suffi-
cient for NETBIOS.

B.1 CONFIGURATION

The following configuration was used to install and test the Token-Ring Network/PC Network Interconnect Program.
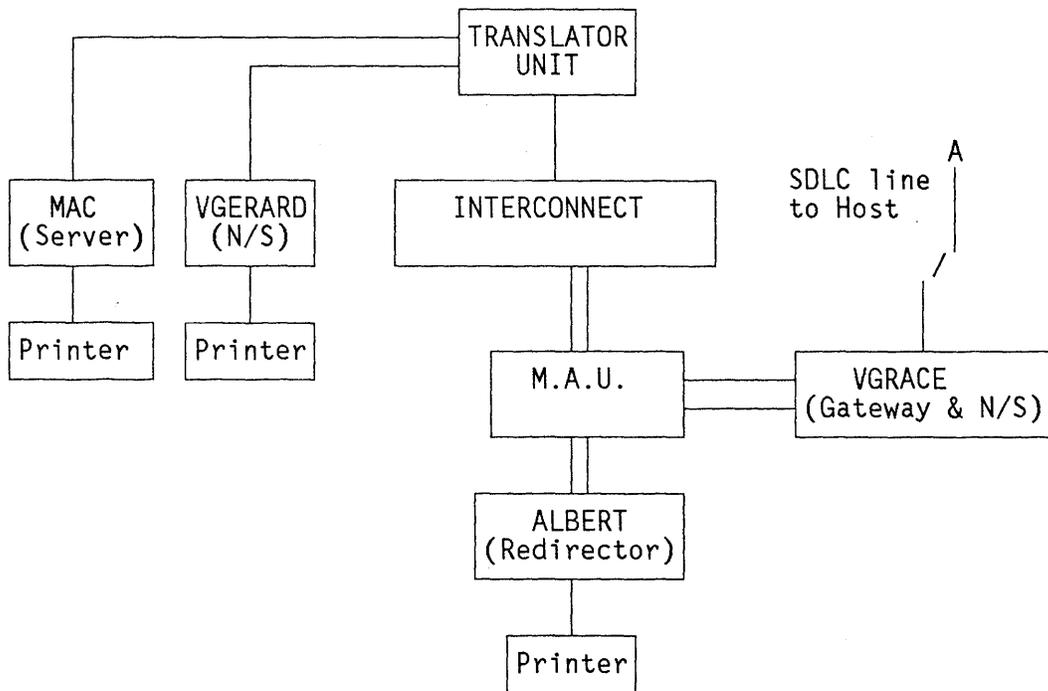

Figure 28.   Sample Interconnect Configuration

B.2 PC RUNNING THE INTERCONNECT PROGRAM

The station running the Interconnect program is a PC XT, with 384 Kb. of memory, one 360 Kb. diskette, one 10 Mb. hard disk and a printer.

The Interconnect program files have been installed on the hard disk, previously formatted with DOS.

Therefore the hard disk contains:

* COMMAND.COM

* TOKREUI.COM, NETBEUI.COM

* All DOS files

* All the Interconnect program files

* AUTOEXEC.BAT crated with EDLIN to include NETBIOS support and to activate automatically both the Interconnect and the Operator Interface:

  ```
  TOKREUI
  NETBEUI
  date
  time
  NIIMAIN
  OPER
  ```

The Interconnect was configured (by the CONFIG utility) with the following System Configuration parameters:

Title for network connected to adapter 0 ...... PCNET (PC Network)

Title for network connected to adapter 1 ...... TRNET (T/R Network)

Maximum message size .... 9 Kbytes

Maximum number of names on Adapter 0 3

Maximum number of names on Adapter 1 5

Number of sessions to support 16

Number of extra session buffers 2

Send time-out value .... 60 seconds

Logging buffer size .... 1 Kbyte

Logging active at initialization time .... Y

Stop logging when buffer is full .... N

The following names were defined:

1. On Adapter 0 (PC Network adapter) the "cross-network involved" names from the token-ring network.

   - VGRACE

     ```
     Network Name ..... VGRACE
     Adapter Number ... 0
     Name Type ........ 5     (NETBIOS)
     Listen Specific .. *
     Group Name ....... N
     ```

   - ALBERT

     ```
     Network Name ..... ALBERT
     Adapter Number ... 0
     Name Type ........ 1     (Redirector)
     ```

2. On Adapter 1 (Token-Ring adapter) the "cross-network involved" names from the PC network.

   - VGERARD

     ```
     Network Name ..... VGERARD
     Adapter Number ... 1
     Name Type ........ 5     (NETBIOS)
     Listen Specific .. *
     Group Name ....... N
     ```

   - MAC

     ```
     Network Name ..... MAC
     Adapter Number ... 1
     Name Type ........ 3     (Server)
     ```

B.3 ALBERT

This station is physically connected to the token-ring network. It is almost
the same configuration described in Appendix A (except that in the AUTOEXEC.BAT
file the Messenger function has been replaced by a Redirector function and that
it "USEs" the shared devices on MAC instead of on LANSERV).

B.4 MAC

This station is physically connected to the PC network.

It is a PC/XT with 384 Kb. of memory, one 360 Kb. diskette, one 10 Mb. hard disk and a printer. The PC Network Program is running in Server mode.

The fixed disk structure is similar to that described for VLANSERV (see Appendix A).

AUTOEXEC.BAT has been created by the PC Network Menu SAVE option

```
: *** Network Batch File ***
: ***
ECHO OFF
PATH C:\NETWORK
YNPROMPT Y N 39 Do you want to start the network (Y/N)?
IF ERRORLEVEL 1 GOTO A
ECHO ON
NET START SRV MAC /SRV:5 /MBI:1600 /SHR:10 /SES:18
NET SHARE NETPRT1=LPT1
NET SHARE APPLS=C:\APPS /R
NET SHARE ALBERT=C:\ALBERT
NET SHARE GERARD=C:\GERARD
ECHO OFF
GOTO B
:A
PATH \
:B
ECHO ON
AUTOUSER.BAT
```

AUTOUSER.BAT is as follows:

```
Echo off
PATH=C:\BATCH;C:\APPS\TEXT;C:\APPS\DOS;C:\NETWORK;C:\;\
PROMPT $P$G
APPEND \
DATE
TIME
```

B.5 VGRACE

This station is physically connected to the token-ring network. It has the same configuration described in Appendix A and should be run only as a PCN 3270 'Gateway with Network Station'.

VGERARD and VGRACE have been defined as Network Station names(with the Gateway Setup task of PCN 3270).

B.6 VGERARD

This station is physically connected to the PC network. It is a PC/XT with 512 Kb. of memory, one 360 Kb. diskette, one 10 Mb. hard disk and a printer.

PCN 3270 runs in the 'Network Station' configuration to a "cross-network" Gateway (VGRACE) and also as a PC Network Redirector (GERARD) using the "same-network" MAC server.

The fixed disk structure is similar to that described for GRACE (see Appendix A).

AUTOEXEC.BAT is as follows:

```
: *** Network Batch File ***
: ***
ECHO OFF
PATH C:\NETWORK
YNPROMPT Y N 39 Do you want to start the network (Y/N)?
IF ERRORLEVEL 1 GOTO A
ECHO ON
NET START RDR GERARD /SRV:5
NET USE D: \\MAC\GERARD
NET USE K: \\MAC\APPLS
ECHO OFF
GOTO B
:A
PATH \
:B
ECHO ON
AUTOUSER.BAT
```

AUTOUSER.BAT is as follows:

```
ECHO OFF
PATH \BATCH;\DOS;\PCN3270;\NETWORK;\PROFED;D:\;\
REMAPKEY C:\PCN3270\REMAP.KEY
PROMPT $P$G
DATE
TIME
YNPROMPT Y N 55 Start the PC Network 3270 session (Y/N)?
IF Errorlevel 1 goto NO3270
PSC.BAT
:NO3270
ECHO Enter  PSC  - to start the 3270 session later.
```

The BATCH directory contains application Batch startup files including PSC.BAT as follows:

```
ECHO OFF
REM RELEASE 1.0
MODE LPT1:
MODE MONO
C:PSCPG C:\pcn3270
```

The REMAP.KEY file to remap the PFK's is as described for VLANSERV in Appendix A.

An Introduction to Local Area Networks (GC20-8203)

IBM Token-Ring Network PC Products Description and Installation (GG24-1739)

IBM Token-Ring Network Architecture Reference (SC30-3374)

IBM Token-Ring Network Problem Determination Guide (SY27-0280)

IBM Token-Ring Network PC Adapter Guide to Operations (SA27-3710)

IBM Token-Ring Network PC Adapter Technical Reference (SC30-3383)

IBM Token-Ring Network PC Adapter Hardware Maintenance and Service (SC30-3384)

IBM PC Network Program User's Guide (P/N 6024195)

IBM PC Network SNA 3270 Emulation Program Reference manual (P/N 6322526)

IBM PC Network Technical Reference manual (P/N 6322505)

IBM Token-Ring Network/PC Network Interconnect User's Guide (P/N 6467036)

APPC/PC Programming Guide (SC30-3396)

These NETBIOS return codes are listed and explained in the Token-Ring Network PC Adapter Technical Reference.

• NETBIOS Return Codes common to PC Network and Token-Ring Network

    00 = Good Return

    01 = Illegal buffer length

    03 = Invalid Command

    05 = Command timed out

    06 = Message incomplete

    08 = Illegal local session number

    09 = No resource available

    0A = Session closed

    0B = Command canceled.

    0D = Duplicate name in local name table

    0E = Name table full

    0F = Command completed, name has active session and is now
         de-registered

    11 = Local session table full

    12 = Session open rejected

    13 = Illegal name number

    14 = Cannot find name called

    15 = Name not found or cannot specify an '*' or null

    16 = Name in use on remote NETBIOS interface

    17 = Name deleted

    18 = Session ended abnormally

    19 = Name conflict detected

    21 = Interface busy

    22 = Too many commands outstanding

    23 = Invalid number in MCB_LANA_NUMBER field

```
24  =  Command completed with cancel occurring

26  =  Command not valid to cancel
```

- User errors Return Codes unique for the Token-Ring Network

```
4E  =  Ring status - one or more of bits 12,14,15 on for longer than
       60 seconds

4F  =  Ring status - one or more of bits 8-11 on
```

- PC or Adapter errors Return Codes unique for the Token-Ring Network

```
F7  =  Error on implicit DIR.INITIALIZE

F8  =  Error on implicit DIR.OPEN.ADAPTER

F9  =  Adapter Support Interface internal error

FA  =  Adapter check

FB  =  NETBIOS Program not loaded in PC

FC  =  DIR.OPEN.ADAPTER or DLC.OPEN.SAP failed - check parameters

FD  =  Invalid implicit init/open - work area in use
```

SWITCH 1 - ROM ADDRESS. In the PC address space, addresses C0000 - DFFFF are used for I/O adapter ROM.: Switch 1 allows you to specify which addresses (within this range) will be used for the 8K of ROM located on the adapter card. In theory, you could select any address in this range. In practice, however, certain conventions are used.

Positions 1, 2, 3, 4, 5 and 6 represent bits 19 through 14 of a 20 bit ROM address. For example, to set the adapter ROM address to D6000 (856k) the bits indicated below would be used.

```
1101 0110 0000 0000 0000
+-----+
```

Note that in order to represent a "1" bit, the switch position must be set to "OFF".

The Guide to Operations suggests that you use CC000 (816k) for the first Token Ring adapter card installed. Therefore the following switch setting applies for SWITCH 1:

Position 1 = OFF

Position 2 = ON

Position 3 = ON

Position 4 = OFF

Position 5 = OFF

Position 6 = ON

If you have a second adapter installed, you must select for it a different 8K block of ROM. The Guide to Operations suggests that you use DC000 (880 K) for the second Token Ring adapter card installed. Therefore the following switch setting applies for SWITCH 1:

Position 1 = OFF

Position 2 = ON

Position 3 = OFF

Position 4 = OFF

Position 5 = OFF

Position 6 = ON

SWITCH 1 - INTERRUPT LEVEL. The IBM PC architecture provides 8 levels of processor interrupts. The level of an interrupt indicates its priority -level 0 being the highest priority. Again, in theory, you could select any one of the eight available levels for the Token Ring adapter to interrupt the PC processor. However, the adapter card restricts you to a choice between levels 2, 3, 6, and 7 (level 0 is reserved for the timer, level 1 for the keyboard, level 4 for asynchronous transmission, and level 5 for the fixed disk).

The manual suggests that you **do not select** level 6 as it is used also by the diskette adapter.

Be aware that some NETBIOS products may restrict the use of the interrupt levels. This is the case of PC Network SNA 3270 Emulation Program that accepts only levels 2 and 3; then a Gateway is restricted to use interrupt level 2 for the Token-Ring Network card, since level 3 is used by the SDLC card.

The interrupt level is set with switch positions 7 and 8 according to the following values:

	Position 7	Position 8
level 2	ON	ON
level 3	OFF	ON
level 6	ON	OFF
level 7	OFF	OFF

SWITCH 2 - PRIMARY OR ALTERNATE ADAPTER SELECTION: This switch usually has positions 3, 5, 6, 7 and 8 permanently set by epoxy and is therefore easily distinguished from SWITCH 1. When only one adapter is being installed, it is the "primary" and therefore position 2 is set "OFF".

If you have two adapters installed, then set position 2 to "ON" to indicate the "alternate" adapter.

READER'S COMMENTS

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